Final Project

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Executive Summary

Introduction

Our primary research interest was in predicting the number of COVID-19 deaths for counties in Indiana (as of 4/28/2021). We had a variety of predictor variables at our disposal. The information we felt could be most helpful in predicting deaths were data related to mask wearing; vaccine distribution; COVID-19 tests and cases; and county demographic information such as total population, political affiliation (based on 2016 Presidential Election results), and both the number and proportion of Senior Citizens (65+) in the county. Although demographic information related to race were available, the truth of the matter is that increased racial diversity would highly correlate to county size, and would be unlikely to be a significant predictor. We leave it as an exercise to the reader to see if this is truly the case.

Data Gathering and Manipulation

We had to merge several .csv files and do quite a bit of data manipulation in order to get everything we needed. You will find the URLs to the data on the final page of this document. Most of the data sets were merged by county FIPS code, known as `LOCATION_ID` in our primary data frame.

The mask data from the *New York Times* consists of the proportion of respondents in each county that wear a mask never, rarely, sometimes, frequently, and always. The file `covid_report_county.csv` contained the number of deaths, positive cases, and tests administered in each county up to the date it was accessed. The county vaccination demographics file contains information about total number of vaccine doses administered (1st dose and 2nd dose for two-dose vaccines, or just Single Dose for one-dose vaccines), as well as the number of people by race who are fully vaccinated. Many counties had "Suppressed" their vaccine dose counts for non-white citizens, but for small, rural counties, it is possible that zero non-white citizens have been vaccinated in those counties, and thus they had nothing to report. Because of this, we replaced "Suppressed" with a 0, and then aggregated vaccination figures across race in each county. `idwd_data_31.csv` contained the number of senior citizens residing in each county. The elderly were at much higher risk of death due to COVID-19 than any other age bracket (according to the CDC). The `pres_votes.csv` file contains the number of votes for Donald Trump, Hillary Clinton, and Other candidates in the 2016 election. We felt either the number or the proportion of the vote for each candidate could be significant in predicting death counts, as Trump supporters have been quite vocal about not taking the COVID-19 pandemic seriously. And finally, we wanted to try and categorize each county by it's size, and we stumbled upon the 2013 Urban-Rural Classification Scheme (URCS) for U.S. counties. It uses an ordinal 1-6 scale to categorize a county as a Large Central Metropolitan Area (1) down to a Non-Core (fully rural) area (6). Most of the counties in Indiana are rated 4 through 6; however, a few counties containing Indiana's largest cities do rate as a 2 or 3. Marion County (Indianapolis) is the only level 1 county in the state.

Model Selection

In every model, the count of the number of deaths due to COVID-19 is the response. We made two different fixed effects models and two different mixed models, one of each being a Binomial count and a Poisson count model. When viewing a scatter plot of the original predictor variables, we noticed that all of the variables that were counts (number of cases, number of votes for Clinton, etc) were right-skewed and would probably benefit from a log transformation. The log-counts were much closer to normally distributed and were thusly added to our data frame as possible predictors. **All raw counts are listed in the data frame as var_name.x, and all log-counts are listed in the data frame as var_name.y** The summaries and plots of our four models are in the last few pages, right before the Data Sources page.

Fixed-Effects Models

When modeling counts, the two primary general linear models to use are Binomial Counts and Poisson Counts. Both models map to logit function, but follow different probability distributions. At first, we thought it would be most appropriate to use a Binomial model, since one either does or does not die of COVID, and the number of "failures" is easy to calculate when total population is known. However, and we will see this later, the Poisson model tends to fit better. This makes sense to us, since the Poisson distribution is used to model counts of sparse or rare events, and dying of a new disease would probably fall under the "rare event" umberella.

When we made our Fixed-Effects models, we were able to get a Binomial model teeming with significant predictors. The model we are referencing is `mod1.1.3`. However, we felt we could do better, and decided to look for interactions in a few specific places (based on gut instinct). We had a feeling that the county URCS code could be interacting with support for Trump, the proportion of the county that is older, and reluctance to wear a mask. As we whittled down our model, all but two subsets of the four-way interaction between `RARELY:olderprop:TrmpProp:2013 code` were highly significant in our model. Unfortunately, every interaction containing URCS code 6 gave had NA values due to singularities. We were unable to diagnose the problem, which is unfortunate as exactly 1-in-4 counties in Indiana are assigned code 6. The Poisson model was generated in a similar way, but with slightly better results and a few extra predictors. This gave us an AIC of 798.23 which turned out to be the lowest of all four models.

Mixed-Effect Models

We decided to see if the variation between death rates in counties could be better explained as a random effect. We tried both the county itself (`LOCATION_ID`) and the URCS code (`2013 code`) as possible random effects. We even used a bootstrap likelihood ratio test to see if a model where `LOCATION_ID` was nested inside of `2013 code` was better than a model with just `2013 code`. The p-value was 0, so as we were model selecting, our models included both `2013 code` and `LOCATION_ID` nested inside `2013 code`. Once we whittled down the predictors, the `2013 code` random effect had a standard deviation of zero, so we removed it, and our final Poisson Mixed-Effects model (`mod26.off`) appears better fitting without it. This was the case for both the Binomial and Poisson regression procedures. When we offset the Poisson model by the log of the population, it made the model regress to a Poisson proportion instead of a count - good when the county population sizes are very different. This generated better-fitting Poisson models across the board.

Conclusion

The standard deviation of our random effect of `LOCATION_ID` in our Poisson model was most definitely non-zero (~0.2). However, the mixed-effects Poisson model had an AIC that was about 30 points higher than the fixed-effects Poisson model, tempting us to default to the fixed effect model. On the other hand, the mixed effect model did not need any of the interaction terms that the fixed effect model required. Because of this, the mixed effect Poisson model was much simpler than the fixed effect model, temping us to want to

default to the mixed effects model instead. However, upon inspection of the residual plot and QQ-plot of our mixed effects model, we must conclude that resuduals are not normally distributed, and quite heteroscedatic, forcing us to dump the mixed-effect models for the fixed-effect models.

Without further assistance in troubleshooting the NA's in the output for URCS code 6, we can't use the model to predict the death count in exactly 1-in-4 Indiana counties, as 23 of 92 are code 6. However, we like the model otherwise, and although it is hefty with predictors, it seems to fit the data quite well. For what it is worth, the main effects with the largest effect on the log-odds of dying from COVID-19 are the proportion of cases ($\beta = 49.87$), the log-number of votes for Trump in 2016 ($\beta = 18.69$), the log-number of total votes in 2016 ($\beta = -20.29$). All three of these coefficients make sense, as the density of cases and support for Trump in a county seem like they should increase COVID deaths, while total votes - an indicator of county size - shows that as the county gets bigger (and therefore more Democratic) - people take COVID more seriously and die at a lower rate. It is also possible that larger counties have a younger overall population, which is a much lower risk of dying from COVID compared to seniors, as cities tend to attract youth.

Code and Output

```
knitr::opts_chunk$set(echo = TRUE)
library(readr)
library(readxl)
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.0 --

## v ggplot2 3.3.3     v dplyr   1.0.5
## v tibble  3.1.0     v stringr 1.4.0
## v tidyr   1.1.3     v forcats 0.5.1
## v purrr   0.3.4

## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
library(mgcv)
```

```
## Loading required package: nlme

##
## Attaching package: 'nlme'

## The following object is masked from 'package:dplyr':
##
##     collapse

## This is mgcv 1.8-33. For overview type 'help("mgcv-package")'.
```

```
library(lme4)
```

```
## Loading required package: Matrix

##
## Attaching package: 'Matrix'

## The following objects are masked from 'package:tidyr':
##
##     expand, pack, unpack

##
## Attaching package: 'lme4'

## The following object is masked from 'package:nlme':
##
##     lmList
```

```
library(ggplot2)
library(RLRsim)
```

```
## Warning: package 'RLRsim' was built under R version 4.0.5
```

```
library(faraway)
library(alr4)
```

```
## Loading required package: car
```

```
## Loading required package: carData
```

```
## Registered S3 methods overwritten by 'car':
##   method                          from
##   influence.merMod                lme4
##   cooks.distance.influence.merMod lme4
##   dfbeta.influence.merMod         lme4
##   dfbetas.influence.merMod        lme4
```

```
##
## Attaching package: 'car'
```

```
## The following objects are masked from 'package:faraway':
##
##     logit, vif
```

```
## The following object is masked from 'package:dplyr':
##
##     recode
```

```
## The following object is masked from 'package:purrr':
##
##     some
```

```
## Loading required package: effects
```

```
## lattice theme set by effectsTheme()
## See ?effectsTheme for details.
```

```
##
## Attaching package: 'alr4'
```

```
## The following objects are masked from 'package:faraway':
##
##     cathedral, pipeline, twins
```

```
library(lmtest)
```

```
## Warning: package 'lmtest' was built under R version 4.0.5
```

```
## Loading required package: zoo

##
## Attaching package: 'zoo'

## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```

Import data and whittle down to initial model.

```
# read in data and re-name FIPS variable for merging.
mask_data <- read.csv("mask_data.txt")
covid_report_county <- read.csv("covid_report_county.csv")
colnames(mask_data)[1] <- "LOCATION_ID"

big_data <- merge(covid_report_county, mask_data, by = "LOCATION_ID")

# read in data and removed non-residents
cnty_vac_dem <- read_excel("county-vaccination-demographics.xlsx")
cnty_vac_dem <- cnty_vac_dem[1:460, ]

## aggregate vaccines across demographics
county_vaccc_sums <- data.frame(all_doses_administered = vector(length = 92), fully_vaccinated = vector

cnty_vac_dem$all_doses_administered[which(cnty_vac_dem$all_doses_administered ==
    "Suppressed")] <- 0
cnty_vac_dem$fully_vaccinated[which(cnty_vac_dem$fully_vaccinated == "Suppressed")] <- 0

cnty_vac_dem$all_doses_administered <- as.numeric(cnty_vac_dem$all_doses_administered)
cnty_vac_dem$fully_vaccinated <- as.numeric(cnty_vac_dem$fully_vaccinated)

for (i in 1:92) {
    temp_df <- data.frame(all_doses_administered = numeric(), fully_vaccinated = numeric())
    temp_df <- colSums(cnty_vac_dem[(((i - 1) * 5 + 1):(i * 5)), c(8, 9)])
    county_vaccc_sums[i, ] <- temp_df
}
county_vaccc_sums <- cbind(big_data$LOCATION_ID, county_vaccc_sums)
colnames(county_vaccc_sums)[1] <- "LOCATION_ID"

# merge aggregated vaccine numbers with our big data set
big_data2 <- merge(big_data, county_vaccc_sums, by = "LOCATION_ID")

# read in county population data & rearrange rows to line up the same.
cnty_pop <- read_csv("csvData.csv")
cnty_pop <- cnty_pop[order(cnty_pop$CTYNAME), ]
head(cnty_pop)
```

```
## # A tibble: 6 x 3
##   CTYNAME            pop2021 GrowthRate
##   <chr>                <dbl>      <dbl>
```

```
## 1 Adams County          36141      4.93
## 2 Allen County         387739      8.93
## 3 Bartholomew County    85893     11.8
## 4 Benton County          8938      0.846
## 5 Blackford County      11426    -10.5
## 6 Boone County          69669     22.4
```

```
cnty_pop2 <- rbind(cnty_pop[1:70, ], cnty_pop[74, ], cnty_pop[71:73, ], cnty_pop[75:92,
    ])

# merge county pop data with data set & create proportion variables
big_data2 <- cbind(big_data2, cnty_pop2$pop2021)
head(big_data2)
```

```
##   LOCATION_ID COVID_COUNT COVID_DEATHS COVID_TEST COUNTY_NAME NEVER RARELY
## 1       18001        3376           52      12828       Adams 0.136  0.047
## 2       18003       38926          670     172721       Allen 0.070  0.140
## 3       18005        7854          153      40731 Bartholomew 0.138  0.084
## 4       18007         962           13       4649      Benton 0.082  0.126
## 5       18009        1328           31       5823   Blackford 0.093  0.152
## 6       18011        6524          100      34238       Boone 0.052  0.085
##   SOMETIMES FREQUENTLY ALWAYS all_doses_administered fully_vaccinated
## 1     0.160      0.348  0.309                 16336             7876
## 2     0.099      0.228  0.464                228676           101921
## 3     0.085      0.286  0.406                 57938            24997
## 4     0.112      0.183  0.496                  4105             1795
## 5     0.106      0.203  0.447                  6611             2888
## 6     0.142      0.308  0.413                 56123            25441
##   cnty_pop2$pop2021
## 1             36141
## 2            387739
## 3             85893
## 4              8938
## 5             11426
## 6             69669
```

```
colnames(big_data2)[13] <- "pop2021"
big_data2$prop_cases <- big_data2$COVID_COUNT/big_data2$pop2021
big_data2$prop_death <- big_data2$COVID_DEATHS/big_data2$pop2021

# read in data on IN residents 65+, merge it, and create proportion variables
IN65plus <- read_csv("idwd_data_31.csv")
IN65plus$fips <- IN65plus$statefips * 1000 + IN65plus$countyfips

big_data2 <- cbind(big_data2, IN65plus[5])
big_data2$olderprop <- big_data2$`Older (65 plus)`/big_data2$pop2021

# read in political data
pres_votes <- read_csv("pres_votes.csv")
colnames(pres_votes)[2] <- "LOCATION_ID"

# create empty variables
big_data3 <- big_data2
```

```
big_data3$ClintVote <- numeric(length = 92)
big_data3$TrmpVote <- numeric(length = 92)
big_data3$OtherVote <- numeric(length = 92)
big_data3$TotalVote <- numeric(length = 92)

# go thru the political data and find the correct values
for (i in 1:92) {
    big_data3$ClintVote[i] <- pres_votes$candidatevotes[(i - 1) * 3 + 1]
    big_data3$TrmpVote[i] <- pres_votes$candidatevotes[(i - 1) * 3 + 2]
    big_data3$OtherVote[i] <- pres_votes$candidatevotes[(i - 1) * 3 + 3]
    big_data3$TotalVote[i] <- pres_votes$totalvotes[(i - 1) * 3 + 1]
}

# make proportion variables
big_data3$ClintProp <- big_data3$ClintVote/big_data3$TotalVote
big_data3$TrmpProp <- big_data3$TrmpVote/big_data3$TotalVote
big_data3$OtherProp <- big_data3$OtherVote/big_data3$TotalVote

# read in county metro code data
MetroCodes2013 <- read_excel("NCHSURCodes2013.xlsx", col_types = c("numeric", "text",
    "skip", "skip", "skip", "skip", "numeric", "skip", "skip"))

# isolate Indiana info and merge datasets
MC2013 <- filter(MetroCodes2013, MetroCodes2013$`State Abr.` == "IN")
MC2013$`2013 code` <- as.factor(MC2013$`2013 code`)
MC2013 <- MC2013[, -2]
colnames(MC2013)[1] <- "LOCATION_ID"

big_data3 <- merge(big_data3, MC2013, by = "LOCATION_ID")
```

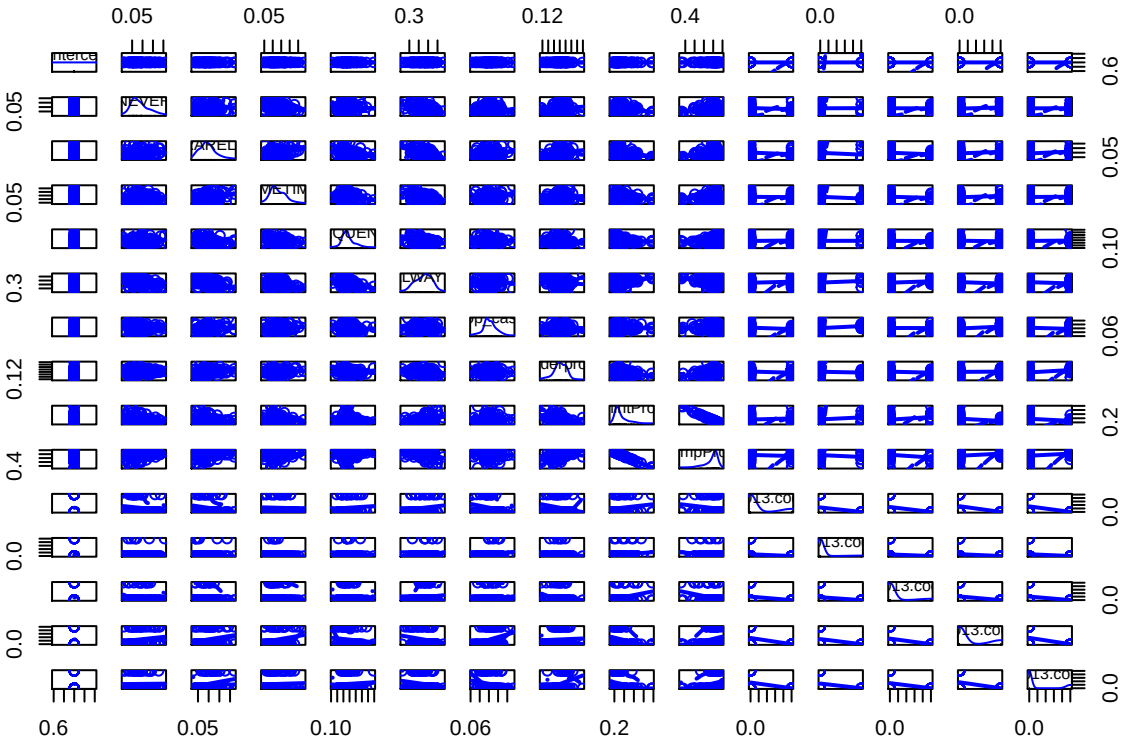
Can our data be used to reliably predict the number of positive cases in an Indiana county? Using binomial count model to start.

```
# Excluded ID variables, excluded 'Other' voting categories bc they are perfect
# linear combos of Trmp&Clint categories, excluded count variables in favor of
# log-counts, and excluded proportion of deaths
mod0 <- glm(cbind(COVID_DEATHS, pop2021 - COVID_DEATHS) ~ 1, data = big_data3, family = binomial)

mod0.1 <- glm(formula = cbind(COVID_DEATHS, pop2021 - COVID_DEATHS) ~ . - LOCATION_ID -
    COUNTY_NAME - prop_death - OtherProp - OtherVote - COVID_COUNT - COVID_TEST -
    all_doses_administered - fully_vaccinated - `Older (65 plus)` - ClintVote - TrmpVote -
    TotalVote - COVID_DEATHS, data = big_data3, family = binomial)
summary(mod0.1)
```

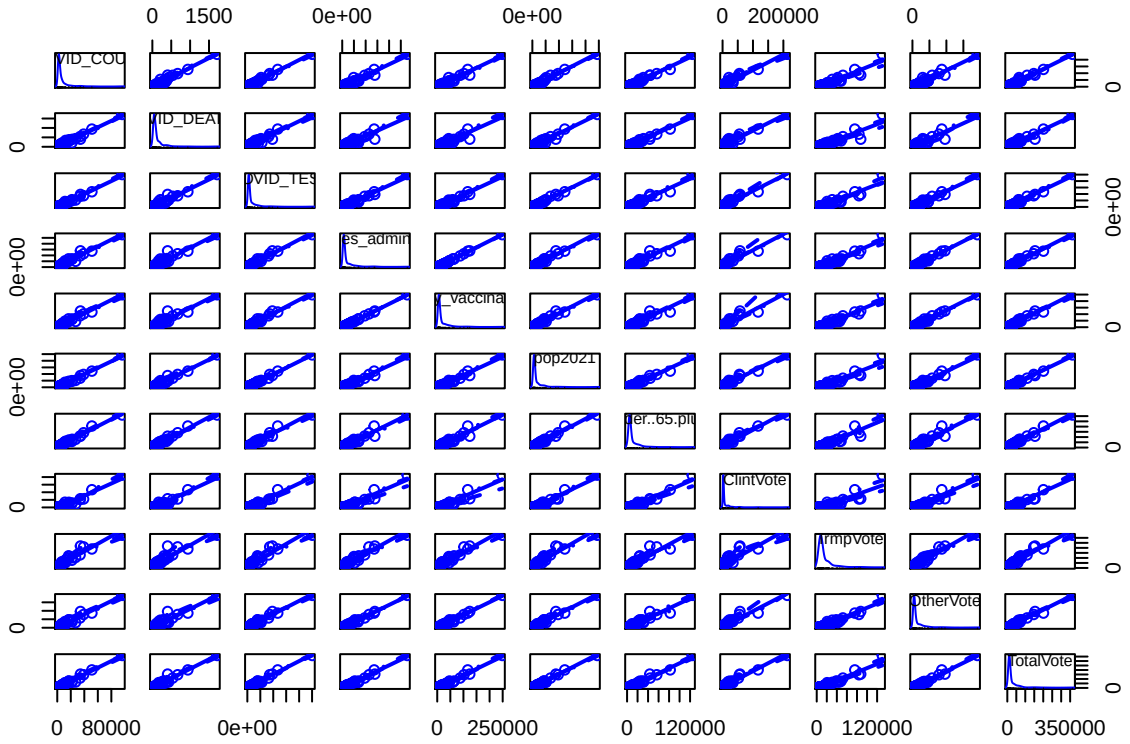
```
##
## Call:
## glm(formula = cbind(COVID_DEATHS, pop2021 - COVID_DEATHS) ~ . -
##     LOCATION_ID - COUNTY_NAME - prop_death - OtherProp - OtherVote -
##     COVID_COUNT - COVID_TEST - all_doses_administered - fully_vaccinated -
##     `Older (65 plus)` - ClintVote - TrmpVote - TotalVote - COVID_DEATHS,
##     family = binomial, data = big_data3)
```

```
##
## Deviance Residuals:
##    Min      1Q  Median      3Q     Max
## -4.244  -1.730  -0.010   1.143   5.640
##
## Coefficients:
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept)  -37.84635   14.02374  -2.699 0.006960 **
## NEVER         23.93403   13.76699   1.739 0.082121 .
## RARELY        23.45074   13.65706   1.717 0.085958 .
## SOMETIMES     24.15894   13.77716   1.754 0.079508 .
## FREQUENTLY    23.73149   13.74563   1.726 0.084262 .
## ALWAYS        23.86185   13.74746   1.736 0.082612 .
## prop_cases     4.20026    0.78018   5.384 7.30e-08 ***
## olderprop      5.21449    0.56279   9.265  < 2e-16 ***
## ClintProp      6.89473    1.59121   4.333 1.47e-05 ***
## TrmpProp       7.03081    1.59135   4.418 9.96e-06 ***
## `2013 code`2  -0.17054    0.04236  -4.026 5.67e-05 ***
## `2013 code`3  -0.17841    0.04614  -3.867 0.000110 ***
## `2013 code`4  -0.21276    0.04555  -4.671 2.99e-06 ***
## `2013 code`5  -0.14754    0.05696  -2.590 0.009586 **
## `2013 code`6  -0.21766    0.06254  -3.480 0.000501 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 795.33  on 91  degrees of freedom
## Residual deviance: 407.94  on 77  degrees of freedom
## AIC: 1007.7
##
## Number of Fisher Scoring iterations: 4
```

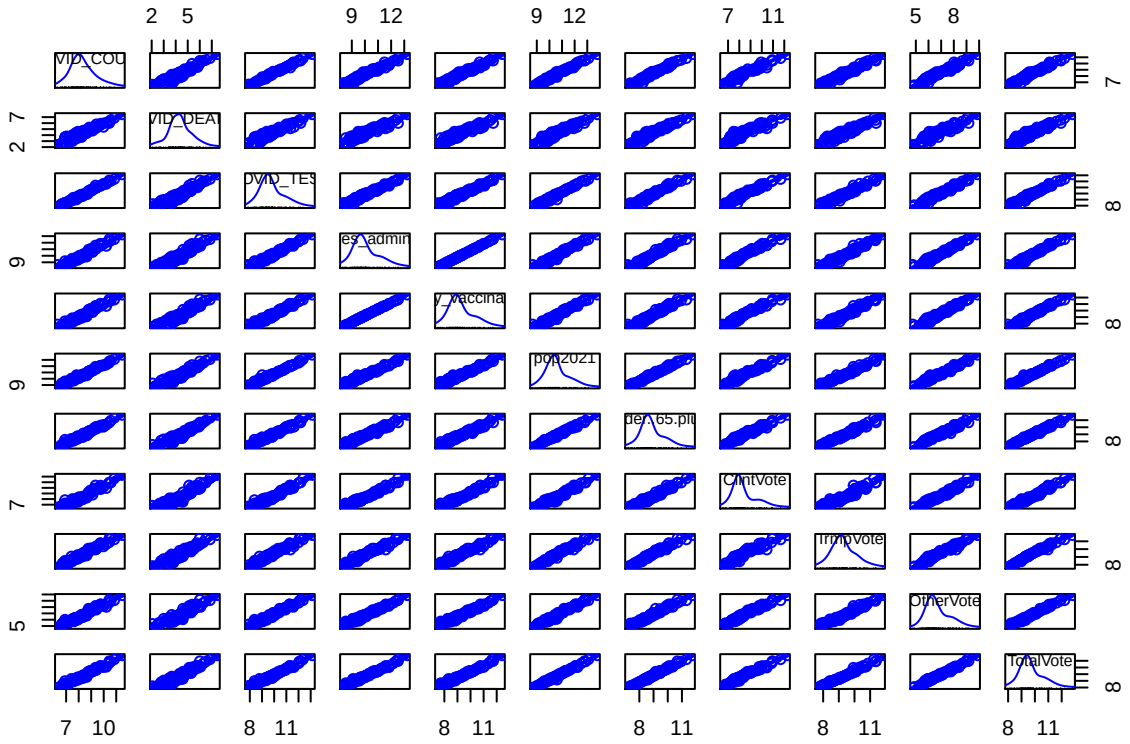
```
scatterplotMatrix(model.matrix(mod0.1))
```




```
# isolate count vars and make scatterplot matrix
countvars <- big_data3[, c(2, 3, 4, 11, 12, 13, 16, 18, 19, 20, 21)]
scatterplotMatrix(countvars)
```




```
# all count variables are right-skewed and could probably use a log
# transformation
logcountvars <- log(big_data3[, c(2, 3, 4, 11, 12, 13, 16, 18, 19, 20, 21)])
scatterplotMatrix(logcountvars)
```




```
logcountvars <- mutate(logcountvars, LOCATION_ID = big_data3$LOCATION_ID)

big_data3 <- merge(big_data3, logcountvars, by = "LOCATION_ID")


# use step-wise selection to find the best model
step(mod0.1, scope = list(lower = mod0, upper = mod0.1), direction = "both")
```

```
## Start:  AIC=1007.71
## cbind(COVID_DEATHS, pop2021 - COVID_DEATHS) ~ (LOCATION_ID +
##     COVID_COUNT + COVID_TEST + COUNTY_NAME + NEVER + RARELY +
##     SOMETIMES + FREQUENTLY + ALWAYS + all_doses_administered +
##     fully_vaccinated + prop_cases + prop_death + `Older (65 plus)` +
##     olderprop + ClintVote + TrmpVote + OtherVote + TotalVote +
##     ClintProp + TrmpProp + OtherProp + `2013 code`) - LOCATION_ID -
##     COUNTY_NAME - prop_death - OtherProp - OtherVote - COVID_COUNT -
##     COVID_TEST - all_doses_administered - fully_vaccinated -
##     `Older (65 plus)` - ClintVote - TrmpVote - TotalVote - COVID_DEATHS
##
##                Df Deviance    AIC
## <none>              407.94 1007.7
## - RARELY        1   410.90 1008.7
## - FREQUENTLY    1   410.93 1008.7
## - ALWAYS        1   410.96 1008.7
## - NEVER         1   410.97 1008.7
```

```
## - SOMETIMES    1   411.03 1008.8
## - ClintProp    1   426.69 1024.5
## - TrmpProp     1   427.42 1025.2
## - `2013 code`  5   436.99 1026.8
## - prop_cases   1   437.04 1034.8
## - olderprop    1   491.90 1089.7

##
## Call:  glm(formula = cbind(COVID_DEATHS, pop2021 - COVID_DEATHS) ~ (LOCATION_ID +
##     COVID_COUNT + COVID_TEST + COUNTY_NAME + NEVER + RARELY +
##     SOMETIMES + FREQUENTLY + ALWAYS + all_doses_administered +
##     fully_vaccinated + prop_cases + prop_death + `Older (65 plus)` +
##     olderprop + ClintVote + TrmpVote + OtherVote + TotalVote +
##     ClintProp + TrmpProp + OtherProp + `2013 code`) - LOCATION_ID -
##     COUNTY_NAME - prop_death - OtherProp - OtherVote - COVID_COUNT -
##     COVID_TEST - all_doses_administered - fully_vaccinated -
##     `Older (65 plus)` - ClintVote - TrmpVote - TotalVote - COVID_DEATHS,
##     family = binomial, data = big_data3)
##
## Coefficients:
##  (Intercept)         NEVER        RARELY     SOMETIMES    FREQUENTLY
##     -37.8463       23.9340       23.4507       24.1589       23.7315
##       ALWAYS    prop_cases     olderprop     ClintProp      TrmpProp
##      23.8619        4.2003        5.2145        6.8947        7.0308
## `2013 code`2  `2013 code`3  `2013 code`4  `2013 code`5  `2013 code`6
##      -0.1705       -0.1784       -0.2128       -0.1475       -0.2177
##
## Degrees of Freedom: 91 Total (i.e. Null);  77 Residual
## Null Deviance:       795.3
## Residual Deviance: 407.9     AIC: 1008
```

```
anova(mod0.1, test = "Chi")
```

```
## Analysis of Deviance Table
##
## Model: binomial, link: logit
##
## Response: cbind(COVID_DEATHS, pop2021 - COVID_DEATHS)
##
## Terms added sequentially (first to last)
##
##
##             Df Deviance Resid. Df Resid. Dev  Pr(>Chi)
## NULL                           91     795.33
## NEVER        1   10.546        90     784.78 0.0011647 **
## RARELY       1   14.363        89     770.42 0.0001508 ***
## SOMETIMES    1   57.254        88     713.16 3.831e-14 ***
## FREQUENTLY   1    0.006        87     713.16 0.9405452
## ALWAYS       1    0.314        86     712.84 0.5751468
## prop_cases   1   76.590        85     636.25 < 2.2e-16 ***
## olderprop    1  159.672        84     476.58 < 2.2e-16 ***
## ClintProp    1    2.740        83     473.84 0.0978832 .
## TrmpProp     1   36.847        82     436.99 1.278e-09 ***
```

```
## `2013 code`  5   29.052        77     407.94 2.265e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
mod0.2 <- glm(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ NEVER +
    RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + olderprop + ClintProp +
    TrmpProp + `2013 code` + COVID_COUNT.y + fully_vaccinated.y + pop2021.y + `Older (65 plus).y` +
    TotalVote.y, family = binomial, data = big_data3)


summary(mod0.2)
```

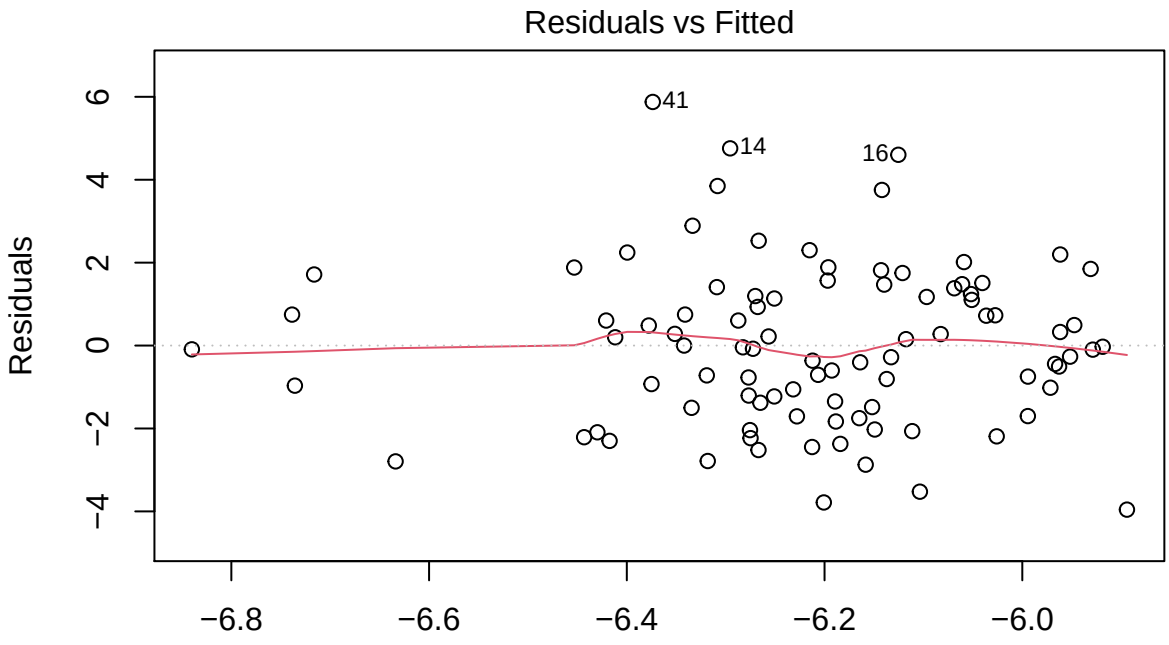
```
##
## Call:
## glm(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~
##     NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases +
##         olderprop + ClintProp + TrmpProp + `2013 code` + COVID_COUNT.y +
##         fully_vaccinated.y + pop2021.y + `Older (65 plus).y` +
##         TotalVote.y, family = binomial, data = big_data3)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -4.2816  -1.4531  -0.0598   1.2502   5.5732
##
## Coefficients:
##                      Estimate Std. Error z value Pr(>|z|)
## (Intercept)         -53.56450   14.57969  -3.674 0.000239 ***
## NEVER                44.56631   14.69197   3.033 0.002418 **
## RARELY               44.23475   14.62369   3.025 0.002487 **
## SOMETIMES            44.56257   14.72501   3.026 0.002476 **
## FREQUENTLY           44.74435   14.71633   3.040 0.002362 **
## ALWAYS               44.59356   14.71319   3.031 0.002439 **
## prop_cases           14.84940    7.55850   1.965 0.049461 *
## olderprop           -11.34591    5.01321  -2.263 0.023623 *
## ClintProp             4.70592    1.97320   2.385 0.017083 *
## TrmpProp              5.56116    1.95746   2.841 0.004497 **
## `2013 code`2         -0.25512    0.05028  -5.074 3.91e-07 ***
## `2013 code`3         -0.37090    0.05854  -6.335 2.37e-10 ***
## `2013 code`4         -0.31110    0.05947  -5.231 1.69e-07 ***
## `2013 code`5         -0.22107    0.06765  -3.268 0.001084 **
## `2013 code`6         -0.20388    0.07432  -2.743 0.006080 **
## COVID_COUNT.y        -1.36283    0.78628  -1.733 0.083049 .
## fully_vaccinated.y    0.52060    0.09198   5.660 1.51e-08 ***
## pop2021.y            -1.83738    1.10622  -1.661 0.096724 .
## `Older (65 plus).y`   3.53142    0.84034   4.202 2.64e-05 ***
## TotalVote.y          -0.70930    0.17524  -4.048 5.18e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 795.33  on 91  degrees of freedom
## Residual deviance: 336.38  on 72  degrees of freedom
## AIC: 946.15
```

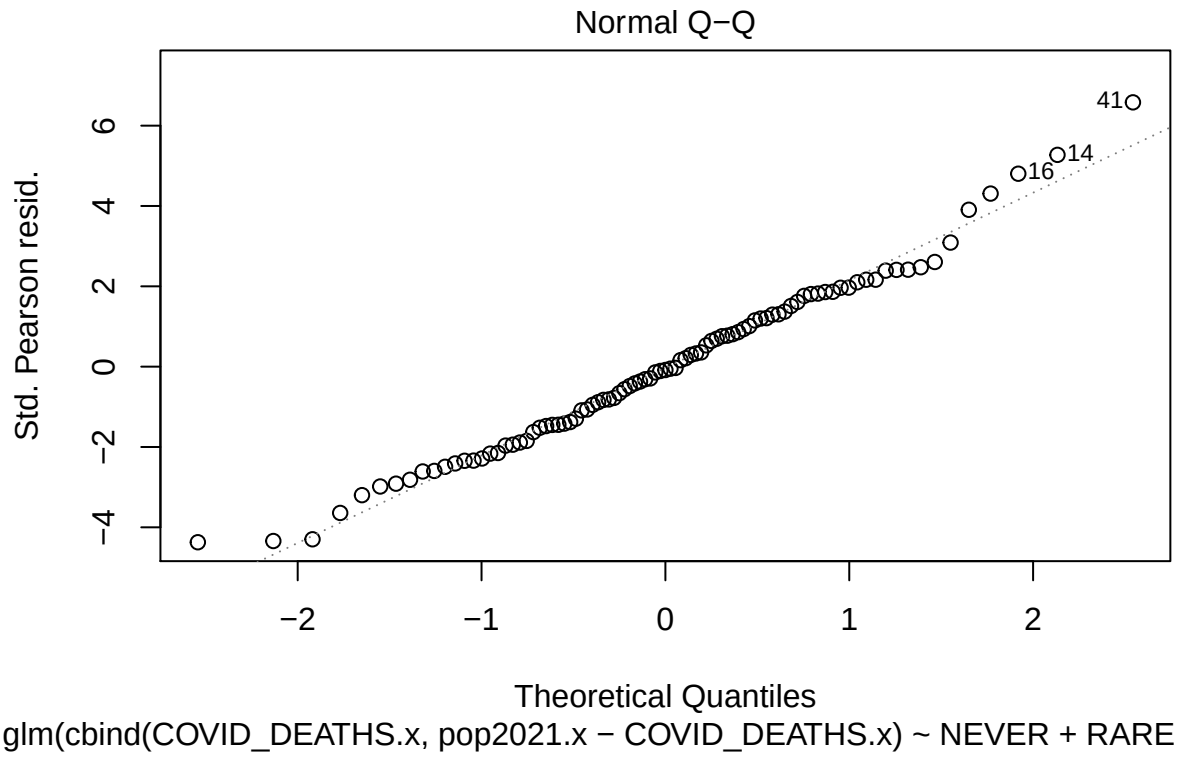
```
##
## Number of Fisher Scoring iterations: 4
```

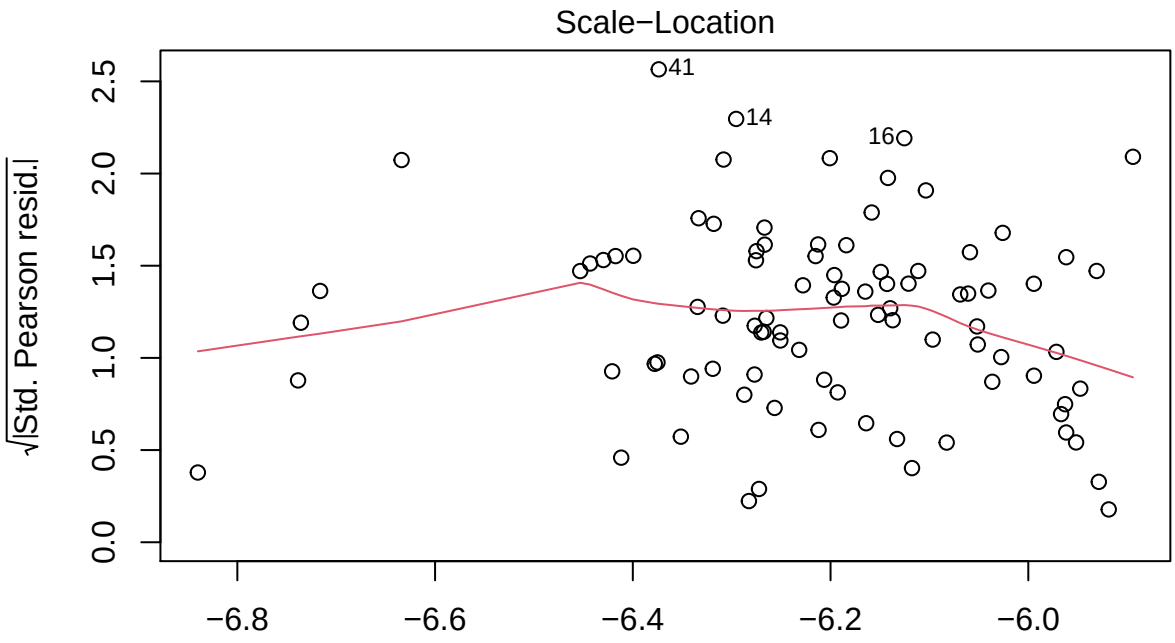
```
drop1(mod0.2, test = "Chi")
```

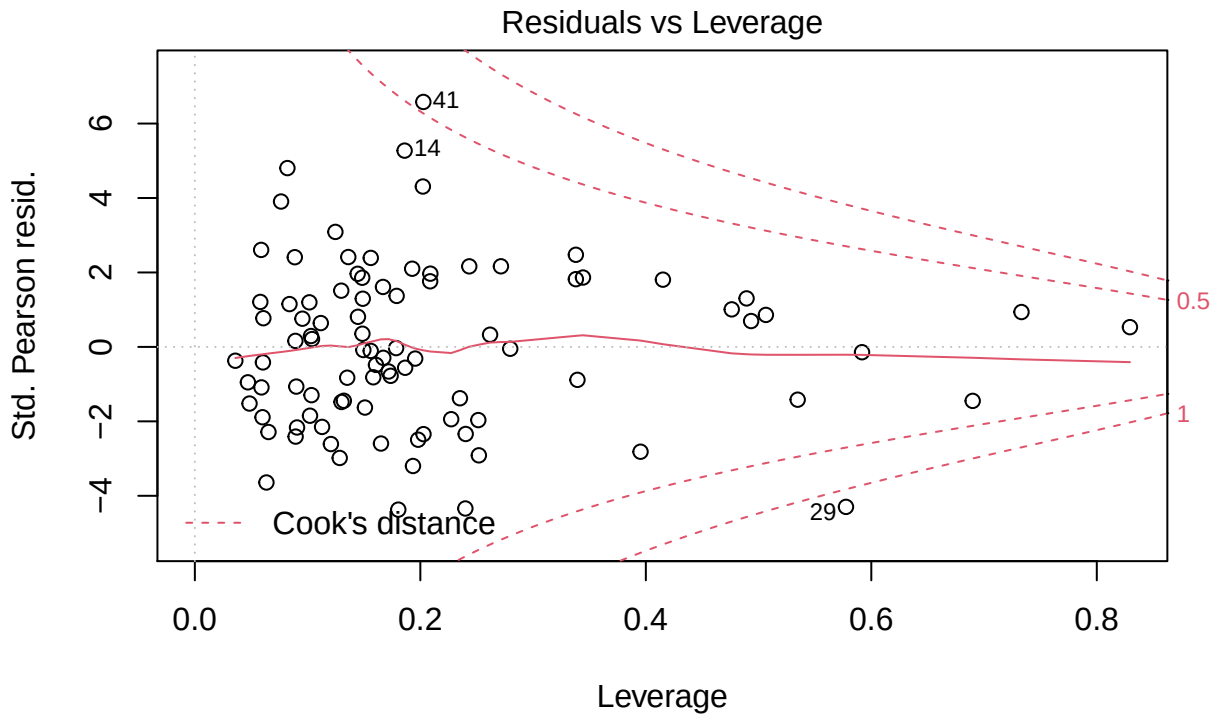
```
## Single term deletions
##
## Model:
## cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ NEVER + RARELY +
##     SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + olderprop +
##     ClintProp + TrmpProp + `2013 code` + COVID_COUNT.y + fully_vaccinated.y +
##     pop2021.y + `Older (65 plus).y` + TotalVote.y
##                      Df Deviance    AIC    LRT  Pr(>Chi)
## <none>                    336.38 946.15
## NEVER                 1   345.62 953.39  9.248  0.002358 **
## RARELY                1   345.57 953.34  9.194  0.002429 **
## SOMETIMES             1   345.58 953.35  9.204  0.002415 **
## FREQUENTLY            1   345.67 953.43  9.289  0.002305 **
## ALWAYS                1   345.61 953.38  9.231  0.002379 **
## prop_cases            1   340.19 947.96  3.814  0.050825 .
## olderprop             1   341.57 949.34  5.197  0.022631 *
## ClintProp             1   342.05 949.82  5.678  0.017180 *
## TrmpProp              1   344.43 952.20  8.056  0.004535 **
## `2013 code`           5   392.52 992.29 56.144 7.591e-11 ***
## COVID_COUNT.y         1   339.35 947.12  2.974  0.084635 .
## fully_vaccinated.y    1   368.35 976.12 31.972 1.564e-08 ***
## pop2021.y             1   339.18 946.95  2.803  0.094091 .
## `Older (65 plus).y`   1   354.42 962.19 18.043 2.160e-05 ***
## TotalVote.y           1   352.81 960.58 16.434 5.038e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
plot(mod0.2)
```


Residuals vs Fitted
Residuals
Predicted values
glm(cbind(COVID_DEATHS.x, pop2021.x − COVID_DEATHS.x) ~ NEVER + RARELY + S
41
14
16
6
4
2
0
−2
−4
−6.8
−6.6
−6.4
−6.2
−6.0


Normal Q−Q
Std. Pearson resid.
Theoretical Quantiles
glm(cbind(COVID_DEATHS.x, pop2021.x − COVID_DEATHS.x) ~ NEVER + RARELY + S
41
14
16
−4
−2
0
2
4
6
−2
−1
0
1
2


Scale−Location
41
14
16
√|Std. Pearson resid.|
0.0
0.5
1.0
1.5
2.0
2.5
−6.8
−6.6
−6.4
−6.2
−6.0
Predicted values
glm(cbind(COVID_DEATHS.x, pop2021.x − COVID_DEATHS.x) ~ NEVER + RARELY +



glm(cbind(COVID_DEATHS.x, pop2021.x − COVID_DEATHS.x) ~ NEVER + RARELY + S

Look for interactions

```
mod1 <- glm(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ . - LOCATION_ID -
    COUNTY_NAME - prop_death - OtherProp - OtherVote.x - COVID_COUNT.x - COVID_TEST.x -
    all_doses_administered.x - fully_vaccinated.x - ClintVote.x - TrmpVote.x - TotalVote.x -
    COVID_DEATHS.y + olderprop * TrmpProp * `2013 code` * RARELY, data = big_data3,
    family = binomial)

summary(mod1)
```

```
##
## Call:
## glm(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~
##     . - LOCATION_ID - COUNTY_NAME - prop_death - OtherProp -
##         OtherVote.x - COVID_COUNT.x - COVID_TEST.x - all_doses_administered.x -
##         fully_vaccinated.x - ClintVote.x - TrmpVote.x - TotalVote.x -
##         COVID_DEATHS.y + olderprop * TrmpProp * `2013 code` *
##         RARELY, family = binomial, data = big_data3)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -3.7675  -0.6099   0.0000   0.2654   2.9639
##
```

```
## Coefficients: (8 not defined because of singularities)
##                                          Estimate Std. Error z value Pr(>|z|)
## (Intercept)                            -4.295e+01  8.144e+01  -0.527 0.597925
## NEVER                                  -3.816e+01  2.391e+01  -1.596 0.110526
## RARELY                                  1.224e+03  7.123e+02   1.719 0.085644
## SOMETIMES                              -3.957e+01  2.400e+01  -1.649 0.099194
## FREQUENTLY                             -3.997e+01  2.401e+01  -1.665 0.095988
## ALWAYS                                 -3.965e+01  2.401e+01  -1.651 0.098699
## prop_cases                              4.692e+01  1.397e+01   3.359 0.000784
## `Older (65 plus).x`                     4.022e-05  8.980e-06   4.478 7.52e-06
## olderprop                               2.650e+02  3.887e+02   0.682 0.495353
## ClintProp                               2.382e+01  3.095e+01   0.770 0.441572
## TrmpProp                                1.293e+02  1.216e+02   1.063 0.287698
## `2013 code2                             1.047e+01  7.031e+01   0.149 0.881588
## `2013 code3                             5.107e+01  5.132e+01   0.995 0.319715
## `2013 code4                             8.199e+01  7.099e+01   1.155 0.248112
## `2013 code5                            -1.147e+02  7.198e+01  -1.593 0.111177
## `2013 code6                             1.979e+00  7.551e+00   0.262 0.793267
## COVID_COUNT.y                          -4.796e+00  1.546e+00  -3.101 0.001926
## COVID_TEST.y                            3.989e-01  2.363e-01   1.688 0.091360
## all_doses_administered.y                6.145e-01  9.137e-01   0.673 0.501228
## fully_vaccinated.y                      2.561e-02  8.442e-01   0.030 0.975803
## pop2021.y                              -6.010e-01  2.244e+00  -0.268 0.788858
## `Older (65 plus).y`                     3.768e+00  2.307e+00   1.633 0.102399
## ClintVote.y                             3.189e+00  2.013e+00   1.584 0.113115
## TrmpVote.y                              8.990e+00  7.443e+00   1.208 0.227134
## OtherVote.y                             1.459e+00  1.657e+00   0.881 0.378491
## TotalVote.y                            -1.327e+01  5.445e+00  -2.437 0.014809
## olderprop:TrmpProp                     -4.977e+02  5.379e+02  -0.925 0.354809
## olderprop:`2013 code2                   2.957e+01  3.917e+02   0.076 0.939808
## olderprop:`2013 code3                  -1.785e+02  2.807e+02  -0.636 0.525003
## olderprop:`2013 code4                  -3.675e+02  3.953e+02  -0.930 0.352601
## olderprop:`2013 code5                   6.834e+02  4.020e+02   1.700 0.089163
## olderprop:`2013 code6                          NA         NA      NA       NA
## TrmpProp:`2013 code2                   -2.774e+01  1.076e+02  -0.258 0.796517
## TrmpProp:`2013 code3                   -8.838e+01  8.299e+01  -1.065 0.286893
## TrmpProp:`2013 code4                   -1.402e+02  1.088e+02  -1.288 0.197636
## TrmpProp:`2013 code5                    1.402e+02  1.085e+02   1.292 0.196288
## TrmpProp:`2013 code6                           NA         NA      NA       NA
## RARELY:olderprop                       -6.202e+03  3.595e+03  -1.725 0.084499
## RARELY:TrmpProp                        -1.967e+03  1.007e+03  -1.954 0.050663
## RARELY:`2013 code2                     -6.368e+02  7.232e+02  -0.881 0.378532
## RARELY:`2013 code3                     -2.852e+02  1.847e+02  -1.544 0.122593
## RARELY:`2013 code4                     -1.382e+03  7.240e+02  -1.909 0.056252
## RARELY:`2013 code5                      5.120e+02  7.557e+02   0.677 0.498109
## RARELY:`2013 code6                             NA         NA      NA       NA
## olderprop:TrmpProp:`2013 code2          2.918e+01  5.432e+02   0.054 0.957159
## olderprop:TrmpProp:`2013 code3          3.514e+02  3.753e+02   0.936 0.349196
## olderprop:TrmpProp:`2013 code4          6.590e+02  5.494e+02   1.200 0.230277
## olderprop:TrmpProp:`2013 code5         -8.398e+02  5.548e+02  -1.514 0.130085
## olderprop:TrmpProp:`2013 code6                 NA         NA      NA       NA
## RARELY:olderprop:TrmpProp               9.665e+03  5.046e+03   1.915 0.055464
## RARELY:olderprop:`2013 code2            2.583e+03  3.652e+03   0.707 0.479401
## RARELY:olderprop:`2013 code3           -5.902e+02  1.474e+03  -0.400 0.688893
```

```
## RARELY:olderprop:‘2013 code‘4           6.754e+03  3.648e+03   1.851 0.064122
## RARELY:olderprop:‘2013 code‘5          -3.488e+03  3.870e+03  -0.901 0.367420
## RARELY:olderprop:‘2013 code‘6                  NA         NA      NA       NA
## RARELY:TrmpProp:‘2013 code‘2            1.045e+03  1.018e+03   1.026 0.304866
## RARELY:TrmpProp:‘2013 code‘3            5.537e+02  3.636e+02   1.523 0.127758
## RARELY:TrmpProp:‘2013 code‘4            2.184e+03  1.019e+03   2.144 0.032050
## RARELY:TrmpProp:‘2013 code‘5           -4.912e+02  1.057e+03  -0.465 0.642119
## RARELY:TrmpProp:‘2013 code‘6                  NA         NA      NA       NA
## RARELY:olderprop:TrmpProp:‘2013 code‘2 -4.306e+03  5.146e+03  -0.837 0.402748
## RARELY:olderprop:TrmpProp:‘2013 code‘3         NA         NA      NA       NA
## RARELY:olderprop:TrmpProp:‘2013 code‘4 -1.074e+04  5.130e+03  -2.093 0.036333
## RARELY:olderprop:TrmpProp:‘2013 code‘5  3.750e+03  5.411e+03   0.693 0.488341
## RARELY:olderprop:TrmpProp:‘2013 code‘6         NA         NA      NA       NA
##
## (Intercept)
## NEVER
## RARELY                                 .
## SOMETIMES                              .
## FREQUENTLY                             .
## ALWAYS                                 .
## prop_cases                             ***
## ‘Older (65 plus).x‘                    ***
## olderprop
## ClintProp
## TrmpProp
## ‘2013 code‘2
## ‘2013 code‘3
## ‘2013 code‘4
## ‘2013 code‘5
## ‘2013 code‘6
## COVID_COUNT.y                          **
## COVID_TEST.y                           .
## all_doses_administered.y
## fully_vaccinated.y
## pop2021.y
## ‘Older (65 plus).y‘
## ClintVote.y
## TrmpVote.y
## OtherVote.y
## TotalVote.y                            *
## olderprop:TrmpProp
## olderprop:‘2013 code‘2
## olderprop:‘2013 code‘3
## olderprop:‘2013 code‘4
## olderprop:‘2013 code‘5                 .
## olderprop:‘2013 code‘6
## TrmpProp:‘2013 code‘2
## TrmpProp:‘2013 code‘3
## TrmpProp:‘2013 code‘4
## TrmpProp:‘2013 code‘5
## TrmpProp:‘2013 code‘6
## RARELY:olderprop                       .
## RARELY:TrmpProp                        .
## RARELY:‘2013 code‘2
```

```
## RARELY:‘2013 code‘3
## RARELY:‘2013 code‘4                    .
## RARELY:‘2013 code‘5
## RARELY:‘2013 code‘6
## olderprop:TrmpProp:‘2013 code‘2
## olderprop:TrmpProp:‘2013 code‘3
## olderprop:TrmpProp:‘2013 code‘4
## olderprop:TrmpProp:‘2013 code‘5
## olderprop:TrmpProp:‘2013 code‘6
## RARELY:olderprop:TrmpProp              .
## RARELY:olderprop:‘2013 code‘2
## RARELY:olderprop:‘2013 code‘3
## RARELY:olderprop:‘2013 code‘4          .
## RARELY:olderprop:‘2013 code‘5
## RARELY:olderprop:‘2013 code‘6
## RARELY:TrmpProp:‘2013 code‘2
## RARELY:TrmpProp:‘2013 code‘3
## RARELY:TrmpProp:‘2013 code‘4           *
## RARELY:TrmpProp:‘2013 code‘5
## RARELY:TrmpProp:‘2013 code‘6
## RARELY:olderprop:TrmpProp:‘2013 code‘2
## RARELY:olderprop:TrmpProp:‘2013 code‘3
## RARELY:olderprop:TrmpProp:‘2013 code‘4 *
## RARELY:olderprop:TrmpProp:‘2013 code‘5
## RARELY:olderprop:TrmpProp:‘2013 code‘6
## ---
## Signif. codes:  0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 795.33  on 91  degrees of freedom
## Residual deviance: 127.38  on 35  degrees of freedom
## AIC: 811.15
##
## Number of Fisher Scoring iterations: 4
```

```
Anova(mod1)
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                                       LR Chisq Df Pr(>Chisq)
## NEVER                                    2.540  1  0.1110160
## RARELY                                   8.769  1  0.0030643 **
## SOMETIMES                                2.711  1  0.0996506 .
## FREQUENTLY                               2.763  1  0.0964463 .
## ALWAYS                                   2.719  1  0.0991587 .
## prop_cases                              11.128  1  0.0008505 ***
## ‘Older (65 plus).x‘                     19.617  1  9.463e-06 ***
## olderprop                                0.088  1  0.7665546
## ClintProp                                0.595  1  0.4406174
## TrmpProp                                 0.671  1  0.4125720
## ‘2013 code‘                             33.978  5  2.405e-06 ***
## COVID_COUNT.y                            9.518  1  0.0020342 **
```

```
## COVID_TEST.y                              2.854  1  0.0911396 .
## all_doses_administered.y                  0.453  1  0.5010991
## fully_vaccinated.y                        0.001  1  0.9758030
## pop2021.y                                 0.072  1  0.7886972
## `Older (65 plus).y`                       2.688  1  0.1010905
## ClintVote.y                               2.510  1  0.1131292
## TrmpVote.y                                1.458  1  0.2271941
## OtherVote.y                               0.779  1  0.3775158
## TotalVote.y                               5.942  1  0.0147884 *
## olderprop:TrmpProp                       13.691  1  0.0002155 ***
## olderprop:`2013 code`                    20.247  4  0.0004463 ***
## TrmpProp:`2013 code`                     13.863  4  0.0077450 **
## RARELY:olderprop                          1.343  1  0.2465642
## RARELY:TrmpProp                          10.159  1  0.0014359 **
## RARELY:`2013 code`                       42.122  4  1.574e-08 ***
## olderprop:TrmpProp:`2013 code`           39.617  4  5.194e-08 ***
## RARELY:olderprop:TrmpProp                 7.331  1  0.0067769 **
## RARELY:olderprop:`2013 code`             25.209  4  4.568e-05 ***
## RARELY:TrmpProp:`2013 code`              13.462  4  0.0092273 **
## RARELY:olderprop:TrmpProp:`2013 code`    26.053  3  9.296e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
drop1(mod1, test = "Chi")
```

```
## Single term deletions
##
## Model:
## cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ (LOCATION_ID +
##     COVID_COUNT.x + COVID_TEST.x + COUNTY_NAME + NEVER + RARELY +
##     SOMETIMES + FREQUENTLY + ALWAYS + all_doses_administered.x +
##     fully_vaccinated.x + prop_cases + prop_death + `Older (65 plus).x` +
##     olderprop + ClintVote.x + TrmpVote.x + OtherVote.x + TotalVote.x +
##     ClintProp + TrmpProp + OtherProp + `2013 code` + COVID_COUNT.y +
##     COVID_DEATHS.y + COVID_TEST.y + all_doses_administered.y +
##     fully_vaccinated.y + pop2021.y + `Older (65 plus).y` + ClintVote.y +
##     TrmpVote.y + OtherVote.y + TotalVote.y) - LOCATION_ID - COUNTY_NAME -
##     prop_death - OtherProp - OtherVote.x - COVID_COUNT.x - COVID_TEST.x -
##     all_doses_administered.x - fully_vaccinated.x - ClintVote.x -
##     TrmpVote.x - TotalVote.x - COVID_DEATHS.y + olderprop * TrmpProp *
##     `2013 code` * RARELY
##                                      Df Deviance    AIC     LRT  Pr(>Chi)
## <none>                                    127.39 811.15
## NEVER                                 1   129.92 811.69  2.5397 0.1110160
## SOMETIMES                             1   130.10 811.87  2.7111 0.0996506 .
## FREQUENTLY                            1   130.15 811.92  2.7633 0.0964463 .
## ALWAYS                                1   130.10 811.87  2.7190 0.0991587 .
## prop_cases                            1   138.51 820.28 11.1277 0.0008505 ***
## `Older (65 plus).x`                   1   147.00 828.77 19.6169 9.463e-06 ***
## ClintProp                             1   127.98 809.75  0.5947 0.4406174
## COVID_COUNT.y                         1   136.90 818.67  9.5184 0.0020342 **
## COVID_TEST.y                          1   130.24 812.01  2.8541 0.0911396 .
## all_doses_administered.y              1   127.84 809.61  0.4526 0.5010991
## fully_vaccinated.y                    1   127.39 809.16  0.0009 0.9758030
```

```
## pop2021.y                                1   127.46 809.23  0.0718 0.7886972
## `Older (65 plus).y`                      1   130.07 811.84  2.6883 0.1010905
## ClintVote.y                              1   129.90 811.66  2.5100 0.1131292
## TrmpVote.y                               1   128.84 810.61  1.4583 0.2271941
## OtherVote.y                              1   128.16 809.93  0.7788 0.3775158
## TotalVote.y                              1   133.33 815.10  5.9415 0.0147884 *
## RARELY:olderprop:TrmpProp:`2013 code`    3   153.44 831.21 26.0533 9.296e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
step(mod1, scope = list(lower = mod0, upper = mod1), direction = "both")
```

```
## Start:  AIC=811.15
## cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ (LOCATION_ID +
##     COVID_COUNT.x + COVID_TEST.x + COUNTY_NAME + NEVER + RARELY +
##     SOMETIMES + FREQUENTLY + ALWAYS + all_doses_administered.x +
##     fully_vaccinated.x + prop_cases + prop_death + `Older (65 plus).x` +
##     olderprop + ClintVote.x + TrmpVote.x + OtherVote.x + TotalVote.x +
##     ClintProp + TrmpProp + OtherProp + `2013 code` + COVID_COUNT.y +
##     COVID_DEATHS.y + COVID_TEST.y + all_doses_administered.y +
##     fully_vaccinated.y + pop2021.y + `Older (65 plus).y` + ClintVote.y +
##     TrmpVote.y + OtherVote.y + TotalVote.y) - LOCATION_ID - COUNTY_NAME -
##     prop_death - OtherProp - OtherVote.x - COVID_COUNT.x - COVID_TEST.x -
##     all_doses_administered.x - fully_vaccinated.x - ClintVote.x -
##     TrmpVote.x - TotalVote.x - COVID_DEATHS.y + olderprop * TrmpProp *
##     `2013 code` * RARELY
##
##                                        Df Deviance    AIC
## - fully_vaccinated.y                    1   127.39 809.16
## - pop2021.y                             1   127.46 809.23
## - all_doses_administered.y              1   127.84 809.61
## - ClintProp                             1   127.98 809.75
## - OtherVote.y                           1   128.16 809.93
## - TrmpVote.y                            1   128.84 810.61
## <none>                                      127.39 811.15
## - ClintVote.y                           1   129.90 811.66
## - NEVER                                 1   129.92 811.69
## - `Older (65 plus).y`                   1   130.07 811.84
## - SOMETIMES                             1   130.10 811.87
## - ALWAYS                                1   130.10 811.87
## - FREQUENTLY                            1   130.15 811.92
## - COVID_TEST.y                          1   130.24 812.01
## - TotalVote.y                           1   133.33 815.10
## - COVID_COUNT.y                         1   136.90 818.67
## - prop_cases                            1   138.51 820.28
## - `Older (65 plus).x`                   1   147.00 828.77
## - RARELY:olderprop:TrmpProp:`2013 code` 3   153.44 831.21
##
## Step:  AIC=809.16
## cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ NEVER + RARELY +
##     SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
##     olderprop + ClintProp + TrmpProp + `2013 code` + COVID_COUNT.y +
##     COVID_TEST.y + all_doses_administered.y + pop2021.y + `Older (65 plus).y` +
##     ClintVote.y + TrmpVote.y + OtherVote.y + TotalVote.y + olderprop:TrmpProp +
```

```
##     olderprop:`2013 code` + TrmpProp:`2013 code` + RARELY:olderprop +
##     RARELY:TrmpProp + RARELY:`2013 code` + olderprop:TrmpProp:`2013 code` +
##     RARELY:olderprop:TrmpProp + RARELY:olderprop:`2013 code` +
##     RARELY:TrmpProp:`2013 code` + RARELY:olderprop:TrmpProp:`2013 code`
##
##                                        Df Deviance    AIC
## - pop2021.y                             1   127.47 807.24
## - ClintProp                             1   128.01 807.78
## - OtherVote.y                           1   128.17 807.94
## - TrmpVote.y                            1   129.12 808.89
## <none>                                      127.39 809.16
## - ClintVote.y                           1   129.95 809.72
## - NEVER                                 1   129.97 809.74
## - SOMETIMES                             1   130.15 809.92
## - ALWAYS                                1   130.15 809.92
## - FREQUENTLY                            1   130.20 809.97
## - COVID_TEST.y                          1   130.34 810.11
## - `Older (65 plus).y`                   1   130.55 810.32
## + fully_vaccinated.y                    1   127.39 811.15
## - TotalVote.y                           1   135.09 814.86
## - COVID_COUNT.y                         1   137.06 816.83
## - prop_cases                            1   138.74 818.50
## - all_doses_administered.y              1   139.42 819.19
## - `Older (65 plus).x`                   1   147.09 826.86
## - RARELY:olderprop:TrmpProp:`2013 code` 3   157.67 833.44
##
## Step:  AIC=807.24
## cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ NEVER + RARELY +
##     SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
##     olderprop + ClintProp + TrmpProp + `2013 code` + COVID_COUNT.y +
##     COVID_TEST.y + all_doses_administered.y + `Older (65 plus).y` +
##     ClintVote.y + TrmpVote.y + OtherVote.y + TotalVote.y + olderprop:TrmpProp +
##     olderprop:`2013 code` + TrmpProp:`2013 code` + RARELY:olderprop +
##     RARELY:TrmpProp + RARELY:`2013 code` + olderprop:TrmpProp:`2013 code` +
##     RARELY:olderprop:TrmpProp + RARELY:olderprop:`2013 code` +
##     RARELY:TrmpProp:`2013 code` + RARELY:olderprop:TrmpProp:`2013 code`
##
##                                        Df Deviance    AIC
## - ClintProp                             1   128.20 805.97
## - OtherVote.y                           1   128.31 806.08
## - TrmpVote.y                            1   129.16 806.93
## <none>                                      127.47 807.24
## - ClintVote.y                           1   129.95 807.72
## - NEVER                                 1   130.20 807.97
## - SOMETIMES                             1   130.38 808.15
## - ALWAYS                                1   130.39 808.16
## - FREQUENTLY                            1   130.44 808.21
## - COVID_TEST.y                          1   130.68 808.45
## + pop2021.y                             1   127.39 809.16
## + fully_vaccinated.y                    1   127.46 809.23
## - `Older (65 plus).y`                   1   133.52 811.29
## - TotalVote.y                           1   135.10 812.87
## - COVID_COUNT.y                         1   138.57 816.34
## - all_doses_administered.y              1   139.90 817.67
```

```
## - prop_cases                               1   140.72 818.48
## - `Older (65 plus).x`                      1   147.75 825.52
## - RARELY:olderprop:TrmpProp:`2013 code`    3   157.71 831.48
##
## Step:  AIC=805.97
## cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ NEVER + RARELY +
##     SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
##     olderprop + TrmpProp + `2013 code` + COVID_COUNT.y + COVID_TEST.y +
##     all_doses_administered.y + `Older (65 plus).y` + ClintVote.y +
##     TrmpVote.y + OtherVote.y + TotalVote.y + olderprop:TrmpProp +
##     olderprop:`2013 code` + TrmpProp:`2013 code` + RARELY:olderprop +
##     RARELY:TrmpProp + RARELY:`2013 code` + olderprop:TrmpProp:`2013 code` +
##     RARELY:olderprop:TrmpProp + RARELY:olderprop:`2013 code` +
##     RARELY:TrmpProp:`2013 code` + RARELY:olderprop:TrmpProp:`2013 code`
##
##                                           Df Deviance    AIC
## - OtherVote.y                              1   128.34 804.11
## <none>                                         128.20 805.97
## - ClintVote.y                              1   130.21 805.98
## - TrmpVote.y                               1   130.72 806.49
## - NEVER                                    1   130.80 806.57
## - SOMETIMES                                1   130.98 806.75
## - ALWAYS                                   1   131.00 806.77
## - FREQUENTLY                               1   131.03 806.80
## - COVID_TEST.y                             1   131.26 807.03
## + ClintProp                                1   127.47 807.24
## + pop2021.y                                1   128.01 807.78
## + fully_vaccinated.y                       1   128.10 807.87
## - `Older (65 plus).y`                      1   134.12 809.89
## - TotalVote.y                              1   135.72 811.50
## - COVID_COUNT.y                            1   138.87 814.64
## - all_doses_administered.y                 1   140.70 816.47
## - prop_cases                               1   141.03 816.80
## - `Older (65 plus).x`                      1   149.95 825.72
## - RARELY:olderprop:TrmpProp:`2013 code`    3   158.31 830.08
##
## Step:  AIC=804.11
## cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ NEVER + RARELY +
##     SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
##     olderprop + TrmpProp + `2013 code` + COVID_COUNT.y + COVID_TEST.y +
##     all_doses_administered.y + `Older (65 plus).y` + ClintVote.y +
##     TrmpVote.y + TotalVote.y + olderprop:TrmpProp + olderprop:`2013 code` +
##     TrmpProp:`2013 code` + RARELY:olderprop + RARELY:TrmpProp +
##     RARELY:`2013 code` + olderprop:TrmpProp:`2013 code` + RARELY:olderprop:TrmpProp +
##     RARELY:olderprop:`2013 code` + RARELY:TrmpProp:`2013 code` +
##     RARELY:olderprop:TrmpProp:`2013 code`
##
##                                           Df Deviance    AIC
## <none>                                         128.34 804.11
## - NEVER                                    1   130.83 804.60
## - SOMETIMES                                1   131.01 804.78
## - ALWAYS                                   1   131.03 804.80
## - FREQUENTLY                               1   131.06 804.83
## - COVID_TEST.y                             1   131.33 805.10
```

```
## + OtherVote.y                              1   128.20 805.97
## + pop2021.y                                1   128.27 806.04
## + ClintProp                                1   128.31 806.08
## + fully_vaccinated.y                       1   128.33 806.10
## - `Older (65 plus).y`                      1   134.14 807.91
## - ClintVote.y                              1   134.35 808.12
## - COVID_COUNT.y                            1   138.88 812.65
## - TrmpVote.y                               1   139.33 813.10
## - prop_cases                               1   141.03 814.80
## - all_doses_administered.y                 1   141.86 815.63
## - TotalVote.y                              1   147.43 821.20
## - `Older (65 plus).x`                      1   155.31 829.08
## - RARELY:olderprop:TrmpProp:`2013 code`    3   159.57 829.34
```

```
##
## Call:  glm(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~
##     NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases +
##         `Older (65 plus).x` + olderprop + TrmpProp + `2013 code` +
##         COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y +
##         `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y +
##         olderprop:TrmpProp + olderprop:`2013 code` + TrmpProp:`2013 code` +
##         RARELY:olderprop + RARELY:TrmpProp + RARELY:`2013 code` +
##         olderprop:TrmpProp:`2013 code` + RARELY:olderprop:TrmpProp +
##         RARELY:olderprop:`2013 code` + RARELY:TrmpProp:`2013 code` +
##         RARELY:olderprop:TrmpProp:`2013 code`, family = binomial,
##     data = big_data3)
##
## Coefficients:
##                             (Intercept)                                    NEVER
##                              -4.640e+00                                -3.686e+01
##                                  RARELY                                 SOMETIMES
##                               1.042e+03                                -3.828e+01
##                              FREQUENTLY                                    ALWAYS
##                              -3.867e+01                                -3.846e+01
##                              prop_cases                      `Older (65 plus).x`
##                               4.683e+01                                 4.188e-05
##                               olderprop                                  TrmpProp
##                               1.795e+02                                 7.034e+01
##                           `2013 code`2                              `2013 code`3
##                              -6.817e+00                                 3.912e+01
##                           `2013 code`4                              `2013 code`5
##                               6.920e+01                                -1.213e+02
##                           `2013 code`6                             COVID_COUNT.y
##                               3.609e+00                                -4.766e+00
##                            COVID_TEST.y                 all_doses_administered.y
##                               3.948e-01                                 6.608e-01
##                     `Older (65 plus).y`                               ClintVote.y
##                               3.222e+00                                 2.067e+00
##                             TrmpVote.y                               TotalVote.y
##                               1.254e+01                                -1.435e+01
##                      olderprop:TrmpProp                    olderprop:`2013 code`2
##                              -3.719e+02                                 1.229e+02
##                  olderprop:`2013 code`3                    olderprop:`2013 code`4
##                              -1.399e+02                                -2.996e+02
```

```
##                 olderprop:`2013 code`5                 olderprop:`2013 code`6
##                             7.194e+02                                     NA
##                  TrmpProp:`2013 code`2                  TrmpProp:`2013 code`3
##                             -7.282e-01                             -6.081e+01
##                  TrmpProp:`2013 code`4                  TrmpProp:`2013 code`5
##                             -1.205e+02                             1.522e+02
##                  TrmpProp:`2013 code`6                      RARELY:olderprop
##                                     NA                             -5.293e+03
##                        RARELY:TrmpProp                    RARELY:`2013 code`2
##                             -1.707e+03                             -4.658e+02
##                    RARELY:`2013 code`3                    RARELY:`2013 code`4
##                             -2.545e+02                             -1.252e+03
##                    RARELY:`2013 code`5                    RARELY:`2013 code`6
##                             6.235e+02                                     NA
##        olderprop:TrmpProp:`2013 code`2        olderprop:TrmpProp:`2013 code`3
##                             -1.044e+02                             2.506e+02
##        olderprop:TrmpProp:`2013 code`4        olderprop:TrmpProp:`2013 code`5
##                             5.667e+02                             -8.920e+02
##        olderprop:TrmpProp:`2013 code`6             RARELY:olderprop:TrmpProp
##                                     NA                             8.374e+03
##          RARELY:olderprop:`2013 code`2          RARELY:olderprop:`2013 code`3
##                             1.746e+03                             -1.095e+02
##          RARELY:olderprop:`2013 code`4          RARELY:olderprop:`2013 code`5
##                             6.140e+03                             -4.007e+03
##          RARELY:olderprop:`2013 code`6           RARELY:TrmpProp:`2013 code`2
##                                     NA                             8.014e+02
##           RARELY:TrmpProp:`2013 code`3           RARELY:TrmpProp:`2013 code`4
##                             3.883e+02                             2.005e+03
##           RARELY:TrmpProp:`2013 code`5           RARELY:TrmpProp:`2013 code`6
##                             -6.510e+02                                     NA
## RARELY:olderprop:TrmpProp:`2013 code`2  RARELY:olderprop:TrmpProp:`2013 code`3
##                             -3.112e+03                                     NA
## RARELY:olderprop:TrmpProp:`2013 code`4  RARELY:olderprop:TrmpProp:`2013 code`5
##                             -9.901e+03                             4.495e+03
## RARELY:olderprop:TrmpProp:`2013 code`6
##                                     NA
##
## Degrees of Freedom: 91 Total (i.e. Null);  39 Residual
## Null Deviance:       795.3
## Residual Deviance: 128.3     AIC: 804.1
```

```
mod1.1.0 <- glm(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ NEVER +
    RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
    olderprop + TrmpProp + `2013 code` + COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y +
    `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y + olderprop:TrmpProp +
    olderprop:`2013 code` + TrmpProp:`2013 code` + RARELY:olderprop + RARELY:TrmpProp +
    RARELY:`2013 code` + olderprop:TrmpProp:`2013 code` + RARELY:olderprop:TrmpProp +
    RARELY:olderprop:`2013 code` + RARELY:TrmpProp:`2013 code` + RARELY:olderprop:TrmpProp:`2013 code`,
    family = binomial, data = big_data3)
summary(mod1.1.0)
```

```
##
## Call:
## glm(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~
```

```
##     NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases +
##         `Older (65 plus).x` + olderprop + TrmpProp + `2013 code` +
##         COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y +
##         `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y +
##         olderprop:TrmpProp + olderprop:`2013 code` + TrmpProp:`2013 code` +
##         RARELY:olderprop + RARELY:TrmpProp + RARELY:`2013 code` +
##         olderprop:TrmpProp:`2013 code` + RARELY:olderprop:TrmpProp +
##         RARELY:olderprop:`2013 code` + RARELY:TrmpProp:`2013 code` +
##         RARELY:olderprop:TrmpProp:`2013 code`, family = binomial,
##     data = big_data3)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -3.5867  -0.5480  -0.0437   0.2417   2.9633
##
## Coefficients: (8 not defined because of singularities)
##                                      Estimate Std. Error z value Pr(>|z|)
## (Intercept)                         -4.640e+00  6.566e+01  -0.071 0.943664
## NEVER                               -3.686e+01  2.329e+01  -1.583 0.113503
## RARELY                               1.042e+03  6.754e+02   1.544 0.122707
## SOMETIMES                           -3.828e+01  2.336e+01  -1.638 0.101327
## FREQUENTLY                          -3.867e+01  2.339e+01  -1.654 0.098173
## ALWAYS                              -3.846e+01  2.340e+01  -1.644 0.100247
## prop_cases                           4.683e+01  1.308e+01   3.582 0.000342
## `Older (65 plus).x`                  4.189e-05  7.952e-06   5.267 1.39e-07
## olderprop                            1.795e+02  3.704e+02   0.485 0.627882
## TrmpProp                             7.034e+01  1.002e+02   0.702 0.482453
## `2013 code`2                        -6.817e+00  6.662e+01  -0.102 0.918501
## `2013 code`3                         3.912e+01  4.873e+01   0.803 0.422122
## `2013 code`4                         6.920e+01  6.860e+01   1.009 0.313040
## `2013 code`5                        -1.213e+02  7.015e+01  -1.730 0.083685
## `2013 code`6                         3.609e+00  7.165e+00   0.504 0.614420
## COVID_COUNT.y                       -4.766e+00  1.462e+00  -3.261 0.001110
## COVID_TEST.y                         3.948e-01  2.282e-01   1.730 0.083628
## all_doses_administered.y             6.608e-01  1.775e-01   3.722 0.000198
## `Older (65 plus).y`                  3.222e+00  1.333e+00   2.417 0.015648
## ClintVote.y                          2.067e+00  8.433e-01   2.452 0.014222
## TrmpVote.y                           1.254e+01  3.783e+00   3.314 0.000920
## TotalVote.y                         -1.435e+01  3.282e+00  -4.371 1.24e-05
## olderprop:TrmpProp                  -3.719e+02  5.128e+02  -0.725 0.468334
## olderprop:`2013 code`2               1.229e+02  3.717e+02   0.331 0.740929
## olderprop:`2013 code`3              -1.399e+02  2.726e+02  -0.513 0.607921
## olderprop:`2013 code`4              -2.996e+02  3.818e+02  -0.785 0.432688
## olderprop:`2013 code`5               7.194e+02  3.922e+02   1.834 0.066600
## olderprop:`2013 code`6                      NA         NA      NA       NA
## TrmpProp:`2013 code`2               -7.282e-01  1.019e+02  -0.007 0.994297
## TrmpProp:`2013 code`3               -6.081e+01  7.509e+01  -0.810 0.417984
## TrmpProp:`2013 code`4               -1.205e+02  1.050e+02  -1.148 0.251147
## TrmpProp:`2013 code`5                1.522e+02  1.059e+02   1.436 0.150902
## TrmpProp:`2013 code`6                       NA         NA      NA       NA
## RARELY:olderprop                    -5.293e+03  3.408e+03  -1.553 0.120434
## RARELY:TrmpProp                     -1.707e+03  9.540e+02  -1.790 0.073514
## RARELY:`2013 code`2                 -4.658e+02  6.831e+02  -0.682 0.495326
## RARELY:`2013 code`3                 -2.545e+02  1.803e+02  -1.411 0.158144
```

```
## RARELY:‘2013 code‘4                    -1.252e+03  7.017e+02  -1.784 0.074431
## RARELY:‘2013 code‘5                     6.235e+02  7.358e+02   0.847 0.396839
## RARELY:‘2013 code‘6                            NA         NA      NA       NA
## olderprop:TrmpProp:‘2013 code‘2        -1.044e+02  5.152e+02  -0.203 0.839350
## olderprop:TrmpProp:‘2013 code‘3         2.506e+02  3.502e+02   0.716 0.474235
## olderprop:TrmpProp:‘2013 code‘4         5.667e+02  5.309e+02   1.067 0.285835
## olderprop:TrmpProp:‘2013 code‘5        -8.920e+02  5.422e+02  -1.645 0.099911
## olderprop:TrmpProp:‘2013 code‘6                NA         NA      NA       NA
## RARELY:olderprop:TrmpProp               8.374e+03  4.784e+03   1.751 0.080012
## RARELY:olderprop:‘2013 code‘2           1.746e+03  3.450e+03   0.506 0.612892
## RARELY:olderprop:‘2013 code‘3          -1.095e+02  1.308e+03  -0.084 0.933245
## RARELY:olderprop:‘2013 code‘4           6.140e+03  3.541e+03   1.734 0.082890
## RARELY:olderprop:‘2013 code‘5          -4.007e+03  3.773e+03  -1.062 0.288254
## RARELY:olderprop:‘2013 code‘6                  NA         NA      NA       NA
## RARELY:TrmpProp:‘2013 code‘2            8.014e+02  9.614e+02   0.834 0.404511
## RARELY:TrmpProp:‘2013 code‘3            3.883e+02  2.924e+02   1.328 0.184189
## RARELY:TrmpProp:‘2013 code‘4            2.005e+03  9.882e+02   2.029 0.042432
## RARELY:TrmpProp:‘2013 code‘5           -6.510e+02  1.030e+03  -0.632 0.527193
## RARELY:TrmpProp:‘2013 code‘6                   NA         NA      NA       NA
## RARELY:olderprop:TrmpProp:‘2013 code‘2 -3.112e+03  4.860e+03  -0.640 0.521995
## RARELY:olderprop:TrmpProp:‘2013 code‘3         NA         NA      NA       NA
## RARELY:olderprop:TrmpProp:‘2013 code‘4 -9.901e+03  4.983e+03  -1.987 0.046954
## RARELY:olderprop:TrmpProp:‘2013 code‘5  4.495e+03  5.279e+03   0.852 0.394472
## RARELY:olderprop:TrmpProp:‘2013 code‘6         NA         NA      NA       NA
##
## (Intercept)
## NEVER
## RARELY
## SOMETIMES
## FREQUENTLY                             .
## ALWAYS
## prop_cases                             ***
## ‘Older (65 plus).x‘                    ***
## olderprop
## TrmpProp
## ‘2013 code‘2
## ‘2013 code‘3
## ‘2013 code‘4
## ‘2013 code‘5                           .
## ‘2013 code‘6
## COVID_COUNT.y                          **
## COVID_TEST.y                           .
## all_doses_administered.y               ***
## ‘Older (65 plus).y‘                    *
## ClintVote.y                            *
## TrmpVote.y                             ***
## TotalVote.y                            ***
## olderprop:TrmpProp
## olderprop:‘2013 code‘2
## olderprop:‘2013 code‘3
## olderprop:‘2013 code‘4
## olderprop:‘2013 code‘5                 .
## olderprop:‘2013 code‘6
## TrmpProp:‘2013 code‘2
```

```
## TrmpProp:‘2013 code‘3
## TrmpProp:‘2013 code‘4
## TrmpProp:‘2013 code‘5
## TrmpProp:‘2013 code‘6
## RARELY:olderprop
## RARELY:TrmpProp                        .
## RARELY:‘2013 code‘2
## RARELY:‘2013 code‘3
## RARELY:‘2013 code‘4                    .
## RARELY:‘2013 code‘5
## RARELY:‘2013 code‘6
## olderprop:TrmpProp:‘2013 code‘2
## olderprop:TrmpProp:‘2013 code‘3
## olderprop:TrmpProp:‘2013 code‘4
## olderprop:TrmpProp:‘2013 code‘5        .
## olderprop:TrmpProp:‘2013 code‘6
## RARELY:olderprop:TrmpProp              .
## RARELY:olderprop:‘2013 code‘2
## RARELY:olderprop:‘2013 code‘3
## RARELY:olderprop:‘2013 code‘4          .
## RARELY:olderprop:‘2013 code‘5
## RARELY:olderprop:‘2013 code‘6
## RARELY:TrmpProp:‘2013 code‘2
## RARELY:TrmpProp:‘2013 code‘3
## RARELY:TrmpProp:‘2013 code‘4           *
## RARELY:TrmpProp:‘2013 code‘5
## RARELY:TrmpProp:‘2013 code‘6
## RARELY:olderprop:TrmpProp:‘2013 code‘2
## RARELY:olderprop:TrmpProp:‘2013 code‘3
## RARELY:olderprop:TrmpProp:‘2013 code‘4 *
## RARELY:olderprop:TrmpProp:‘2013 code‘5
## RARELY:olderprop:TrmpProp:‘2013 code‘6
## ---
## Signif. codes:  0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 795.33  on 91  degrees of freedom
## Residual deviance: 128.34  on 39  degrees of freedom
## AIC: 804.11
##
## Number of Fisher Scoring iterations: 4
```

```
Anova(mod1.1.0)
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                                      LR Chisq Df Pr(>Chisq)
## NEVER                                   2.496  1  0.1141324
## RARELY                                  7.713  1  0.0054835 **
## SOMETIMES                               2.675  1  0.1019290
## FREQUENTLY                              2.725  1  0.0987763 .
## ALWAYS                                  2.692  1  0.1008513
```

```
## prop_cases                                12.696  1  0.0003664 ***
## `Older (65 plus).x`                       26.972  1  2.064e-07 ***
## olderprop                                  6.405  1  0.0113775 *
## TrmpProp                                   4.304  1  0.0380137 *
## `2013 code`                               38.443  5  3.074e-07 ***
## COVID_COUNT.y                             10.548  1  0.0011630 **
## COVID_TEST.y                               2.997  1  0.0834070 .
## all_doses_administered.y                  13.523  1  0.0002357 ***
## `Older (65 plus).y`                        5.807  1  0.0159580 *
## ClintVote.y                                6.009  1  0.0142316 *
## TrmpVote.y                                10.989  1  0.0009167 ***
## TotalVote.y                               19.093  1  1.245e-05 ***
## olderprop:TrmpProp                         9.358  1  0.0022201 **
## olderprop:`2013 code`                     27.391  4  1.657e-05 ***
## TrmpProp:`2013 code`                      15.276  4  0.0041617 **
## RARELY:olderprop                           0.383  1  0.5360539
## RARELY:TrmpProp                            6.788  1  0.0091756 **
## RARELY:`2013 code`                        51.433  4  1.812e-10 ***
## olderprop:TrmpProp:`2013 code`            67.829  4  6.518e-14 ***
## RARELY:olderprop:TrmpProp                  4.193  1  0.0405867 *
## RARELY:olderprop:`2013 code`              27.405  4  1.647e-05 ***
## RARELY:TrmpProp:`2013 code`               13.875  4  0.0077034 **
## RARELY:olderprop:TrmpProp:`2013 code`     31.229  3  7.607e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod1.1.0, test = 'Chi')

# drop NEVER
mod1.1.1 <- glm(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ RARELY +
    SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` + olderprop +
    TrmpProp + `2013 code` + COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y +
    `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y + olderprop:TrmpProp +
    olderprop:`2013 code` + TrmpProp:`2013 code` + RARELY:olderprop + RARELY:TrmpProp +
    RARELY:`2013 code` + olderprop:TrmpProp:`2013 code` + RARELY:olderprop:TrmpProp +
    RARELY:olderprop:`2013 code` + RARELY:TrmpProp:`2013 code` + RARELY:olderprop:TrmpProp:`2013 code`,
    family = binomial, data = big_data3)
summary(mod1.1.1)
```

```
##
## Call:
## glm(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~
##     RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
##         olderprop + TrmpProp + `2013 code` + COVID_COUNT.y +
##         COVID_TEST.y + all_doses_administered.y + `Older (65 plus).y` +
##         ClintVote.y + TrmpVote.y + TotalVote.y + olderprop:TrmpProp +
##         olderprop:`2013 code` + TrmpProp:`2013 code` + RARELY:olderprop +
##         RARELY:TrmpProp + RARELY:`2013 code` + olderprop:TrmpProp:`2013 code` +
##         RARELY:olderprop:TrmpProp + RARELY:olderprop:`2013 code` +
##         RARELY:TrmpProp:`2013 code` + RARELY:olderprop:TrmpProp:`2013 code`,
##     family = binomial, data = big_data3)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
```

```
## -3.8221  -0.7727   0.0000   0.3362   3.4361
##
## Coefficients: (8 not defined because of singularities)
##                                      Estimate Std. Error z value Pr(>|z|)
## (Intercept)                        -2.481e+01  6.425e+01  -0.386 0.699366
## RARELY                              8.610e+02  6.633e+02   1.298 0.194223
## SOMETIMES                          -1.313e+00  4.810e-01  -2.731 0.006323
## FREQUENTLY                         -1.673e+00  4.945e-01  -3.382 0.000718
## ALWAYS                             -1.436e+00  4.466e-01  -3.215 0.001304
## prop_cases                          4.162e+01  1.266e+01   3.287 0.001013
## `Older (65 plus).x`                 3.564e-05  6.955e-06   5.125 2.98e-07
## olderprop                           7.012e+01  3.630e+02   0.193 0.846812
## TrmpProp                            4.343e+01  9.841e+01   0.441 0.659010
## `2013 code`2                       -2.571e+01  6.536e+01  -0.393 0.694005
## `2013 code`3                        2.490e+01  4.779e+01   0.521 0.602404
## `2013 code`4                        4.400e+01  6.654e+01   0.661 0.508477
## `2013 code`5                       -1.341e+02  6.956e+01  -1.927 0.053951
## `2013 code`6                        5.222e+00  7.082e+00   0.737 0.460883
## COVID_COUNT.y                      -4.260e+00  1.427e+00  -2.985 0.002837
## COVID_TEST.y                        4.027e-01  2.275e-01   1.771 0.076622
## all_doses_administered.y            6.396e-01  1.776e-01   3.601 0.000317
## `Older (65 plus).y`                 2.813e+00  1.308e+00   2.150 0.031527
## ClintVote.y                         2.333e+00  8.263e-01   2.823 0.004752
## TrmpVote.y                          1.006e+01  3.443e+00   2.923 0.003471
## TotalVote.y                        -1.217e+01  2.981e+00  -4.084 4.43e-05
## olderprop:TrmpProp                 -2.128e+02  5.016e+02  -0.424 0.671323
## olderprop:`2013 code`2              2.285e+02  3.648e+02   0.626 0.531003
## olderprop:`2013 code`3             -5.676e+01  2.671e+02  -0.213 0.831702
## olderprop:`2013 code`4             -1.630e+02  3.710e+02  -0.439 0.660303
## olderprop:`2013 code`5              7.900e+02  3.890e+02   2.031 0.042255
## olderprop:`2013 code`6                     NA         NA      NA       NA
## TrmpProp:`2013 code`2               2.883e+01  9.987e+01   0.289 0.772814
## TrmpProp:`2013 code`3              -4.196e+01  7.398e+01  -0.567 0.570594
## TrmpProp:`2013 code`4              -8.058e+01  1.017e+02  -0.793 0.428069
## TrmpProp:`2013 code`5               1.729e+02  1.049e+02   1.648 0.099450
## TrmpProp:`2013 code`6                      NA         NA      NA       NA
## RARELY:olderprop                   -4.193e+03  3.325e+03  -1.261 0.207338
## RARELY:TrmpProp                    -1.394e+03  9.299e+02  -1.499 0.133884
## RARELY:`2013 code`2                -2.797e+02  6.706e+02  -0.417 0.676637
## RARELY:`2013 code`3                -1.994e+02  1.764e+02  -1.130 0.258294
## RARELY:`2013 code`4                -9.960e+02  6.805e+02  -1.464 0.143290
## RARELY:`2013 code`5                 7.377e+02  7.305e+02   1.010 0.312534
## RARELY:`2013 code`6                        NA         NA      NA       NA
## olderprop:TrmpProp:`2013 code`2    -2.563e+02  5.048e+02  -0.508 0.611608
## olderprop:TrmpProp:`2013 code`3     1.522e+02  3.440e+02   0.442 0.658266
## olderprop:TrmpProp:`2013 code`4     3.632e+02  5.137e+02   0.707 0.479573
## olderprop:TrmpProp:`2013 code`5    -9.939e+02  5.374e+02  -1.850 0.064367
## olderprop:TrmpProp:`2013 code`6            NA         NA      NA       NA
## RARELY:olderprop:TrmpProp           6.797e+03  4.662e+03   1.458 0.144883
## RARELY:olderprop:`2013 code`2       7.951e+02  3.387e+03   0.235 0.814381
## RARELY:olderprop:`2013 code`3      -4.047e+02  1.294e+03  -0.313 0.754382
## RARELY:olderprop:`2013 code`4       4.842e+03  3.433e+03   1.411 0.158370
## RARELY:olderprop:`2013 code`5      -4.541e+03  3.749e+03  -1.211 0.225834
## RARELY:olderprop:`2013 code`6              NA         NA      NA       NA
```

```
## RARELY:TrmpProp:‘2013 code‘2            5.313e+02  9.429e+02   0.564 0.573094
## RARELY:TrmpProp:‘2013 code‘3            3.877e+02  2.921e+02   1.327 0.184438
## RARELY:TrmpProp:‘2013 code‘4            1.624e+03  9.550e+02   1.700 0.089063
## RARELY:TrmpProp:‘2013 code‘5           -8.199e+02  1.021e+03  -0.803 0.422191
## RARELY:TrmpProp:‘2013 code‘6                   NA         NA      NA       NA
## RARELY:olderprop:TrmpProp:‘2013 code‘2 -1.736e+03  4.766e+03  -0.364 0.715738
## RARELY:olderprop:TrmpProp:‘2013 code‘3         NA         NA      NA       NA
## RARELY:olderprop:TrmpProp:‘2013 code‘4 -7.965e+03  4.814e+03  -1.654 0.098033
## RARELY:olderprop:TrmpProp:‘2013 code‘5  5.286e+03  5.243e+03   1.008 0.313292
## RARELY:olderprop:TrmpProp:‘2013 code‘6         NA         NA      NA       NA
##
## (Intercept)
## RARELY
## SOMETIMES                              **
## FREQUENTLY                             ***
## ALWAYS                                 **
## prop_cases                             **
## ‘Older (65 plus).x‘                    ***
## olderprop
## TrmpProp
## ‘2013 code‘2
## ‘2013 code‘3
## ‘2013 code‘4
## ‘2013 code‘5                           .
## ‘2013 code‘6
## COVID_COUNT.y                          **
## COVID_TEST.y                           .
## all_doses_administered.y               ***
## ‘Older (65 plus).y‘                    *
## ClintVote.y                            **
## TrmpVote.y                             **
## TotalVote.y                            ***
## olderprop:TrmpProp
## olderprop:‘2013 code‘2
## olderprop:‘2013 code‘3
## olderprop:‘2013 code‘4
## olderprop:‘2013 code‘5                 *
## olderprop:‘2013 code‘6
## TrmpProp:‘2013 code‘2
## TrmpProp:‘2013 code‘3
## TrmpProp:‘2013 code‘4
## TrmpProp:‘2013 code‘5                  .
## TrmpProp:‘2013 code‘6
## RARELY:olderprop
## RARELY:TrmpProp
## RARELY:‘2013 code‘2
## RARELY:‘2013 code‘3
## RARELY:‘2013 code‘4
## RARELY:‘2013 code‘5
## RARELY:‘2013 code‘6
## olderprop:TrmpProp:‘2013 code‘2
## olderprop:TrmpProp:‘2013 code‘3
## olderprop:TrmpProp:‘2013 code‘4
## olderprop:TrmpProp:‘2013 code‘5        .
```

```
## olderprop:TrmpProp:‘2013 code‘6
## RARELY:olderprop:TrmpProp
## RARELY:olderprop:‘2013 code‘2
## RARELY:olderprop:‘2013 code‘3
## RARELY:olderprop:‘2013 code‘4
## RARELY:olderprop:‘2013 code‘5
## RARELY:olderprop:‘2013 code‘6
## RARELY:TrmpProp:‘2013 code‘2
## RARELY:TrmpProp:‘2013 code‘3
## RARELY:TrmpProp:‘2013 code‘4           .
## RARELY:TrmpProp:‘2013 code‘5
## RARELY:TrmpProp:‘2013 code‘6
## RARELY:olderprop:TrmpProp:‘2013 code‘2
## RARELY:olderprop:TrmpProp:‘2013 code‘3
## RARELY:olderprop:TrmpProp:‘2013 code‘4 .
## RARELY:olderprop:TrmpProp:‘2013 code‘5
## RARELY:olderprop:TrmpProp:‘2013 code‘6
## ---
## Signif. codes:  0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 795.33  on 91  degrees of freedom
## Residual deviance: 130.83  on 40  degrees of freedom
## AIC: 804.6
##
## Number of Fisher Scoring iterations: 4
```

```
Anova(mod1.1.1)
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                                      LR Chisq Df Pr(>Chisq)
## RARELY                                 0.931  1  0.3344964
## SOMETIMES                              7.441  1  0.0063764 **
## FREQUENTLY                            11.525  1  0.0006868 ***
## ALWAYS                                10.344  1  0.0012991 **
## prop_cases                            10.700  1  0.0010716 **
## ‘Older (65 plus).x‘                   25.925  1  3.549e-07 ***
## olderprop                              5.670  1  0.0172622 *
## TrmpProp                               3.249  1  0.0714720 .
## ‘2013 code‘                           34.826  5  1.630e-06 ***
## COVID_COUNT.y                          8.844  1  0.0029404 **
## COVID_TEST.y                           3.140  1  0.0763727 .
## all_doses_administered.y              12.678  1  0.0003700 ***
## ‘Older (65 plus).y‘                    4.599  1  0.0319920 *
## ClintVote.y                            7.970  1  0.0047564 **
## TrmpVote.y                             8.545  1  0.0034650 **
## TotalVote.y                           16.676  1  4.434e-05 ***
## olderprop:TrmpProp                     8.561  1  0.0034347 **
## olderprop:‘2013 code‘                 25.559  4  3.883e-05 ***
## TrmpProp:‘2013 code‘                  16.474  4  0.0024447 **
## RARELY:olderprop                       0.355  1  0.5515689
```

```
## RARELY:TrmpProp                            8.159  1  0.0042846 **
## RARELY:`2013 code`                        57.293  4  1.074e-11 ***
## olderprop:TrmpProp:`2013 code`            69.014  4  3.665e-14 ***
## RARELY:olderprop:TrmpProp                  4.193  1  0.0405969 *
## RARELY:olderprop:`2013 code`              27.913  4  1.299e-05 ***
## RARELY:TrmpProp:`2013 code`               14.143  4  0.0068538 **
## RARELY:olderprop:TrmpProp:`2013 code`     28.750  3  2.527e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod1.1.1, test = 'Chi')

# remove COVID_TEST.y
mod1.1.2 <- glm(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ RARELY +
    SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` + olderprop +
    TrmpProp + `2013 code` + COVID_COUNT.y + all_doses_administered.y + `Older (65 plus).y` +
    ClintVote.y + TrmpVote.y + TotalVote.y + olderprop:TrmpProp + olderprop:`2013 code` +
    TrmpProp:`2013 code` + RARELY:olderprop + RARELY:TrmpProp + RARELY:`2013 code` +
    olderprop:TrmpProp:`2013 code` + RARELY:olderprop:TrmpProp + RARELY:olderprop:`2013 code` +
    RARELY:TrmpProp:`2013 code` + RARELY:olderprop:TrmpProp:`2013 code`, family = binomial,
    data = big_data3)
summary(mod1.1.2)
```

```
##
## Call:
## glm(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~
##     RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
##         olderprop + TrmpProp + `2013 code` + COVID_COUNT.y +
##         all_doses_administered.y + `Older (65 plus).y` + ClintVote.y +
##         TrmpVote.y + TotalVote.y + olderprop:TrmpProp + olderprop:`2013 code` +
##         TrmpProp:`2013 code` + RARELY:olderprop + RARELY:TrmpProp +
##         RARELY:`2013 code` + olderprop:TrmpProp:`2013 code` +
##         RARELY:olderprop:TrmpProp + RARELY:olderprop:`2013 code` +
##         RARELY:TrmpProp:`2013 code` + RARELY:olderprop:TrmpProp:`2013 code`,
##     family = binomial, data = big_data3)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -4.0961  -0.6268   0.0000   0.4373   3.4648
##
## Coefficients: (8 not defined because of singularities)
##                                       Estimate Std. Error z value Pr(>|z|)
## (Intercept)                         -3.373e+01  6.420e+01  -0.525 0.599294
## RARELY                               9.924e+02  6.608e+02   1.502 0.133145
## SOMETIMES                           -1.230e+00  4.786e-01  -2.571 0.010143
## FREQUENTLY                          -1.743e+00  4.917e-01  -3.546 0.000392
## ALWAYS                              -1.592e+00  4.364e-01  -3.648 0.000264
## prop_cases                           3.489e+01  1.208e+01   2.889 0.003863
## `Older (65 plus).x`                  3.615e-05  6.956e-06   5.197 2.02e-07
## olderprop                            1.425e+02  3.614e+02   0.394 0.693340
## TrmpProp                             5.812e+01  9.829e+01   0.591 0.554270
## `2013 code`2                        -9.529e+00  6.487e+01  -0.147 0.883211
## `2013 code`3                         3.510e+01  4.753e+01   0.739 0.460202
## `2013 code`4                         6.173e+01  6.592e+01   0.936 0.349041
```

```
## `2013 code`5                                -1.212e+02  6.937e+01  -1.747 0.080679
## `2013 code`6                                 3.516e+00  7.027e+00   0.500 0.616795
## COVID_COUNT.y                               -3.299e+00  1.320e+00  -2.499 0.012455
## all_doses_administered.y                     6.558e-01  1.773e-01   3.699 0.000216
## `Older (65 plus).y`                          2.325e+00  1.279e+00   1.818 0.068992
## ClintVote.y                                  1.846e+00  7.776e-01   2.374 0.017595
## TrmpVote.y                                   1.168e+01  3.320e+00   3.519 0.000433
## TotalVote.y                                 -1.340e+01  2.901e+00  -4.617 3.89e-06
## olderprop:TrmpProp                          -3.014e+02  5.000e+02  -0.603 0.546698
## olderprop:`2013 code`2                       1.420e+02  3.622e+02   0.392 0.695000
## olderprop:`2013 code`3                      -1.186e+02  2.652e+02  -0.447 0.654590
## olderprop:`2013 code`4                      -2.603e+02  3.676e+02  -0.708 0.478885
## olderprop:`2013 code`5                       7.224e+02  3.881e+02   1.861 0.062701
## olderprop:`2013 code`6                              NA         NA      NA       NA
## TrmpProp:`2013 code`2                        4.923e+00  9.918e+01   0.050 0.960407
## TrmpProp:`2013 code`3                       -5.169e+01  7.393e+01  -0.699 0.484420
## TrmpProp:`2013 code`4                       -1.070e+02  1.008e+02  -1.062 0.288310
## TrmpProp:`2013 code`5                        1.536e+02  1.046e+02   1.468 0.142027
## TrmpProp:`2013 code`6                               NA         NA      NA       NA
## RARELY:olderprop                            -4.802e+03  3.315e+03  -1.449 0.147377
## RARELY:TrmpProp                             -1.567e+03  9.270e+02  -1.690 0.090962
## RARELY:`2013 code`2                         -4.529e+02  6.654e+02  -0.681 0.496110
## RARELY:`2013 code`3                         -2.559e+02  1.740e+02  -1.471 0.141284
## RARELY:`2013 code`4                         -1.185e+03  6.737e+02  -1.759 0.078588
## RARELY:`2013 code`5                          6.137e+02  7.293e+02   0.841 0.400091
## RARELY:`2013 code`6                                 NA         NA      NA       NA
## olderprop:TrmpProp:`2013 code`2             -1.408e+02  5.016e+02  -0.281 0.778903
## olderprop:TrmpProp:`2013 code`3              2.015e+02  3.435e+02   0.587 0.557410
## olderprop:TrmpProp:`2013 code`4              4.963e+02  5.091e+02   0.975 0.329627
## olderprop:TrmpProp:`2013 code`5             -9.054e+02  5.364e+02  -1.688 0.091431
## olderprop:TrmpProp:`2013 code`6                     NA         NA      NA       NA
## RARELY:olderprop:TrmpProp                    7.593e+03  4.650e+03   1.633 0.102499
## RARELY:olderprop:`2013 code`2                1.635e+03  3.362e+03   0.486 0.626652
## RARELY:olderprop:`2013 code`3               -2.731e+01  1.275e+03  -0.021 0.982904
## RARELY:olderprop:`2013 code`4                5.793e+03  3.398e+03   1.705 0.088196
## RARELY:olderprop:`2013 code`5               -3.975e+03  3.746e+03  -1.061 0.288669
## RARELY:olderprop:`2013 code`6                       NA         NA      NA       NA
## RARELY:TrmpProp:`2013 code`2                 7.708e+02  9.358e+02   0.824 0.410084
## RARELY:TrmpProp:`2013 code`3                 3.689e+02  2.921e+02   1.263 0.206745
## RARELY:TrmpProp:`2013 code`4                 1.887e+03  9.456e+02   1.996 0.045949
## RARELY:TrmpProp:`2013 code`5                -6.515e+02  1.020e+03  -0.639 0.522993
## RARELY:TrmpProp:`2013 code`6                        NA         NA      NA       NA
## RARELY:olderprop:TrmpProp:`2013 code`2 -2.899e+03  4.732e+03  -0.613 0.540112
## RARELY:olderprop:TrmpProp:`2013 code`3              NA         NA      NA       NA
## RARELY:olderprop:TrmpProp:`2013 code`4 -9.298e+03  4.765e+03  -1.952 0.050985
## RARELY:olderprop:TrmpProp:`2013 code`5  4.521e+03  5.239e+03   0.863 0.388178
## RARELY:olderprop:TrmpProp:`2013 code`6          NA         NA      NA       NA
##
## (Intercept)
## RARELY
## SOMETIMES                                *
## FREQUENTLY                               ***
## ALWAYS                                   ***
## prop_cases                               **
```

```
## `Older (65 plus).x`                    ***
## olderprop
## TrmpProp
## `2013 code`2
## `2013 code`3
## `2013 code`4
## `2013 code`5                           .
## `2013 code`6
## COVID_COUNT.y                          *
## all_doses_administered.y               ***
## `Older (65 plus).y`                    .
## ClintVote.y                            *
## TrmpVote.y                             ***
## TotalVote.y                            ***
## olderprop:TrmpProp
## olderprop:`2013 code`2
## olderprop:`2013 code`3
## olderprop:`2013 code`4
## olderprop:`2013 code`5                 .
## olderprop:`2013 code`6
## TrmpProp:`2013 code`2
## TrmpProp:`2013 code`3
## TrmpProp:`2013 code`4
## TrmpProp:`2013 code`5
## TrmpProp:`2013 code`6
## RARELY:olderprop
## RARELY:TrmpProp                        .
## RARELY:`2013 code`2
## RARELY:`2013 code`3
## RARELY:`2013 code`4                    .
## RARELY:`2013 code`5
## RARELY:`2013 code`6
## olderprop:TrmpProp:`2013 code`2
## olderprop:TrmpProp:`2013 code`3
## olderprop:TrmpProp:`2013 code`4
## olderprop:TrmpProp:`2013 code`5        .
## olderprop:TrmpProp:`2013 code`6
## RARELY:olderprop:TrmpProp
## RARELY:olderprop:`2013 code`2
## RARELY:olderprop:`2013 code`3
## RARELY:olderprop:`2013 code`4          .
## RARELY:olderprop:`2013 code`5
## RARELY:olderprop:`2013 code`6
## RARELY:TrmpProp:`2013 code`2
## RARELY:TrmpProp:`2013 code`3
## RARELY:TrmpProp:`2013 code`4           *
## RARELY:TrmpProp:`2013 code`5
## RARELY:TrmpProp:`2013 code`6
## RARELY:olderprop:TrmpProp:`2013 code`2
## RARELY:olderprop:TrmpProp:`2013 code`3
## RARELY:olderprop:TrmpProp:`2013 code`4 .
## RARELY:olderprop:TrmpProp:`2013 code`5
## RARELY:olderprop:TrmpProp:`2013 code`6
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 795.33  on 91  degrees of freedom
## Residual deviance: 133.97  on 41  degrees of freedom
## AIC: 805.74
##
## Number of Fisher Scoring iterations: 4
```

```
Anova(mod1.1.2)
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                                       LR Chisq Df Pr(>Chisq)
## RARELY                                 1.156  1  0.2823024
## SOMETIMES                              6.596  1  0.0102208 *
## FREQUENTLY                            12.680  1  0.0003696 ***
## ALWAYS                                13.358  1  0.0002574 ***
## prop_cases                             8.264  1  0.0040431 **
## `Older (65 plus).x`                   26.654  1  2.433e-07 ***
## olderprop                              4.249  1  0.0392648 *
## TrmpProp                               3.266  1  0.0707092 .
## `2013 code`                           24.740  5  0.0001564 ***
## COVID_COUNT.y                          6.196  1  0.0128009 *
## all_doses_administered.y              13.375  1  0.0002549 ***
## `Older (65 plus).y`                    3.290  1  0.0696844 .
## ClintVote.y                            5.623  1  0.0177264 *
## TrmpVote.y                            12.389  1  0.0004319 ***
## TotalVote.y                           21.310  1  3.908e-06 ***
## olderprop:TrmpProp                     6.518  1  0.0106773 *
## olderprop:`2013 code`                 27.854  4  1.335e-05 ***
## TrmpProp:`2013 code`                  16.370  4  0.0025611 **
## RARELY:olderprop                       0.093  1  0.7600714
## RARELY:TrmpProp                        7.692  1  0.0055467 **
## RARELY:`2013 code`                    58.758  4  5.290e-12 ***
## olderprop:TrmpProp:`2013 code`        67.918  4  6.244e-14 ***
## RARELY:olderprop:TrmpProp              1.150  1  0.2835523
## RARELY:olderprop:`2013 code`          25.250  4  4.481e-05 ***
## RARELY:TrmpProp:`2013 code`           11.936  4  0.0178326 *
## RARELY:olderprop:TrmpProp:`2013 code` 31.732  3  5.960e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod1.1.2, test = 'Chi')

# remove Older.y
mod1.1.3 <- glm(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ RARELY +
    SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` + olderprop +
    TrmpProp + `2013 code` + COVID_COUNT.y + all_doses_administered.y + ClintVote.y +
    TrmpVote.y + TotalVote.y + olderprop:TrmpProp + olderprop:`2013 code` + TrmpProp:`2013 code` +
    RARELY:olderprop + RARELY:TrmpProp + RARELY:`2013 code` + olderprop:TrmpProp:`2013 code` +
```

```
    RARELY:olderprop:TrmpProp + RARELY:olderprop:`2013 code` + RARELY:TrmpProp:`2013 code` +
    RARELY:olderprop:TrmpProp:`2013 code`, family = binomial, data = big_data3)
summary(mod1.1.3)
```

```
##
## Call:
## glm(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~
##     RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
##         olderprop + TrmpProp + `2013 code` + COVID_COUNT.y +
##         all_doses_administered.y + ClintVote.y + TrmpVote.y +
##         TotalVote.y + olderprop:TrmpProp + olderprop:`2013 code` +
##         TrmpProp:`2013 code` + RARELY:olderprop + RARELY:TrmpProp +
##         RARELY:`2013 code` + olderprop:TrmpProp:`2013 code` +
##         RARELY:olderprop:TrmpProp + RARELY:olderprop:`2013 code` +
##         RARELY:TrmpProp:`2013 code` + RARELY:olderprop:TrmpProp:`2013 code`,
##     family = binomial, data = big_data3)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -4.1183  -0.7292   0.0000   0.5470   3.5508
##
## Coefficients: (8 not defined because of singularities)
##                                      Estimate Std. Error z value Pr(>|z|)
## (Intercept)                         -2.722e+01  6.341e+01  -0.429 0.667726
## RARELY                               9.567e+02  6.532e+02   1.465 0.143020
## SOMETIMES                           -1.067e+00  4.695e-01  -2.273 0.023027
## FREQUENTLY                          -1.663e+00  4.890e-01  -3.402 0.000670
## ALWAYS                              -1.452e+00  4.288e-01  -3.386 0.000709
## prop_cases                           1.346e+01  2.682e+00   5.020 5.17e-07
## `Older (65 plus).x`                  3.338e-05  6.797e-06   4.911 9.05e-07
## olderprop                            1.174e+02  3.573e+02   0.328 0.742540
## TrmpProp                             5.028e+01  9.711e+01   0.518 0.604658
## `2013 code`2                        -1.645e+01  6.405e+01  -0.257 0.797237
## `2013 code`3                         2.771e+01  4.685e+01   0.591 0.554186
## `2013 code`4                         5.765e+01  6.515e+01   0.885 0.376267
## `2013 code`5                        -1.281e+02  6.863e+01  -1.866 0.062040
## `2013 code`6                         4.277e+00  6.936e+00   0.617 0.537411
## COVID_COUNT.y                       -9.510e-01  2.780e-01  -3.421 0.000623
## all_doses_administered.y             5.269e-01  1.637e-01   3.219 0.001287
## ClintVote.y                          1.698e+00  7.734e-01   2.196 0.028086
## TrmpVote.y                           1.105e+01  3.294e+00   3.354 0.000798
## TotalVote.y                         -1.251e+01  2.855e+00  -4.383 1.17e-05
## olderprop:TrmpProp                  -2.544e+02  4.941e+02  -0.515 0.606664
## olderprop:`2013 code`2               1.869e+02  3.576e+02   0.523 0.601269
## olderprop:`2013 code`3              -6.148e+01  2.607e+02  -0.236 0.813570
## olderprop:`2013 code`4              -2.375e+02  3.635e+02  -0.653 0.513440
## olderprop:`2013 code`5               7.692e+02  3.839e+02   2.004 0.045103
## olderprop:`2013 code`6                      NA         NA      NA       NA
## TrmpProp:`2013 code`2                1.524e+01  9.791e+01   0.156 0.876290
## TrmpProp:`2013 code`3               -4.478e+01  7.309e+01  -0.613 0.540067
## TrmpProp:`2013 code`4               -9.959e+01  9.957e+01  -1.000 0.317192
## TrmpProp:`2013 code`5                1.637e+02  1.035e+02   1.581 0.113782
## TrmpProp:`2013 code`6                       NA         NA      NA       NA
```

```
## RARELY:olderprop                          -4.594e+03  3.278e+03  -1.401 0.161079
## RARELY:TrmpProp                           -1.521e+03  9.165e+02  -1.659 0.097058
## RARELY:`2013 code`2                       -4.335e+02  6.581e+02  -0.659 0.510114
## RARELY:`2013 code`3                       -2.421e+02  1.718e+02  -1.409 0.158927
## RARELY:`2013 code`4                       -1.215e+03  6.661e+02  -1.824 0.068207
## RARELY:`2013 code`5                        6.779e+02  7.222e+02   0.939 0.347925
## RARELY:`2013 code`6                               NA         NA      NA       NA
## olderprop:TrmpProp:`2013 code`2           -2.018e+02  4.952e+02  -0.407 0.683643
## olderprop:TrmpProp:`2013 code`3            1.458e+02  3.388e+02   0.430 0.666923
## olderprop:TrmpProp:`2013 code`4            4.616e+02  5.034e+02   0.917 0.359118
## olderprop:TrmpProp:`2013 code`5           -9.678e+02  5.306e+02  -1.824 0.068187
## olderprop:TrmpProp:`2013 code`6                   NA         NA      NA       NA
## RARELY:olderprop:TrmpProp                  7.320e+03  4.599e+03   1.592 0.111438
## RARELY:olderprop:`2013 code`2              1.513e+03  3.327e+03   0.455 0.649212
## RARELY:olderprop:`2013 code`3             -3.179e+02  1.262e+03  -0.252 0.801221
## RARELY:olderprop:`2013 code`4              6.007e+03  3.360e+03   1.788 0.073810
## RARELY:olderprop:`2013 code`5             -4.351e+03  3.711e+03  -1.172 0.241098
## RARELY:olderprop:`2013 code`6                     NA         NA      NA       NA
## RARELY:TrmpProp:`2013 code`2               7.398e+02  9.255e+02   0.799 0.424082
## RARELY:TrmpProp:`2013 code`3               4.242e+02  2.898e+02   1.464 0.143212
## RARELY:TrmpProp:`2013 code`4               1.926e+03  9.349e+02   2.060 0.039427
## RARELY:TrmpProp:`2013 code`5              -7.403e+02  1.010e+03  -0.733 0.463588
## RARELY:TrmpProp:`2013 code`6                      NA         NA      NA       NA
## RARELY:olderprop:TrmpProp:`2013 code`2 -2.703e+03  4.683e+03  -0.577 0.563845
## RARELY:olderprop:TrmpProp:`2013 code`3         NA         NA      NA       NA
## RARELY:olderprop:TrmpProp:`2013 code`4 -9.590e+03  4.712e+03  -2.035 0.041827
## RARELY:olderprop:TrmpProp:`2013 code`5  5.045e+03  5.190e+03   0.972 0.331073
## RARELY:olderprop:TrmpProp:`2013 code`6         NA         NA      NA       NA
##
## (Intercept)
## RARELY
## SOMETIMES                                *
## FREQUENTLY                               ***
## ALWAYS                                   ***
## prop_cases                               ***
## `Older (65 plus).x`                      ***
## olderprop
## TrmpProp
## `2013 code`2
## `2013 code`3
## `2013 code`4
## `2013 code`5                             .
## `2013 code`6
## COVID_COUNT.y                            ***
## all_doses_administered.y                 **
## ClintVote.y                              *
## TrmpVote.y                               ***
## TotalVote.y                              ***
## olderprop:TrmpProp
## olderprop:`2013 code`2
## olderprop:`2013 code`3
## olderprop:`2013 code`4
## olderprop:`2013 code`5                   *
## olderprop:`2013 code`6
```

```
## TrmpProp:‘2013 code‘2
## TrmpProp:‘2013 code‘3
## TrmpProp:‘2013 code‘4
## TrmpProp:‘2013 code‘5
## TrmpProp:‘2013 code‘6
## RARELY:olderprop
## RARELY:TrmpProp                         .
## RARELY:‘2013 code‘2
## RARELY:‘2013 code‘3
## RARELY:‘2013 code‘4                     .
## RARELY:‘2013 code‘5
## RARELY:‘2013 code‘6
## olderprop:TrmpProp:‘2013 code‘2
## olderprop:TrmpProp:‘2013 code‘3
## olderprop:TrmpProp:‘2013 code‘4
## olderprop:TrmpProp:‘2013 code‘5         .
## olderprop:TrmpProp:‘2013 code‘6
## RARELY:olderprop:TrmpProp
## RARELY:olderprop:‘2013 code‘2
## RARELY:olderprop:‘2013 code‘3
## RARELY:olderprop:‘2013 code‘4           .
## RARELY:olderprop:‘2013 code‘5
## RARELY:olderprop:‘2013 code‘6
## RARELY:TrmpProp:‘2013 code‘2
## RARELY:TrmpProp:‘2013 code‘3
## RARELY:TrmpProp:‘2013 code‘4            *
## RARELY:TrmpProp:‘2013 code‘5
## RARELY:TrmpProp:‘2013 code‘6
## RARELY:olderprop:TrmpProp:‘2013 code‘2
## RARELY:olderprop:TrmpProp:‘2013 code‘3
## RARELY:olderprop:TrmpProp:‘2013 code‘4 *
## RARELY:olderprop:TrmpProp:‘2013 code‘5
## RARELY:olderprop:TrmpProp:‘2013 code‘6
## ---
## Signif. codes:  0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 795.33  on 91  degrees of freedom
## Residual deviance: 137.26  on 42  degrees of freedom
## AIC: 807.03
##
## Number of Fisher Scoring iterations: 4
```

```
Anova(mod1.1.3)
```

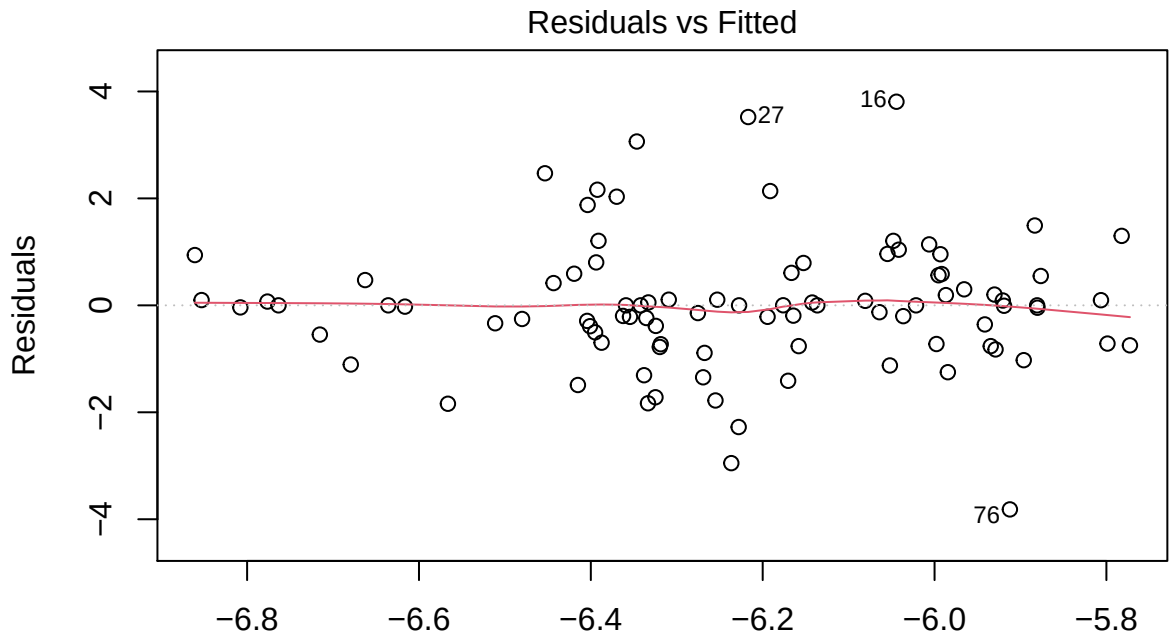
```
## Analysis of Deviance Table (Type II tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                                      LR Chisq Df Pr(>Chisq)
## RARELY                                 0.349  1  0.5549325
## SOMETIMES                              5.153  1  0.0231996 *
## FREQUENTLY                            11.663  1  0.0006375 ***
## ALWAYS                                11.492  1  0.0006989 ***
```

```
## prop_cases                                24.911  1  6.005e-07 ***
## `Older (65 plus).x`                       23.843  1  1.045e-06 ***
## olderprop                                 63.645  1  1.490e-15 ***
## TrmpProp                                   8.814  1  0.0029894 **
## `2013 code`                               27.314  5  4.955e-05 ***
## COVID_COUNT.y                             11.622  1  0.0006518 ***
## all_doses_administered.y                  10.218  1  0.0013907 **
## ClintVote.y                                4.813  1  0.0282540 *
## TrmpVote.y                                11.243  1  0.0007994 ***
## TotalVote.y                               19.175  1  1.193e-05 ***
## olderprop:TrmpProp                        18.482  1  1.715e-05 ***
## olderprop:`2013 code`                     27.927  4  1.290e-05 ***
## TrmpProp:`2013 code`                      16.350  4  0.0025838 **
## RARELY:olderprop                           1.995  1  0.1577976
## RARELY:TrmpProp                            7.734  1  0.0054196 **
## RARELY:`2013 code`                        57.144  4  1.154e-11 ***
## olderprop:TrmpProp:`2013 code`            62.183  4  1.008e-12 ***
## RARELY:olderprop:TrmpProp                  0.073  1  0.7872664
## RARELY:olderprop:`2013 code`              26.554  4  2.447e-05 ***
## RARELY:TrmpProp:`2013 code`                9.777  4  0.0443489 *
## RARELY:olderprop:TrmpProp:`2013 code`     37.222  3  4.129e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

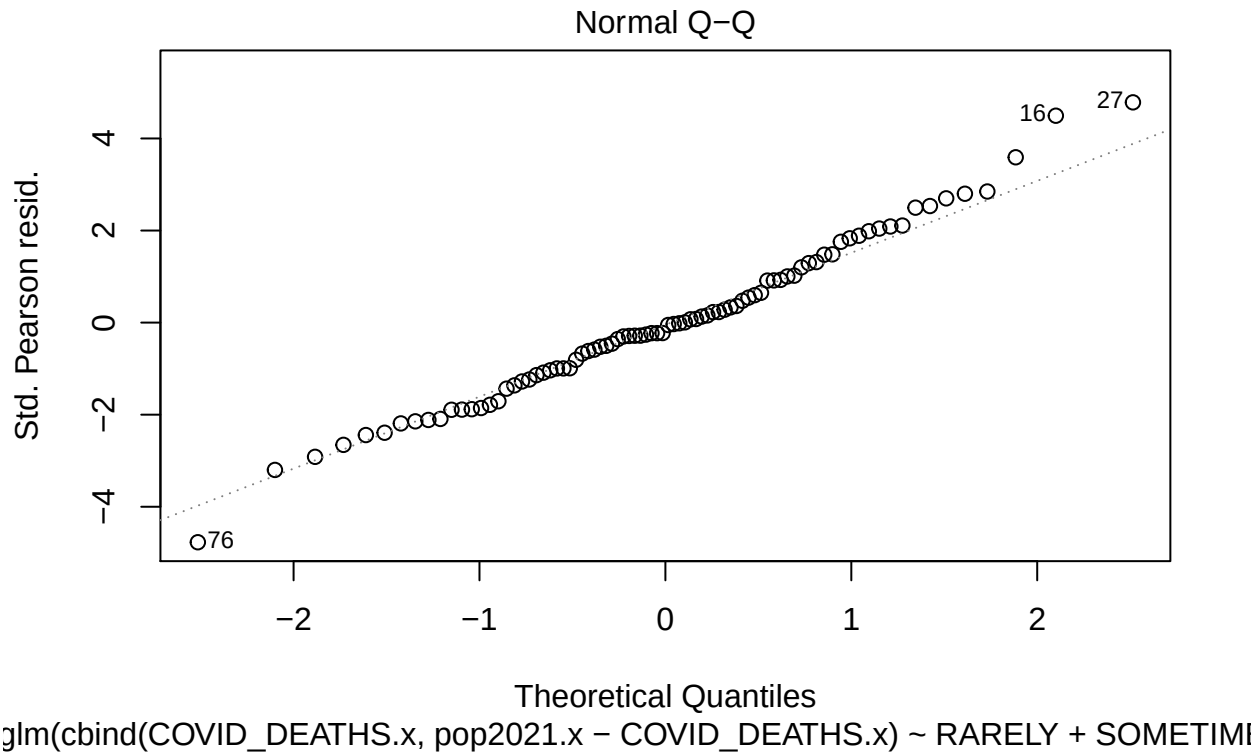
```
drop1(mod1.1.3, test = "Chi")
```

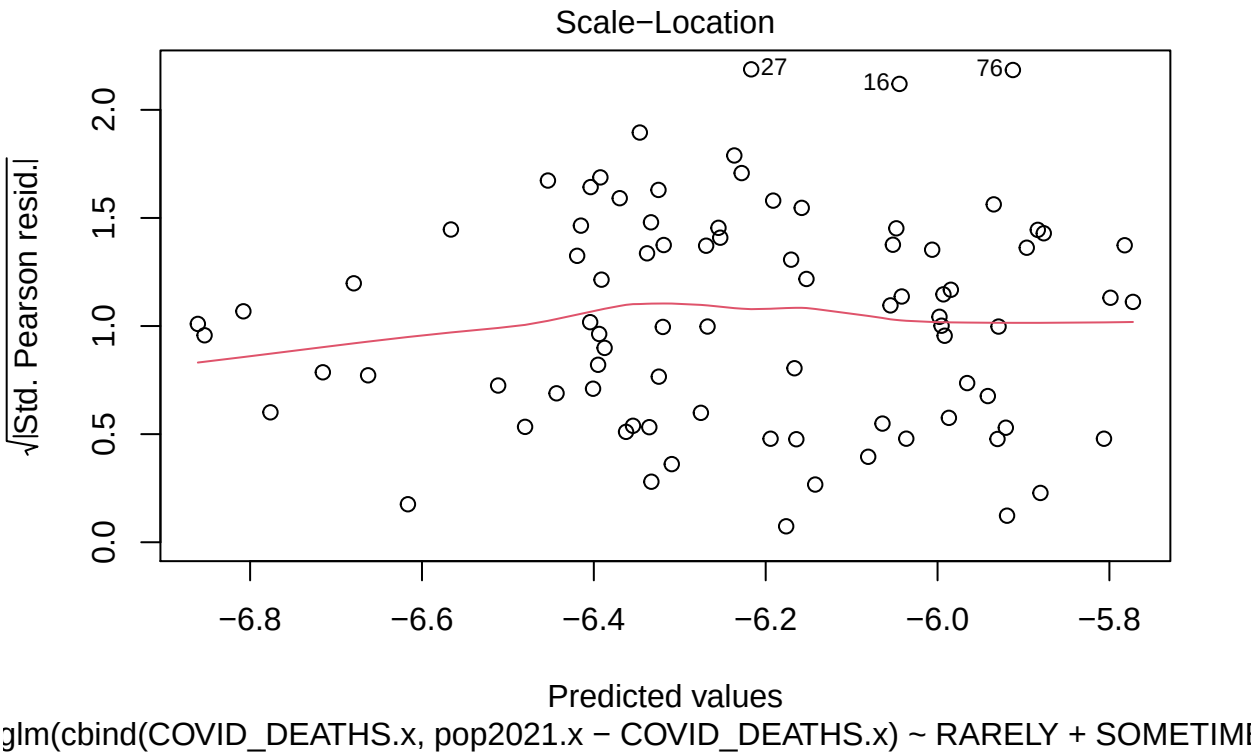
```
## Single term deletions
##
## Model:
## cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ RARELY +
##     SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
##     olderprop + TrmpProp + `2013 code` + COVID_COUNT.y + all_doses_administered.y +
##     ClintVote.y + TrmpVote.y + TotalVote.y + olderprop:TrmpProp +
##     olderprop:`2013 code` + TrmpProp:`2013 code` + RARELY:olderprop +
##     RARELY:TrmpProp + RARELY:`2013 code` + olderprop:TrmpProp:`2013 code` +
##     RARELY:olderprop:TrmpProp + RARELY:olderprop:`2013 code` +
##     RARELY:TrmpProp:`2013 code` + RARELY:olderprop:TrmpProp:`2013 code`
##                                       Df Deviance    AIC    LRT  Pr(>Chi)
## <none>                                     137.26 807.03
## SOMETIMES                              1   142.42 810.19  5.153 0.0231996 *
## FREQUENTLY                             1   148.93 816.70 11.663 0.0006375 ***
## ALWAYS                                 1   148.76 816.53 11.492 0.0006989 ***
## prop_cases                             1   162.18 829.94 24.911 6.005e-07 ***
## `Older (65 plus).x`                    1   161.11 828.88 23.843 1.045e-06 ***
## COVID_COUNT.y                          1   148.89 816.66 11.622 0.0006518 ***
## all_doses_administered.y               1   147.48 815.25 10.218 0.0013907 **
## ClintVote.y                            1   142.08 809.85  4.813 0.0282540 *
## TrmpVote.y                             1   148.51 816.28 11.243 0.0007994 ***
## TotalVote.y                            1   156.44 824.21 19.175 1.193e-05 ***
## RARELY:olderprop:TrmpProp:`2013 code`  3   174.49 838.26 37.222 4.129e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

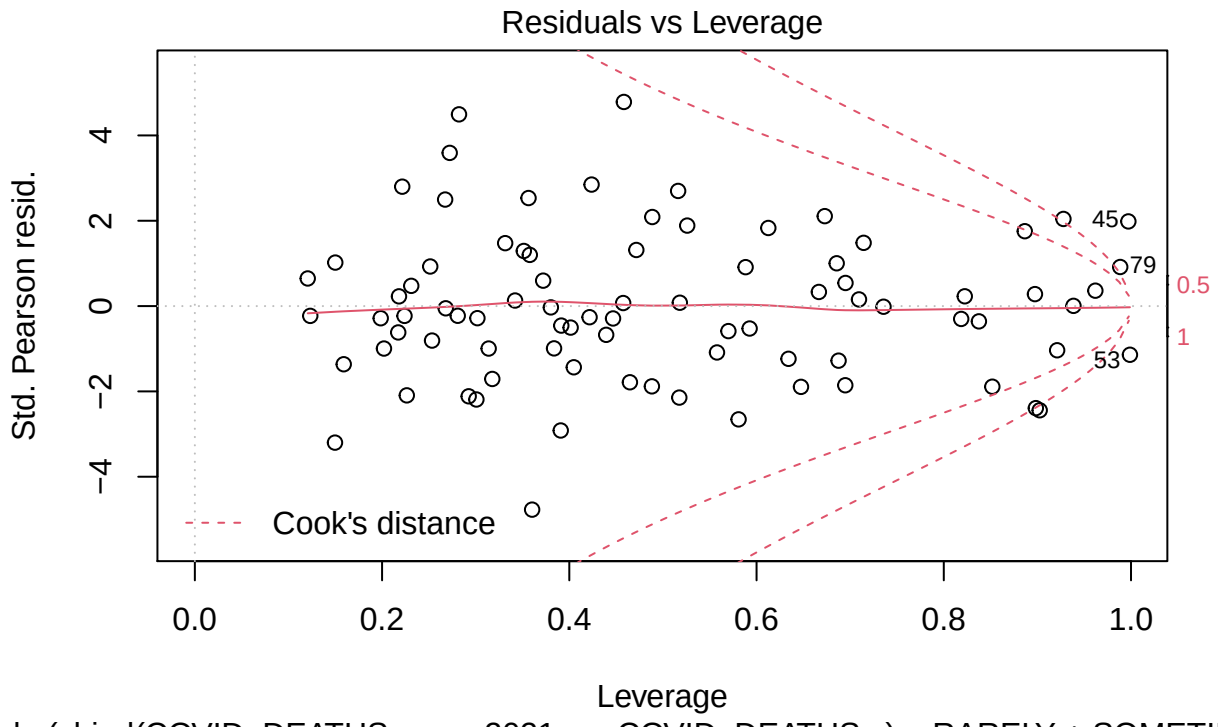
```
plot(mod1.1.3)
```



glm(cbind(COVID_DEATHS.x, pop2021.x − COVID_DEATHS.x) ~ RARELY + SOMETIMI


Normal Q−Q
Std. Pearson resid.
Theoretical Quantiles
glm(cbind(COVID_DEATHS.x, pop2021.x − COVID_DEATHS.x) ~ RARELY + SOMETIMI
76
16
27
−4
−2
0
2
4
−2
−1
0
1
2


Scale−Location
27
16
76
√|Std. Pearson resid.|
0.0
0.5
1.0
1.5
2.0
−6.8
−6.6
−6.4
−6.2
−6.0
−5.8
Predicted values
glm(cbind(COVID_DEATHS.x, pop2021.x − COVID_DEATHS.x) ~ RARELY + SOMETIMI



glm(cbind(COVID_DEATHS.x, pop2021.x − COVID_DEATHS.x) ~ RARELY + SOMETIMI

```
bptest(mod1.1.3)
```

```
##
##  studentized Breusch-Pagan test
##
## data:  mod1.1.3
## BP = 35.633, df = 49, p-value = 0.9234
```

```
## Mod1.1.3 is our final Binomial model with only Fixed Effects AIC = 807.03
```

Poisson Model instead of Binomial Model?

```
mod5 <- glm(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + olderprop + `2013 code` +
    prop_cases + TrmpProp + ClintVote.x + `Older (65 plus).x` + RARELY + olderprop *
    TrmpProp * RARELY * `2013 code`, family = poisson, data = big_data3)
summary(mod5)
```

```
##
## Call:
## glm(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + olderprop +
##     `2013 code` + prop_cases + TrmpProp + ClintVote.x + `Older (65 plus).x` +
##     RARELY + olderprop * TrmpProp * RARELY * `2013 code`, family = poisson,
```

```
##     data = big_data3)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -3.9803  -0.8915   0.0000   0.7948   5.2957
##
## Coefficients: (8 not defined because of singularities)
##                                       Estimate Std. Error z value Pr(>|z|)
## (Intercept)                           2.924e+00  6.327e+01   0.046  0.96314
## olderprop                            -9.147e+01  3.528e+02  -0.259  0.79543
## `2013 code`2                         -1.737e+01  6.369e+01  -0.273  0.78509
## `2013 code`3                         -1.582e+01  4.560e+01  -0.347  0.72863
## `2013 code`4                         -7.853e+00  6.340e+01  -0.124  0.90142
## `2013 code`5                         -1.397e+02  6.829e+01  -2.046  0.04077
## `2013 code`6                          5.406e+00  6.789e+00   0.796  0.42586
## prop_cases                            4.909e+00  1.053e+00   4.660 3.16e-06
## TrmpProp                             -8.094e+00  9.677e+01  -0.084  0.93334
## ClintVote.x                          -1.800e-05  5.822e-06  -3.092  0.00199
## `Older (65 plus).x`                   2.255e-05  7.522e-06   2.998  0.00272
## RARELY                                3.999e+02  6.477e+02   0.617  0.53698
## olderprop:TrmpProp                    6.276e+01  4.888e+02   0.128  0.89784
## olderprop:RARELY                     -1.973e+03  3.254e+03  -0.606  0.54425
## TrmpProp:RARELY                      -6.992e+02  9.099e+02  -0.768  0.44225
## olderprop:`2013 code`2                1.449e+02  3.554e+02   0.408  0.68352
## olderprop:`2013 code`3                1.341e+02  2.509e+02   0.535  0.59288
## olderprop:`2013 code`4                6.866e+01  3.541e+02   0.194  0.84624
## olderprop:`2013 code`5                8.032e+02  3.818e+02   2.104  0.03539
## olderprop:`2013 code`6                       NA         NA      NA       NA
## `2013 code`2:TrmpProp                 1.950e+01  9.741e+01   0.200  0.84131
## `2013 code`3:TrmpProp                 2.022e+01  7.197e+01   0.281  0.77879
## `2013 code`4:TrmpProp                 1.038e+01  9.704e+01   0.107  0.91481
## `2013 code`5:TrmpProp                 1.860e+02  1.031e+02   1.805  0.07114
## `2013 code`6:TrmpProp                        NA         NA      NA       NA
## `2013 code`2:RARELY                  -4.397e+02  6.599e+02  -0.666  0.50516
## `2013 code`3:RARELY                  -4.845e+01  1.650e+02  -0.294  0.76906
## `2013 code`4:RARELY                  -4.809e+02  6.505e+02  -0.739  0.45975
## `2013 code`5:RARELY                   9.773e+02  7.245e+02   1.349  0.17735
## `2013 code`6:RARELY                          NA         NA      NA       NA
## olderprop:TrmpProp:RARELY             3.463e+03  4.572e+03   0.757  0.44875
## olderprop:`2013 code`2:TrmpProp      -1.435e+02  4.930e+02  -0.291  0.77104
## olderprop:`2013 code`3:TrmpProp      -1.382e+02  3.312e+02  -0.417  0.67646
## olderprop:`2013 code`4:TrmpProp      -5.113e+01  4.907e+02  -0.104  0.91702
## olderprop:`2013 code`5:TrmpProp      -1.037e+03  5.289e+02  -1.960  0.05000
## olderprop:`2013 code`6:TrmpProp              NA         NA      NA       NA
## olderprop:`2013 code`2:RARELY         2.146e+03  3.335e+03   0.643  0.51997
## olderprop:`2013 code`3:RARELY        -5.147e+02  1.131e+03  -0.455  0.64916
## olderprop:`2013 code`4:RARELY         2.571e+03  3.279e+03   0.784  0.43308
## olderprop:`2013 code`5:RARELY        -5.514e+03  3.724e+03  -1.481  0.13868
## olderprop:`2013 code`6:RARELY                NA         NA      NA       NA
## `2013 code`2:TrmpProp:RARELY          7.527e+02  9.287e+02   0.811  0.41764
## `2013 code`3:TrmpProp:RARELY          2.005e+02  2.787e+02   0.719  0.47195
## `2013 code`4:TrmpProp:RARELY          7.488e+02  9.146e+02   0.819  0.41293
## `2013 code`5:TrmpProp:RARELY         -1.204e+03  1.015e+03  -1.187  0.23525
## `2013 code`6:TrmpProp:RARELY                 NA         NA      NA       NA
```

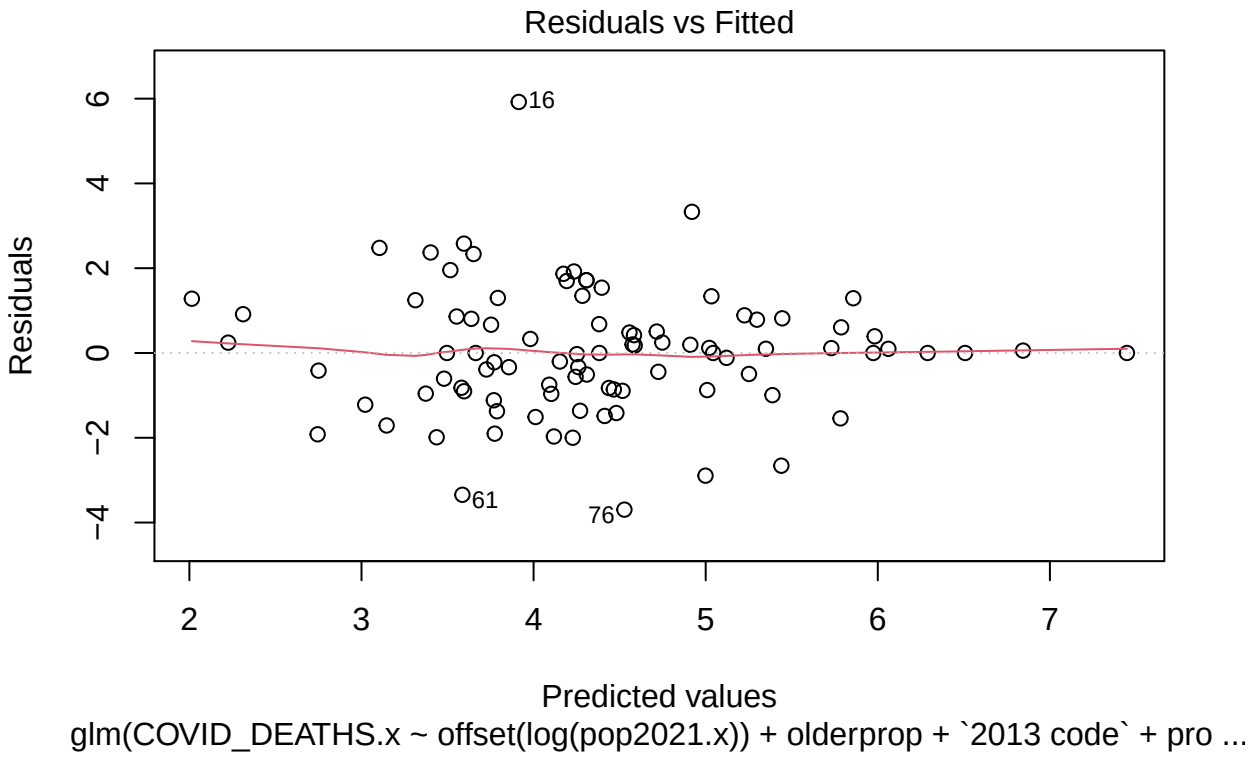
```
## olderprop:‘2013 code‘2:TrmpProp:RARELY -3.682e+03  4.697e+03  -0.784  0.43314
## olderprop:‘2013 code‘3:TrmpProp:RARELY         NA         NA      NA       NA
## olderprop:‘2013 code‘4:TrmpProp:RARELY -4.032e+03  4.607e+03  -0.875  0.38149
## olderprop:‘2013 code‘5:TrmpProp:RARELY  6.885e+03  5.216e+03   1.320  0.18680
## olderprop:‘2013 code‘6:TrmpProp:RARELY         NA         NA      NA       NA
##
## (Intercept)
## olderprop
## ‘2013 code‘2
## ‘2013 code‘3
## ‘2013 code‘4
## ‘2013 code‘5                          *
## ‘2013 code‘6
## prop_cases                            ***
## TrmpProp
## ClintVote.x                           **
## ‘Older (65 plus).x‘                   **
## RARELY
## olderprop:TrmpProp
## olderprop:RARELY
## TrmpProp:RARELY
## olderprop:‘2013 code‘2
## olderprop:‘2013 code‘3
## olderprop:‘2013 code‘4
## olderprop:‘2013 code‘5                *
## olderprop:‘2013 code‘6
## ‘2013 code‘2:TrmpProp
## ‘2013 code‘3:TrmpProp
## ‘2013 code‘4:TrmpProp
## ‘2013 code‘5:TrmpProp                 .
## ‘2013 code‘6:TrmpProp
## ‘2013 code‘2:RARELY
## ‘2013 code‘3:RARELY
## ‘2013 code‘4:RARELY
## ‘2013 code‘5:RARELY
## ‘2013 code‘6:RARELY
## olderprop:TrmpProp:RARELY
## olderprop:‘2013 code‘2:TrmpProp
## olderprop:‘2013 code‘3:TrmpProp
## olderprop:‘2013 code‘4:TrmpProp
## olderprop:‘2013 code‘5:TrmpProp        .
## olderprop:‘2013 code‘6:TrmpProp
## olderprop:‘2013 code‘2:RARELY
## olderprop:‘2013 code‘3:RARELY
## olderprop:‘2013 code‘4:RARELY
## olderprop:‘2013 code‘5:RARELY
## olderprop:‘2013 code‘6:RARELY
## ‘2013 code‘2:TrmpProp:RARELY
## ‘2013 code‘3:TrmpProp:RARELY
## ‘2013 code‘4:TrmpProp:RARELY
## ‘2013 code‘5:TrmpProp:RARELY
## ‘2013 code‘6:TrmpProp:RARELY
## olderprop:‘2013 code‘2:TrmpProp:RARELY
## olderprop:‘2013 code‘3:TrmpProp:RARELY
```

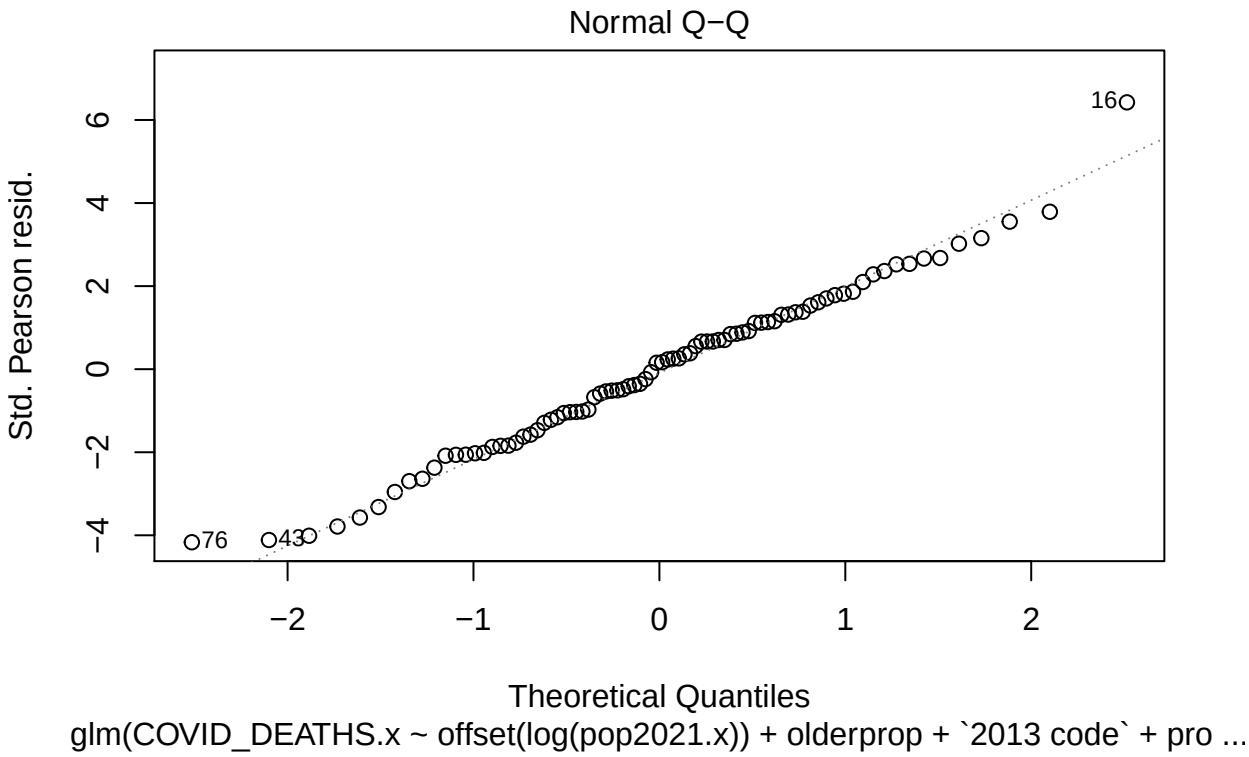
```
## olderprop:`2013 code`4:TrmpProp:RARELY
## olderprop:`2013 code`5:TrmpProp:RARELY
## olderprop:`2013 code`6:TrmpProp:RARELY
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 793.82  on 91  degrees of freedom
## Residual deviance: 194.17  on 49  degrees of freedom
## AIC: 850.13
##
## Number of Fisher Scoring iterations: 4
```

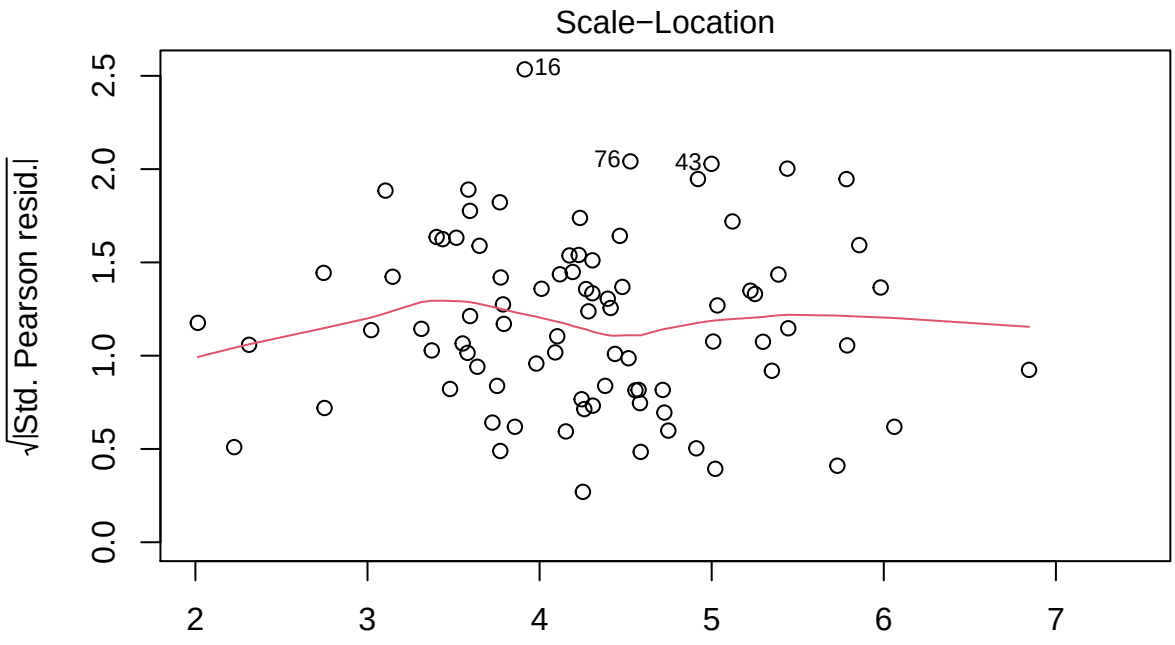
```
Anova(mod5)
```

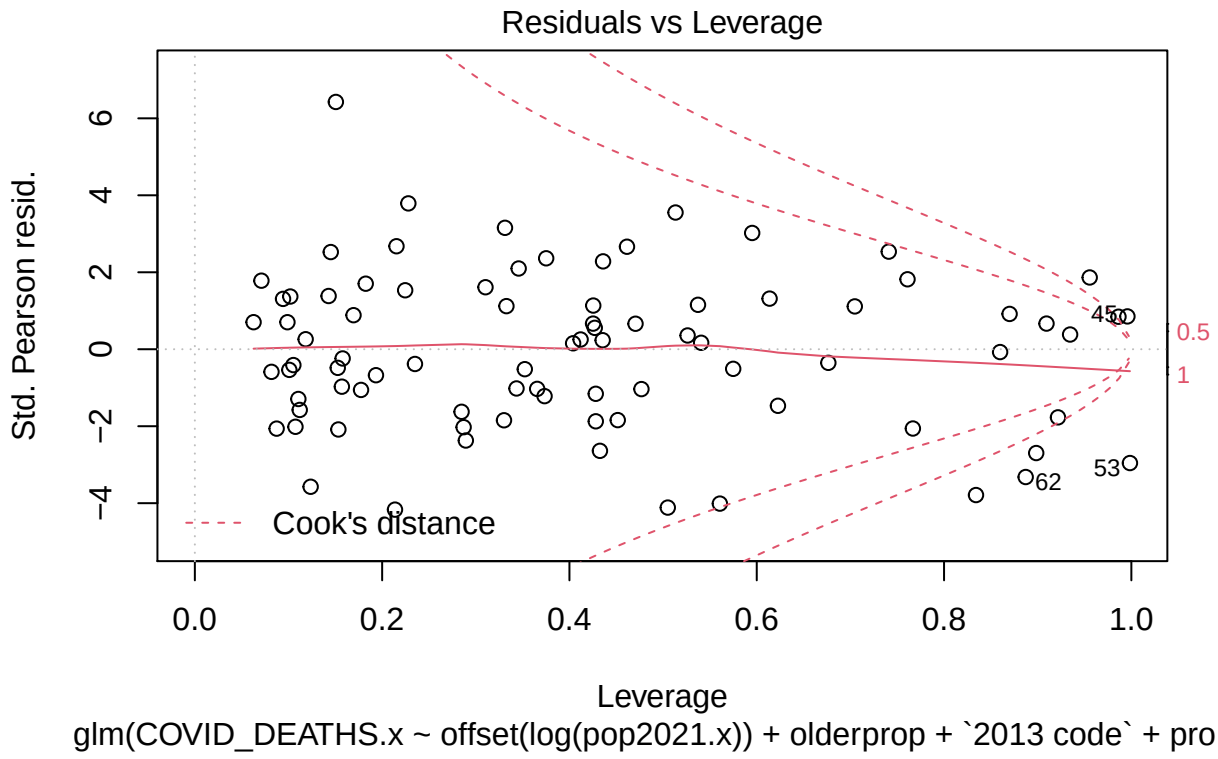
```
## Analysis of Deviance Table (Type II tests)
##
## Response: COVID_DEATHS.x
##                                      LR Chisq Df Pr(>Chisq)
## olderprop                             124.440  1  < 2.2e-16 ***
## `2013 code`                            41.451  5  7.607e-08 ***
## prop_cases                             21.398  1  3.731e-06 ***
## TrmpProp                                0.052  1  0.8194342
## ClintVote.x                             9.634  1  0.0019104 **
## `Older (65 plus).x`                     9.153  1  0.0024829 **
## RARELY                                  8.036  1  0.0045845 **
## olderprop:TrmpProp                     11.423  1  0.0007253 ***
## olderprop:RARELY                        2.331  1  0.1268495
## TrmpProp:RARELY                         5.447  1  0.0196072 *
## olderprop:`2013 code`                  30.585  4  3.721e-06 ***
## `2013 code`:TrmpProp                   15.766  4  0.0033504 **
## `2013 code`:RARELY                     39.327  4  5.962e-08 ***
## olderprop:TrmpProp:RARELY               0.267  1  0.6055565
## olderprop:`2013 code`:TrmpProp         24.563  4  6.160e-05 ***
## olderprop:`2013 code`:RARELY           18.363  4  0.0010478 **
## `2013 code`:TrmpProp:RARELY            13.364  4  0.0096297 **
## olderprop:`2013 code`:TrmpProp:RARELY  19.301  3  0.0002369 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
plot(mod5)
```


Residuals vs Fitted
Residuals
Predicted values
glm(COVID_DEATHS.x ~ offset(log(pop2021.x)) + olderprop + `2013 code` + pro ...
16
61
76
6
4
2
0
−2
−4
2
3
4
5
6
7


Normal Q−Q
Std. Pearson resid.
Theoretical Quantiles
glm(COVID_DEATHS.x ~ offset(log(pop2021.x)) + olderprop + `2013 code` + pro ...
16
76
43
−4
−2
0
2
4
6
−2
−1
0
1
2


Scale−Location
16
76
43
√|Std. Pearson resid.|
0.0
0.5
1.0
1.5
2.0
2.5
2
3
4
5
6
7
Predicted values
glm(COVID_DEATHS.x ~ offset(log(pop2021.x)) + olderprop + `2013 code` + pro ...




```
# try everything and work backwards
mod5.1 <- glm(formula = COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases + COVID_COUNT.x +
    COVID_TEST.x + NEVER + SOMETIMES + COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y +
    fully_vaccinated.y + `Older (65 plus).y` + TrmpVote.x + TrmpVote.y + ClintVote.x +
    ClintVote.y + TotalVote.x + TotalVote.y + FREQUENTLY + ALWAYS + all_doses_administered.x +
    fully_vaccinated.x + `2013 code` + `Older (65 plus).x` + olderprop * TrmpProp *
    RARELY * `2013 code`, family = poisson, data = big_data3)
summary(mod5.1)
```

```
##
## Call:
## glm(formula = COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases +
##     COVID_COUNT.x + COVID_TEST.x + NEVER + SOMETIMES + COVID_COUNT.y +
##     COVID_TEST.y + all_doses_administered.y + fully_vaccinated.y +
##     `Older (65 plus).y` + TrmpVote.x + TrmpVote.y + ClintVote.x +
##     ClintVote.y + TotalVote.x + TotalVote.y + FREQUENTLY + ALWAYS +
##     all_doses_administered.x + fully_vaccinated.x + `2013 code` +
##     `Older (65 plus).x` + olderprop * TrmpProp * RARELY * `2013 code`,
##     family = poisson, data = big_data3)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -3.4403  -0.5495  -0.0053   0.4260   3.1618
##
## Coefficients: (8 not defined because of singularities)
##                                        Estimate Std. Error z value Pr(>|z|)
```

```
## (Intercept)                          1.458e+01  8.171e+01   0.178 0.858422
## pop2021.x                            8.911e-05  2.599e-05   3.429 0.000606
## pop2021.y                           -8.151e+00  6.283e+00  -1.297 0.194544
## prop_cases                           6.818e+01  1.637e+01   4.164 3.13e-05
## COVID_COUNT.x                       -2.410e-04  9.222e-05  -2.614 0.008958
## COVID_TEST.x                        -6.134e-06  9.195e-06  -0.667 0.504672
## NEVER                               -3.196e+01  3.200e+01  -0.999 0.317911
## SOMETIMES                           -3.345e+01  3.208e+01  -1.043 0.297020
## COVID_COUNT.y                       -6.516e+00  1.775e+00  -3.671 0.000242
## COVID_TEST.y                         7.869e-01  3.530e-01   2.229 0.025817
## all_doses_administered.y             1.707e-01  1.522e+00   0.112 0.910707
## fully_vaccinated.y                   6.441e-01  1.360e+00   0.473 0.635887
## `Older (65 plus).y`                  1.255e+01  6.004e+00   2.090 0.036653
## TrmpVote.x                          -4.114e-04  4.315e-04  -0.953 0.340367
## TrmpVote.y                           2.286e+01  6.691e+00   3.416 0.000635
## ClintVote.x                         -3.424e-04  4.106e-04  -0.834 0.404381
## ClintVote.y                          2.873e+00  1.603e+00   1.792 0.073102
## TotalVote.x                          3.040e-04  4.013e-04   0.758 0.448697
## TotalVote.y                         -2.408e+01  6.081e+00  -3.959 7.51e-05
## FREQUENTLY                          -3.359e+01  3.214e+01  -1.045 0.295972
## ALWAYS                              -3.309e+01  3.210e+01  -1.031 0.302680
## all_doses_administered.x            -3.896e-05  5.414e-05  -0.720 0.471803
## fully_vaccinated.x                   3.421e-05  9.695e-05   0.353 0.724225
## `2013 code2                         -4.527e+01  8.621e+01  -0.525 0.599491
## `2013 code3                          4.742e+01  5.414e+01   0.876 0.381101
## `2013 code4                          6.378e+01  7.358e+01   0.867 0.386028
## `2013 code5                         -1.319e+02  7.693e+01  -1.714 0.086535
## `2013 code6                          1.846e+01  8.930e+00   2.067 0.038697
## `Older (65 plus).x`                 -1.070e-04  5.527e-05  -1.936 0.052853
## olderprop                            9.361e+01  4.091e+02   0.229 0.818998
## TrmpProp                             5.076e+01  1.097e+02   0.463 0.643546
## RARELY                               1.186e+03  7.341e+02   1.615 0.106306
## olderprop:TrmpProp                  -3.436e+02  5.545e+02  -0.620 0.535459
## olderprop:RARELY                    -6.090e+03  3.709e+03  -1.642 0.100584
## TrmpProp:RARELY                     -1.946e+03  1.034e+03  -1.881 0.059957
## `2013 code2:olderprop                4.220e+02  4.980e+02   0.847 0.396766
## `2013 code3:olderprop                9.852e+01  2.897e+02   0.340 0.733790
## `2013 code4:olderprop               -1.693e+02  4.065e+02  -0.417 0.677007
## `2013 code5:olderprop                8.394e+02  4.289e+02   1.957 0.050312
## `2013 code6:olderprop                       NA         NA      NA       NA
## `2013 code2:TrmpProp                 7.189e+01  1.291e+02   0.557 0.577766
## `2013 code3:TrmpProp                -1.177e+02  1.076e+02  -1.094 0.274072
## `2013 code4:TrmpProp                -9.908e+01  1.123e+02  -0.882 0.377557
## `2013 code5:TrmpProp                 1.832e+02  1.145e+02   1.600 0.109550
## `2013 code6:TrmpProp                        NA         NA      NA       NA
## `2013 code2:RARELY                   2.389e+01  9.597e+02   0.025 0.980138
## `2013 code3:RARELY                  -2.981e+02  1.912e+02  -1.559 0.119027
## `2013 code4:RARELY                  -1.295e+03  7.524e+02  -1.721 0.085248
## `2013 code5:RARELY                   5.923e+02  8.045e+02   0.736 0.461580
## `2013 code6:RARELY                          NA         NA      NA       NA
## olderprop:TrmpProp:RARELY            9.723e+03  5.191e+03   1.873 0.061070
## `2013 code2:olderprop:TrmpProp      -5.139e+02  6.847e+02  -0.750 0.452954
## `2013 code3:olderprop:TrmpProp       2.766e+02  4.173e+02   0.663 0.507509
## `2013 code4:olderprop:TrmpProp       4.188e+02  5.660e+02   0.740 0.459351
```

```
## `2013 code`5:olderprop:TrmpProp        -1.038e+03  5.886e+02  -1.763 0.077887
## `2013 code`6:olderprop:TrmpProp                NA         NA      NA       NA
## `2013 code`2:olderprop:RARELY          -1.207e+03  5.211e+03  -0.232 0.816804
## `2013 code`3:olderprop:RARELY          -4.184e+03  3.150e+03  -1.329 0.184011
## `2013 code`4:olderprop:RARELY           6.034e+03  3.795e+03   1.590 0.111798
## `2013 code`5:olderprop:RARELY          -3.771e+03  4.144e+03  -0.910 0.362750
## `2013 code`6:olderprop:RARELY                  NA         NA      NA       NA
## `2013 code`2:TrmpProp:RARELY            1.128e+02  1.336e+03   0.084 0.932713
## `2013 code`3:TrmpProp:RARELY            1.493e+03  8.157e+02   1.830 0.067253
## `2013 code`4:TrmpProp:RARELY            2.095e+03  1.068e+03   1.963 0.049669
## `2013 code`5:TrmpProp:RARELY           -5.750e+02  1.119e+03  -0.514 0.607209
## `2013 code`6:TrmpProp:RARELY                   NA         NA      NA       NA
## `2013 code`2:olderprop:TrmpProp:RARELY  1.055e+03  7.259e+03   0.145 0.884401
## `2013 code`3:olderprop:TrmpProp:RARELY         NA         NA      NA       NA
## `2013 code`4:olderprop:TrmpProp:RARELY -9.884e+03  5.378e+03  -1.838 0.066052
## `2013 code`5:olderprop:TrmpProp:RARELY  4.004e+03  5.761e+03   0.695 0.487013
## `2013 code`6:olderprop:TrmpProp:RARELY         NA         NA      NA       NA
##
## (Intercept)
## pop2021.x                              ***
## pop2021.y
## prop_cases                             ***
## COVID_COUNT.x                          **
## COVID_TEST.x
## NEVER
## SOMETIMES
## COVID_COUNT.y                          ***
## COVID_TEST.y                           *
## all_doses_administered.y
## fully_vaccinated.y
## `Older (65 plus).y`                    *
## TrmpVote.x
## TrmpVote.y                             ***
## ClintVote.x
## ClintVote.y                            .
## TotalVote.x
## TotalVote.y                            ***
## FREQUENTLY
## ALWAYS
## all_doses_administered.x
## fully_vaccinated.x
## `2013 code`2
## `2013 code`3
## `2013 code`4
## `2013 code`5                           .
## `2013 code`6                           *
## `Older (65 plus).x`                    .
## olderprop
## TrmpProp
## RARELY
## olderprop:TrmpProp
## olderprop:RARELY
## TrmpProp:RARELY                        .
## `2013 code`2:olderprop
```

```
## `2013 code`3:olderprop
## `2013 code`4:olderprop
## `2013 code`5:olderprop                .
## `2013 code`6:olderprop
## `2013 code`2:TrmpProp
## `2013 code`3:TrmpProp
## `2013 code`4:TrmpProp
## `2013 code`5:TrmpProp
## `2013 code`6:TrmpProp
## `2013 code`2:RARELY
## `2013 code`3:RARELY
## `2013 code`4:RARELY                   .
## `2013 code`5:RARELY
## `2013 code`6:RARELY
## olderprop:TrmpProp:RARELY             .
## `2013 code`2:olderprop:TrmpProp
## `2013 code`3:olderprop:TrmpProp
## `2013 code`4:olderprop:TrmpProp
## `2013 code`5:olderprop:TrmpProp       .
## `2013 code`6:olderprop:TrmpProp
## `2013 code`2:olderprop:RARELY
## `2013 code`3:olderprop:RARELY
## `2013 code`4:olderprop:RARELY
## `2013 code`5:olderprop:RARELY
## `2013 code`6:olderprop:RARELY
## `2013 code`2:TrmpProp:RARELY
## `2013 code`3:TrmpProp:RARELY          .
## `2013 code`4:TrmpProp:RARELY          *
## `2013 code`5:TrmpProp:RARELY
## `2013 code`6:TrmpProp:RARELY
## `2013 code`2:olderprop:TrmpProp:RARELY
## `2013 code`3:olderprop:TrmpProp:RARELY
## `2013 code`4:olderprop:TrmpProp:RARELY .
## `2013 code`5:olderprop:TrmpProp:RARELY
## `2013 code`6:olderprop:TrmpProp:RARELY
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 16416.47  on 91  degrees of freedom
## Residual deviance:   108.83  on 29  degrees of freedom
## AIC: 804.79
##
## Number of Fisher Scoring iterations: 4
```

```
Anova(mod5.1)
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: COVID_DEATHS.x
##                                    LR Chisq Df Pr(>Chisq)
## pop2021.x                            11.864  1  0.0005723 ***
## pop2021.y                             1.680  1  0.1949613
```

```
## prop_cases                                17.227  1  3.317e-05 ***
## COVID_COUNT.x                              6.853  1  0.0088507 **
## COVID_TEST.x                               0.445  1  0.5046443
## NEVER                                      0.997  1  0.3179601
## SOMETIMES                                  1.087  1  0.2970577
## COVID_COUNT.y                             13.453  1  0.0002446 ***
## COVID_TEST.y                               5.015  1  0.0251271 *
## all_doses_administered.y                   0.013  1  0.9107168
## fully_vaccinated.y                         0.224  1  0.6356754
## `Older (65 plus).y`                        4.360  1  0.0367855 *
## TrmpVote.x                                 0.908  1  0.3406520
## TrmpVote.y                                11.854  1  0.0005755 ***
## ClintVote.x                                0.694  1  0.4046714
## ClintVote.y                                3.193  1  0.0739340 .
## TotalVote.x                                0.574  1  0.4488684
## TotalVote.y                               15.986  1  6.381e-05 ***
## FREQUENTLY                                 1.092  1  0.2960034
## ALWAYS                                     1.062  1  0.3027251
## all_doses_administered.x                   0.518  1  0.4715189
## fully_vaccinated.x                         0.125  1  0.7241537
## `2013 code`                               25.244  5  0.0001250 ***
## `Older (65 plus).x`                        3.780  1  0.0518780 .
## olderprop                                 16.869  1  4.006e-05 ***
## TrmpProp                                   1.660  1  0.1976422
## RARELY                                     4.603  1  0.0319210 *
## olderprop:TrmpProp                         2.272  1  0.1317347
## olderprop:RARELY                           3.330  1  0.0680167 .
## TrmpProp:RARELY                           12.933  1  0.0003229 ***
## `2013 code`:olderprop                     32.725  4  1.360e-06 ***
## `2013 code`:TrmpProp                       9.155  4  0.0573466 .
## `2013 code`:RARELY                        36.987  4  1.812e-07 ***
## olderprop:TrmpProp:RARELY                  5.003  1  0.0252992 *
## `2013 code`:olderprop:TrmpProp            34.911  4  4.844e-07 ***
## `2013 code`:olderprop:RARELY              25.575  4  3.855e-05 ***
## `2013 code`:TrmpProp:RARELY               19.753  4  0.0005586 ***
## `2013 code`:olderprop:TrmpProp:RARELY     17.417  3  0.0005800 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod5.1, test = 'Chi')

# drop alldosesadministered.y
mod5.2 <- glm(formula = COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases + COVID_COUNT.x +
    COVID_TEST.x + NEVER + SOMETIMES + COVID_COUNT.y + COVID_TEST.y + fully_vaccinated.y +
    `Older (65 plus).y` + TrmpVote.x + TrmpVote.y + ClintVote.x + ClintVote.y + TotalVote.x +
    TotalVote.y + FREQUENTLY + ALWAYS + all_doses_administered.x + fully_vaccinated.x +
    `2013 code` + `Older (65 plus).x` + olderprop * TrmpProp * RARELY * `2013 code`,
    family = poisson, data = big_data3)
summary(mod5.2)
```

```
##
## Call:
## glm(formula = COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases +
##     COVID_COUNT.x + COVID_TEST.x + NEVER + SOMETIMES + COVID_COUNT.y +
```

```
##     COVID_TEST.y + fully_vaccinated.y + `Older (65 plus).y` +
##     TrmpVote.x + TrmpVote.y + ClintVote.x + ClintVote.y + TotalVote.x +
##     TotalVote.y + FREQUENTLY + ALWAYS + all_doses_administered.x +
##     fully_vaccinated.x + `2013 code` + `Older (65 plus).x` +
##     olderprop * TrmpProp * RARELY * `2013 code`, family = poisson,
##     data = big_data3)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -3.4294  -0.5536  -0.0034   0.4188   3.1614
##
## Coefficients: (8 not defined because of singularities)
##                                    Estimate Std. Error z value Pr(>|z|)
## (Intercept)                       1.828e+01  7.474e+01   0.245 0.806820
## pop2021.x                         8.815e-05  2.454e-05   3.591 0.000329
## pop2021.y                        -8.160e+00  6.284e+00  -1.299 0.194109
## prop_cases                        6.775e+01  1.592e+01   4.255 2.10e-05
## COVID_COUNT.x                    -2.393e-04  9.094e-05  -2.632 0.008498
## COVID_TEST.x                     -5.935e-06  9.022e-06  -0.658 0.510611
## NEVER                            -3.261e+01  3.148e+01  -1.036 0.300163
## SOMETIMES                        -3.410e+01  3.155e+01  -1.081 0.279764
## COVID_COUNT.y                    -6.473e+00  1.732e+00  -3.737 0.000186
## COVID_TEST.y                      7.826e-01  3.509e-01   2.230 0.025724
## fully_vaccinated.y                7.926e-01  3.105e-01   2.553 0.010677
## `Older (65 plus).y`               1.255e+01  6.005e+00   2.090 0.036651
## TrmpVote.x                       -3.923e-04  3.967e-04  -0.989 0.322618
## TrmpVote.y                        2.299e+01  6.595e+00   3.485 0.000492
## ClintVote.x                      -3.247e-04  3.791e-04  -0.857 0.391697
## ClintVote.y                       2.794e+00  1.441e+00   1.939 0.052461
## TotalVote.x                       2.857e-04  3.667e-04   0.779 0.435837
## TotalVote.y                      -2.413e+01  6.061e+00  -3.982 6.85e-05
## FREQUENTLY                       -3.423e+01  3.163e+01  -1.082 0.279180
## ALWAYS                           -3.372e+01  3.160e+01  -1.067 0.285875
## all_doses_administered.x         -3.444e-05  3.612e-05  -0.953 0.340428
## fully_vaccinated.x                2.657e-05  6.900e-05   0.385 0.700179
## `2013 code`2                     -4.804e+01  8.260e+01  -0.582 0.560816
## `2013 code`3                      4.598e+01  5.259e+01   0.874 0.381981
## `2013 code`4                      6.181e+01  7.144e+01   0.865 0.386932
## `2013 code`5                     -1.326e+02  7.668e+01  -1.729 0.083886
## `2013 code`6                      1.850e+01  8.923e+00   2.074 0.038115
## `Older (65 plus).x`              -1.054e-04  5.330e-05  -1.977 0.048057
## olderprop                         8.038e+01  3.917e+02   0.205 0.837384
## TrmpProp                          4.667e+01  1.035e+02   0.451 0.651896
## RARELY                            1.161e+03  7.020e+02   1.655 0.098019
## olderprop:TrmpProp               -3.254e+02  5.302e+02  -0.614 0.539365
## olderprop:RARELY                 -5.971e+03  3.554e+03  -1.680 0.092940
## TrmpProp:RARELY                  -1.914e+03  9.939e+02  -1.926 0.054166
## `2013 code`2:olderprop            4.363e+02  4.813e+02   0.906 0.364702
## `2013 code`3:olderprop            1.000e+02  2.894e+02   0.346 0.729610
## `2013 code`4:olderprop           -1.600e+02  3.979e+02  -0.402 0.687591
## `2013 code`5:olderprop            8.424e+02  4.281e+02   1.968 0.049091
## `2013 code`6:olderprop                   NA         NA      NA       NA
## `2013 code`2:TrmpProp             7.570e+01  1.246e+02   0.608 0.543468
## `2013 code`3:TrmpProp            -1.143e+02  1.032e+02  -1.107 0.268141
```

```
## `2013 code`4:TrmpProp                   -9.642e+01  1.098e+02  -0.879 0.379651
## `2013 code`5:TrmpProp                    1.842e+02  1.141e+02   1.614 0.106527
## `2013 code`6:TrmpProp                           NA         NA      NA       NA
## `2013 code`2:RARELY                      5.272e+01  9.247e+02   0.057 0.954538
## `2013 code`3:RARELY                     -2.926e+02  1.849e+02  -1.583 0.113502
## `2013 code`4:RARELY                     -1.280e+03  7.412e+02  -1.727 0.084080
## `2013 code`5:RARELY                      6.008e+02  8.011e+02   0.750 0.453280
## `2013 code`6:RARELY                             NA         NA      NA       NA
## olderprop:TrmpProp:RARELY                9.560e+03  4.983e+03   1.918 0.055055
## `2013 code`2:olderprop:TrmpProp         -5.333e+02  6.626e+02  -0.805 0.420910
## `2013 code`3:olderprop:TrmpProp          2.671e+02  4.087e+02   0.654 0.513357
## `2013 code`4:olderprop:TrmpProp          4.066e+02  5.554e+02   0.732 0.464138
## `2013 code`5:olderprop:TrmpProp         -1.042e+03  5.875e+02  -1.773 0.076189
## `2013 code`6:olderprop:TrmpProp                 NA         NA      NA       NA
## `2013 code`2:olderprop:RARELY           -1.355e+03  5.042e+03  -0.269 0.788217
## `2013 code`3:olderprop:RARELY           -4.095e+03  3.047e+03  -1.344 0.178971
## `2013 code`4:olderprop:RARELY            5.971e+03  3.753e+03   1.591 0.111622
## `2013 code`5:olderprop:RARELY           -3.807e+03  4.131e+03  -0.922 0.356772
## `2013 code`6:olderprop:RARELY                   NA         NA      NA       NA
## `2013 code`2:TrmpProp:RARELY             7.337e+01  1.289e+03   0.057 0.954599
## `2013 code`3:TrmpProp:RARELY             1.462e+03  7.692e+02   1.901 0.057289
## `2013 code`4:TrmpProp:RARELY             2.077e+03  1.055e+03   1.969 0.048961
## `2013 code`5:TrmpProp:RARELY            -5.864e+02  1.114e+03  -0.526 0.598609
## `2013 code`6:TrmpProp:RARELY                    NA         NA      NA       NA
## `2013 code`2:olderprop:TrmpProp:RARELY   1.257e+03  7.034e+03   0.179 0.858189
## `2013 code`3:olderprop:TrmpProp:RARELY          NA         NA      NA       NA
## `2013 code`4:olderprop:TrmpProp:RARELY -9.807e+03  5.333e+03  -1.839 0.065937
## `2013 code`5:olderprop:TrmpProp:RARELY  4.052e+03  5.744e+03   0.705 0.480558
## `2013 code`6:olderprop:TrmpProp:RARELY          NA         NA      NA       NA
##
## (Intercept)
## pop2021.x                               ***
## pop2021.y
## prop_cases                              ***
## COVID_COUNT.x                           **
## COVID_TEST.x
## NEVER
## SOMETIMES
## COVID_COUNT.y                           ***
## COVID_TEST.y                            *
## fully_vaccinated.y                      *
## `Older (65 plus).y`                     *
## TrmpVote.x
## TrmpVote.y                              ***
## ClintVote.x
## ClintVote.y                             .
## TotalVote.x
## TotalVote.y                             ***
## FREQUENTLY
## ALWAYS
## all_doses_administered.x
## fully_vaccinated.x
## `2013 code`2
## `2013 code`3
```

```
## `2013 code`4
## `2013 code`5                          .
## `2013 code`6                          *
## `Older (65 plus).x`                   *
## olderprop
## TrmpProp
## RARELY                                .
## olderprop:TrmpProp
## olderprop:RARELY                      .
## TrmpProp:RARELY                       .
## `2013 code`2:olderprop
## `2013 code`3:olderprop
## `2013 code`4:olderprop
## `2013 code`5:olderprop                *
## `2013 code`6:olderprop
## `2013 code`2:TrmpProp
## `2013 code`3:TrmpProp
## `2013 code`4:TrmpProp
## `2013 code`5:TrmpProp
## `2013 code`6:TrmpProp
## `2013 code`2:RARELY
## `2013 code`3:RARELY
## `2013 code`4:RARELY                   .
## `2013 code`5:RARELY
## `2013 code`6:RARELY
## olderprop:TrmpProp:RARELY             .
## `2013 code`2:olderprop:TrmpProp
## `2013 code`3:olderprop:TrmpProp
## `2013 code`4:olderprop:TrmpProp
## `2013 code`5:olderprop:TrmpProp       .
## `2013 code`6:olderprop:TrmpProp
## `2013 code`2:olderprop:RARELY
## `2013 code`3:olderprop:RARELY
## `2013 code`4:olderprop:RARELY
## `2013 code`5:olderprop:RARELY
## `2013 code`6:olderprop:RARELY
## `2013 code`2:TrmpProp:RARELY
## `2013 code`3:TrmpProp:RARELY          .
## `2013 code`4:TrmpProp:RARELY          *
## `2013 code`5:TrmpProp:RARELY
## `2013 code`6:TrmpProp:RARELY
## `2013 code`2:olderprop:TrmpProp:RARELY
## `2013 code`3:olderprop:TrmpProp:RARELY
## `2013 code`4:olderprop:TrmpProp:RARELY .
## `2013 code`5:olderprop:TrmpProp:RARELY
## `2013 code`6:olderprop:TrmpProp:RARELY
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 16416.47  on 91  degrees of freedom
## Residual deviance:   108.84  on 30  degrees of freedom
## AIC: 802.8
```

```
##
## Number of Fisher Scoring iterations: 4
```

```
Anova(mod5.2)
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: COVID_DEATHS.x
##                                        LR Chisq Df Pr(>Chisq)
## pop2021.x                                12.999  1  0.0003117 ***
## pop2021.y                                 1.683  1  0.1945407
## prop_cases                               17.952  1  2.265e-05 ***
## COVID_COUNT.x                             6.941  1  0.0084224 **
## COVID_TEST.x                              0.433  1  0.5105848
## NEVER                                     1.073  1  0.3003307
## SOMETIMES                                 1.167  1  0.2799252
## COVID_COUNT.y                            13.939  1  0.0001889 ***
## COVID_TEST.y                              5.018  1  0.0250797 *
## fully_vaccinated.y                        6.505  1  0.0107598 *
## `Older (65 plus).y`                       4.360  1  0.0367873 *
## TrmpVote.x                                0.977  1  0.3229144
## TrmpVote.y                               12.335  1  0.0004444 ***
## ClintVote.x                               0.733  1  0.3919757
## ClintVote.y                               3.731  1  0.0534235 .
## TotalVote.x                               0.607  1  0.4360257
## TotalVote.y                              16.160  1  5.821e-05 ***
## FREQUENTLY                                1.170  1  0.2793381
## ALWAYS                                    1.138  1  0.2860444
## all_doses_administered.x                  0.911  1  0.3399517
## fully_vaccinated.x                        0.148  1  0.7000842
## `2013 code`                              21.431  5  0.0006715 ***
## `Older (65 plus).x`                       3.934  1  0.0473238 *
## olderprop                                18.832  1  1.427e-05 ***
## TrmpProp                                  0.739  1  0.3898914
## RARELY                                    6.789  1  0.0091716 **
## olderprop:TrmpProp                        4.195  1  0.0405454 *
## olderprop:RARELY                          2.723  1  0.0989270 .
## TrmpProp:RARELY                          14.987  1  0.0001082 ***
## `2013 code`:olderprop                    32.907  4  1.248e-06 ***
## `2013 code`:TrmpProp                      8.776  4  0.0669437 .
## `2013 code`:RARELY                       43.028  4  1.021e-08 ***
## olderprop:TrmpProp:RARELY                 7.399  1  0.0065275 **
## `2013 code`:olderprop:TrmpProp           35.197  4  4.232e-07 ***
## `2013 code`:olderprop:RARELY             26.014  4  3.143e-05 ***
## `2013 code`:TrmpProp:RARELY              20.787  4  0.0003490 ***
## `2013 code`:olderprop:TrmpProp:RARELY    17.410  3  0.0005819 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
drop1(mod5.2, test = "Chi")
```

```
## Single term deletions
##
```

```
## Model:
## COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases + COVID_COUNT.x +
##     COVID_TEST.x + NEVER + SOMETIMES + COVID_COUNT.y + COVID_TEST.y +
##     fully_vaccinated.y + `Older (65 plus).y` + TrmpVote.x + TrmpVote.y +
##     ClintVote.x + ClintVote.y + TotalVote.x + TotalVote.y + FREQUENTLY +
##     ALWAYS + all_doses_administered.x + fully_vaccinated.x +
##     `2013 code` + `Older (65 plus).x` + olderprop * TrmpProp *
##     RARELY * `2013 code`
##                                       Df Deviance    AIC     LRT  Pr(>Chi)
## <none>                                     108.84 802.80
## pop2021.x                              1   121.84 813.80 12.9989 0.0003117 ***
## pop2021.y                              1   110.53 802.48  1.6829 0.1945407
## prop_cases                             1   126.80 818.75 17.9522 2.265e-05 ***
## COVID_COUNT.x                          1   115.79 807.74  6.9414 0.0084224 **
## COVID_TEST.x                           1   109.28 801.23  0.4329 0.5105848
## NEVER                                  1   109.92 801.87  1.0727 0.3003307
## SOMETIMES                              1   110.01 801.97  1.1675 0.2799252
## COVID_COUNT.y                          1   122.78 814.74 13.9386 0.0001889 ***
## COVID_TEST.y                           1   113.86 805.82  5.0184 0.0250797 *
## fully_vaccinated.y                     1   115.35 807.31  6.5046 0.0107598 *
## `Older (65 plus).y`                    1   113.20 805.16  4.3602 0.0367873 *
## TrmpVote.x                             1   109.82 801.78  0.9771 0.3229144
## TrmpVote.y                             1   121.18 813.14 12.3355 0.0004444 ***
## ClintVote.x                            1   109.58 801.53  0.7328 0.3919757
## ClintVote.y                            1   112.58 804.53  3.7306 0.0534235 .
## TotalVote.x                            1   109.45 801.41  0.6067 0.4360257
## TotalVote.y                            1   125.00 816.96 16.1600 5.821e-05 ***
## FREQUENTLY                             1   110.02 801.97  1.1703 0.2793381
## ALWAYS                                 1   109.98 801.94  1.1381 0.2860444
## all_doses_administered.x               1   109.75 801.71  0.9106 0.3399517
## fully_vaccinated.x                     1   108.99 800.95  0.1484 0.7000842
## `Older (65 plus).x`                    1   112.78 804.73  3.9338 0.0473238 *
## `2013 code`:olderprop:TrmpProp:RARELY  3   126.25 814.21 17.4101 0.0005819 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop fullyvaccinated.x
mod5.3 <- glm(formula = COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases + COVID_COUNT.x +
    COVID_TEST.x + NEVER + SOMETIMES + COVID_COUNT.y + COVID_TEST.y + fully_vaccinated.y +
    `Older (65 plus).y` + TrmpVote.x + TrmpVote.y + ClintVote.x + ClintVote.y + TotalVote.x +
    TotalVote.y + FREQUENTLY + ALWAYS + all_doses_administered.x + `2013 code` +
    `Older (65 plus).x` + olderprop * TrmpProp * RARELY * `2013 code`, family = poisson,
    data = big_data3)
summary(mod5.3)
```

```
##
## Call:
## glm(formula = COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases +
##     COVID_COUNT.x + COVID_TEST.x + NEVER + SOMETIMES + COVID_COUNT.y +
##     COVID_TEST.y + fully_vaccinated.y + `Older (65 plus).y` +
##     TrmpVote.x + TrmpVote.y + ClintVote.x + ClintVote.y + TotalVote.x +
##     TotalVote.y + FREQUENTLY + ALWAYS + all_doses_administered.x +
##     `2013 code` + `Older (65 plus).x` + olderprop * TrmpProp *
##     RARELY * `2013 code`, family = poisson, data = big_data3)
```

```
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -3.5064  -0.5302  -0.0008   0.3977   3.1801
##
## Coefficients: (8 not defined because of singularities)
##                                      Estimate Std. Error z value Pr(>|z|)
## (Intercept)                         1.736e+01  7.474e+01   0.232 0.816335
## pop2021.x                           8.526e-05  2.337e-05   3.648 0.000265
## pop2021.y                          -7.360e+00  5.937e+00  -1.240 0.215134
## prop_cases                          6.889e+01  1.565e+01   4.401 1.08e-05
## COVID_COUNT.x                      -2.309e-04  8.831e-05  -2.615 0.008929
## COVID_TEST.x                       -5.962e-06  9.022e-06  -0.661 0.508759
## NEVER                              -3.261e+01  3.149e+01  -1.036 0.300424
## SOMETIMES                          -3.411e+01  3.156e+01  -1.081 0.279794
## COVID_COUNT.y                      -6.620e+00  1.690e+00  -3.918 8.94e-05
## COVID_TEST.y                        7.687e-01  3.490e-01   2.203 0.027619
## fully_vaccinated.y                  8.211e-01  3.014e-01   2.724 0.006447
## `Older (65 plus).y`                 1.192e+01  5.784e+00   2.060 0.039360
## TrmpVote.x                         -2.858e-04  2.845e-04  -1.005 0.315113
## TrmpVote.y                          2.289e+01  6.598e+00   3.470 0.000520
## ClintVote.x                        -2.280e-04  2.842e-04  -0.802 0.422402
## ClintVote.y                         2.574e+00  1.324e+00   1.944 0.051839
## TotalVote.x                         1.906e-04  2.712e-04   0.703 0.482105
## TotalVote.y                        -2.386e+01  6.025e+00  -3.960 7.50e-05
## FREQUENTLY                         -3.426e+01  3.165e+01  -1.082 0.279048
## ALWAYS                             -3.377e+01  3.161e+01  -1.068 0.285411
## all_doses_administered.x           -2.214e-05  1.685e-05  -1.314 0.188873
## `2013 code`2                       -3.835e+01  7.871e+01  -0.487 0.626070
## `2013 code`3                        4.969e+01  5.172e+01   0.961 0.336731
## `2013 code`4                        6.176e+01  7.146e+01   0.864 0.387424
## `2013 code`5                       -1.351e+02  7.642e+01  -1.768 0.077027
## `2013 code`6                        1.696e+01  7.983e+00   2.125 0.033582
## `Older (65 plus).x`                -1.028e-04  5.288e-05  -1.944 0.051841
## olderprop                           8.786e+01  3.913e+02   0.225 0.822348
## TrmpProp                            4.614e+01  1.035e+02   0.446 0.655644
## RARELY                              1.146e+03  7.011e+02   1.635 0.101994
## olderprop:TrmpProp                 -3.286e+02  5.303e+02  -0.620 0.535558
## olderprop:RARELY                   -5.905e+03  3.551e+03  -1.663 0.096271
## TrmpProp:RARELY                    -1.888e+03  9.920e+02  -1.904 0.056960
## `2013 code`2:olderprop              3.714e+02  4.511e+02   0.823 0.410320
## `2013 code`3:olderprop              7.992e+01  2.846e+02   0.281 0.778881
## `2013 code`4:olderprop             -1.711e+02  3.969e+02  -0.431 0.666440
## `2013 code`5:olderprop              8.490e+02  4.279e+02   1.984 0.047215
## `2013 code`6:olderprop                     NA         NA      NA       NA
## `2013 code`2:TrmpProp               6.013e+01  1.179e+02   0.510 0.610059
## `2013 code`3:TrmpProp              -1.257e+02  9.886e+01  -1.271 0.203614
## `2013 code`4:TrmpProp              -9.803e+01  1.097e+02  -0.894 0.371564
## `2013 code`5:TrmpProp               1.861e+02  1.141e+02   1.631 0.102810
## `2013 code`6:TrmpProp                      NA         NA      NA       NA
## `2013 code`2:RARELY                -6.642e+01  8.719e+02  -0.076 0.939274
## `2013 code`3:RARELY                -2.808e+02  1.824e+02  -1.539 0.123686
## `2013 code`4:RARELY                -1.270e+03  7.409e+02  -1.714 0.086519
## `2013 code`5:RARELY                 6.251e+02  7.988e+02   0.783 0.433910
```

```
## `2013 code`6:RARELY                           NA         NA      NA       NA
## olderprop:TrmpProp:RARELY               9.446e+03  4.976e+03   1.898 0.057636
## `2013 code`2:olderprop:TrmpProp        -4.429e+02  6.199e+02  -0.714 0.474940
## `2013 code`3:olderprop:TrmpProp         3.175e+02  3.873e+02   0.820 0.412403
## `2013 code`4:olderprop:TrmpProp         4.198e+02  5.545e+02   0.757 0.449006
## `2013 code`5:olderprop:TrmpProp        -1.053e+03  5.870e+02  -1.794 0.072738
## `2013 code`6:olderprop:TrmpProp                NA         NA      NA       NA
## `2013 code`2:olderprop:RARELY          -6.281e+02  4.679e+03  -0.134 0.893212
## `2013 code`3:olderprop:RARELY          -4.337e+03  2.979e+03  -1.456 0.145508
## `2013 code`4:olderprop:RARELY           5.968e+03  3.754e+03   1.590 0.111917
## `2013 code`5:olderprop:RARELY          -3.933e+03  4.119e+03  -0.955 0.339630
## `2013 code`6:olderprop:RARELY                  NA         NA      NA       NA
## `2013 code`2:TrmpProp:RARELY            2.405e+02  1.214e+03   0.198 0.842995
## `2013 code`3:TrmpProp:RARELY            1.508e+03  7.597e+02   1.984 0.047206
## `2013 code`4:TrmpProp:RARELY            2.058e+03  1.054e+03   1.952 0.050908
## `2013 code`5:TrmpProp:RARELY           -6.241e+02  1.110e+03  -0.562 0.573915
## `2013 code`6:TrmpProp:RARELY                   NA         NA      NA       NA
## `2013 code`2:olderprop:TrmpProp:RARELY  2.351e+02  6.518e+03   0.036 0.971221
## `2013 code`3:olderprop:TrmpProp:RARELY         NA         NA      NA       NA
## `2013 code`4:olderprop:TrmpProp:RARELY -9.780e+03  5.334e+03  -1.834 0.066724
## `2013 code`5:olderprop:TrmpProp:RARELY  4.247e+03  5.723e+03   0.742 0.458062
## `2013 code`6:olderprop:TrmpProp:RARELY         NA         NA      NA       NA
##
## (Intercept)
## pop2021.x                              ***
## pop2021.y
## prop_cases                             ***
## COVID_COUNT.x                          **
## COVID_TEST.x
## NEVER
## SOMETIMES
## COVID_COUNT.y                          ***
## COVID_TEST.y                           *
## fully_vaccinated.y                     **
## `Older (65 plus).y`                    *
## TrmpVote.x
## TrmpVote.y                             ***
## ClintVote.x
## ClintVote.y                            .
## TotalVote.x
## TotalVote.y                            ***
## FREQUENTLY
## ALWAYS
## all_doses_administered.x
## `2013 code`2
## `2013 code`3
## `2013 code`4
## `2013 code`5                           .
## `2013 code`6                           *
## `Older (65 plus).x`                    .
## olderprop
## TrmpProp
## RARELY
## olderprop:TrmpProp
```

```
## olderprop:RARELY                        .
## TrmpProp:RARELY                         .
## `2013 code`2:olderprop
## `2013 code`3:olderprop
## `2013 code`4:olderprop
## `2013 code`5:olderprop                  *
## `2013 code`6:olderprop
## `2013 code`2:TrmpProp
## `2013 code`3:TrmpProp
## `2013 code`4:TrmpProp
## `2013 code`5:TrmpProp
## `2013 code`6:TrmpProp
## `2013 code`2:RARELY
## `2013 code`3:RARELY
## `2013 code`4:RARELY                     .
## `2013 code`5:RARELY
## `2013 code`6:RARELY
## olderprop:TrmpProp:RARELY               .
## `2013 code`2:olderprop:TrmpProp
## `2013 code`3:olderprop:TrmpProp
## `2013 code`4:olderprop:TrmpProp
## `2013 code`5:olderprop:TrmpProp         .
## `2013 code`6:olderprop:TrmpProp
## `2013 code`2:olderprop:RARELY
## `2013 code`3:olderprop:RARELY
## `2013 code`4:olderprop:RARELY
## `2013 code`5:olderprop:RARELY
## `2013 code`6:olderprop:RARELY
## `2013 code`2:TrmpProp:RARELY
## `2013 code`3:TrmpProp:RARELY            *
## `2013 code`4:TrmpProp:RARELY            .
## `2013 code`5:TrmpProp:RARELY
## `2013 code`6:TrmpProp:RARELY
## `2013 code`2:olderprop:TrmpProp:RARELY
## `2013 code`3:olderprop:TrmpProp:RARELY
## `2013 code`4:olderprop:TrmpProp:RARELY .
## `2013 code`5:olderprop:TrmpProp:RARELY
## `2013 code`6:olderprop:TrmpProp:RARELY
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 16416.47  on 91  degrees of freedom
## Residual deviance:   108.99  on 31  degrees of freedom
## AIC: 800.95
##
## Number of Fisher Scoring iterations: 4
```

```
Anova(mod5.3)
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: COVID_DEATHS.x
```

```
##                                        LR Chisq Df Pr(>Chisq)
## pop2021.x                               13.442  1  0.0002460 ***
## pop2021.y                                1.537  1  0.2150624
## prop_cases                              19.172  1  1.194e-05 ***
## COVID_COUNT.x                            6.862  1  0.0088059 **
## COVID_TEST.x                             0.437  1  0.5087320
## NEVER                                    1.072  1  0.3005925
## SOMETIMES                                1.167  1  0.2799570
## COVID_COUNT.y                           15.310  1  9.125e-05 ***
## COVID_TEST.y                             4.894  1  0.0269481 *
## fully_vaccinated.y                       7.410  1  0.0064868 **
## `Older (65 plus).y`                      4.253  1  0.0391711 *
## TrmpVote.x                               1.009  1  0.3152273
## TrmpVote.y                              12.239  1  0.0004679 ***
## ClintVote.x                              0.643  1  0.4225480
## ClintVote.y                              3.753  1  0.0527201 .
## TotalVote.x                              0.494  1  0.4822568
## TotalVote.y                             16.028  1  6.240e-05 ***
## FREQUENTLY                               1.171  1  0.2792072
## ALWAYS                                   1.140  1  0.2855829
## all_doses_administered.x                 1.726  1  0.1889351
## `2013 code`                             38.131  5  3.551e-07 ***
## `Older (65 plus).x`                      3.805  1  0.0510966 .
## olderprop                                9.066  1  0.0026042 **
## TrmpProp                                 0.747  1  0.3872716
## RARELY                                   6.209  1  0.0127081 *
## olderprop:TrmpProp                       3.654  1  0.0559264 .
## olderprop:RARELY                         2.900  1  0.0886039 .
## TrmpProp:RARELY                         18.617  1  1.597e-05 ***
## `2013 code`:olderprop                   35.611  4  3.480e-07 ***
## `2013 code`:TrmpProp                    16.762  4  0.0021496 **
## `2013 code`:RARELY                      46.832  4  1.653e-09 ***
## olderprop:TrmpProp:RARELY                7.456  1  0.0063235 **
## `2013 code`:olderprop:TrmpProp          38.209  4  1.015e-07 ***
## `2013 code`:olderprop:RARELY            25.849  4  3.394e-05 ***
## `2013 code`:TrmpProp:RARELY             21.822  4  0.0002174 ***
## `2013 code`:olderprop:TrmpProp:RARELY   17.441  3  0.0005734 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
drop1(mod5.3, test = "Chi")
```

```
## Single term deletions
##
## Model:
## COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases + COVID_COUNT.x +
##     COVID_TEST.x + NEVER + SOMETIMES + COVID_COUNT.y + COVID_TEST.y +
##     fully_vaccinated.y + `Older (65 plus).y` + TrmpVote.x + TrmpVote.y +
##     ClintVote.x + ClintVote.y + TotalVote.x + TotalVote.y + FREQUENTLY +
##     ALWAYS + all_doses_administered.x + `2013 code` + `Older (65 plus).x` +
##     olderprop * TrmpProp * RARELY * `2013 code`
##                                        Df Deviance    AIC     LRT  Pr(>Chi)
## <none>                                      108.99 800.95
## pop2021.x                               1   122.44 812.39 13.4422 0.0002460 ***
```

```
## pop2021.y                                1   110.53 800.49  1.5370 0.2150624
## prop_cases                               1   128.17 818.12 19.1725 1.194e-05 ***
## COVID_COUNT.x                            1   115.86 805.81  6.8618 0.0088059 **
## COVID_TEST.x                             1   109.43 799.39  0.4367 0.5087320
## NEVER                                    1   110.06 800.02  1.0716 0.3005925
## SOMETIMES                                1   110.16 800.12  1.1673 0.2799570
## COVID_COUNT.y                            1   124.30 814.26 15.3097 9.125e-05 ***
## COVID_TEST.y                             1   113.89 803.84  4.8941 0.0269481 *
## fully_vaccinated.y                       1   116.40 806.36  7.4099 0.0064868 **
## `Older (65 plus).y`                      1   113.25 803.20  4.2534 0.0391711 *
## TrmpVote.x                               1   110.00 799.96  1.0086 0.3152273
## TrmpVote.y                               1   121.23 811.19 12.2393 0.0004679 ***
## ClintVote.x                              1   109.64 799.59  0.6432 0.4225480
## ClintVote.y                              1   112.75 802.70  3.7528 0.0527201 .
## TotalVote.x                              1   109.49 799.44  0.4938 0.4822568
## TotalVote.y                              1   125.02 814.98 16.0284 6.240e-05 ***
## FREQUENTLY                               1   110.16 800.12  1.1709 0.2792072
## ALWAYS                                   1   110.13 800.09  1.1403 0.2855829
## all_doses_administered.x                 1   110.72 800.68  1.7259 0.1889351
## `Older (65 plus).x`                      1   112.80 802.75  3.8051 0.0510966 .
## `2013 code`:olderprop:TrmpProp:RARELY    3   126.43 812.39 17.4413 0.0005734 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop covidtest.x
mod5.4 <- glm(formula = COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases + COVID_COUNT.x +
    NEVER + SOMETIMES + COVID_COUNT.y + COVID_TEST.y + fully_vaccinated.y + `Older (65 plus).y` +
    TrmpVote.x + TrmpVote.y + ClintVote.x + ClintVote.y + TotalVote.x + TotalVote.y +
    FREQUENTLY + ALWAYS + all_doses_administered.x + `2013 code` + `Older (65 plus).x` +
    olderprop * TrmpProp * RARELY * `2013 code`, family = poisson, data = big_data3)
summary(mod5.4)
```

```
##
## Call:
## glm(formula = COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases +
##     COVID_COUNT.x + NEVER + SOMETIMES + COVID_COUNT.y + COVID_TEST.y +
##     fully_vaccinated.y + `Older (65 plus).y` + TrmpVote.x + TrmpVote.y +
##     ClintVote.x + ClintVote.y + TotalVote.x + TotalVote.y + FREQUENTLY +
##     ALWAYS + all_doses_administered.x + `2013 code` + `Older (65 plus).x` +
##     olderprop * TrmpProp * RARELY * `2013 code`, family = poisson,
##     data = big_data3)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -3.5016  -0.6354   0.0000   0.4191   3.1594
##
## Coefficients: (8 not defined because of singularities)
##                                        Estimate Std. Error z value Pr(>|z|)
## (Intercept)                           1.888e+01  7.476e+01   0.253 0.800602
## pop2021.x                             8.166e-05  2.275e-05   3.590 0.000330
## pop2021.y                            -7.580e+00  5.927e+00  -1.279 0.200883
## prop_cases                            6.722e+01  1.543e+01   4.356 1.32e-05
## COVID_COUNT.x                        -2.425e-04  8.663e-05  -2.799 0.005130
## NEVER                                -2.915e+01  3.106e+01  -0.939 0.347927
```

```
## SOMETIMES                          -3.064e+01  3.112e+01  -0.984 0.324973
## COVID_COUNT.y                      -6.333e+00  1.631e+00  -3.883 0.000103
## COVID_TEST.y                        6.069e-01  2.479e-01   2.448 0.014346
## fully_vaccinated.y                  7.596e-01  2.869e-01   2.648 0.008106
## `Older (65 plus).y`                 1.205e+01  5.780e+00   2.085 0.037031
## TrmpVote.x                         -2.457e-04  2.780e-04  -0.884 0.376870
## TrmpVote.y                          2.186e+01  6.397e+00   3.417 0.000634
## ClintVote.x                        -1.914e-04  2.788e-04  -0.687 0.492364
## ClintVote.y                         2.545e+00  1.323e+00   1.924 0.054320
## TotalVote.x                         1.455e-04  2.625e-04   0.554 0.579302
## TotalVote.y                        -2.278e+01  5.788e+00  -3.936 8.28e-05
## FREQUENTLY                         -3.073e+01  3.120e+01  -0.985 0.324592
## ALWAYS                             -3.027e+01  3.117e+01  -0.971 0.331516
## all_doses_administered.x           -1.723e-05  1.513e-05  -1.138 0.254944
## `2013 code`2                       -5.053e+01  7.656e+01  -0.660 0.509261
## `2013 code`3                        4.318e+01  5.080e+01   0.850 0.395352
## `2013 code`4                        5.660e+01  7.104e+01   0.797 0.425646
## `2013 code`5                       -1.369e+02  7.641e+01  -1.791 0.073294
## `2013 code`6                        1.723e+01  7.977e+00   2.160 0.030769
## `Older (65 plus).x`                -8.709e-05  4.720e-05  -1.845 0.065013
## olderprop                           5.907e+01  3.891e+02   0.152 0.879324
## TrmpProp                            3.950e+01  1.030e+02   0.383 0.701390
## RARELY                              1.091e+03  6.961e+02   1.567 0.117153
## olderprop:TrmpProp                 -2.884e+02  5.270e+02  -0.547 0.584239
## olderprop:RARELY                   -5.608e+03  3.523e+03  -1.592 0.111365
## TrmpProp:RARELY                    -1.803e+03  9.837e+02  -1.833 0.066790
## `2013 code`2:olderprop              4.381e+02  4.399e+02   0.996 0.319323
## `2013 code`3:olderprop              7.159e+01  2.845e+02   0.252 0.801354
## `2013 code`4:olderprop             -1.472e+02  3.954e+02  -0.372 0.709618
## `2013 code`5:olderprop              8.565e+02  4.279e+02   2.001 0.045340
## `2013 code`6:olderprop                     NA         NA      NA       NA
## `2013 code`2:TrmpProp               7.800e+01  1.148e+02   0.679 0.496933
## `2013 code`3:TrmpProp              -1.020e+02  9.217e+01  -1.107 0.268427
## `2013 code`4:TrmpProp              -9.021e+01  1.091e+02  -0.827 0.408251
## `2013 code`5:TrmpProp               1.891e+02  1.140e+02   1.658 0.097220
## `2013 code`6:TrmpProp                      NA         NA      NA       NA
## `2013 code`2:RARELY                 9.022e+01  8.394e+02   0.107 0.914414
## `2013 code`3:RARELY                -2.749e+02  1.822e+02  -1.509 0.131281
## `2013 code`4:RARELY                -1.227e+03  7.381e+02  -1.662 0.096466
## `2013 code`5:RARELY                 6.586e+02  7.975e+02   0.826 0.408842
## `2013 code`6:RARELY                        NA         NA      NA       NA
## olderprop:TrmpProp:RARELY           9.019e+03  4.934e+03   1.828 0.067557
## `2013 code`2:olderprop:TrmpProp    -5.388e+02  6.031e+02  -0.893 0.371655
## `2013 code`3:olderprop:TrmpProp     2.517e+02  3.745e+02   0.672 0.501490
## `2013 code`4:olderprop:TrmpProp     3.855e+02  5.521e+02   0.698 0.485083
## `2013 code`5:olderprop:TrmpProp    -1.065e+03  5.870e+02  -1.814 0.069637
## `2013 code`6:olderprop:TrmpProp            NA         NA      NA       NA
## `2013 code`2:olderprop:RARELY      -1.480e+03  4.500e+03  -0.329 0.742281
## `2013 code`3:olderprop:RARELY      -3.472e+03  2.677e+03  -1.297 0.194667
## `2013 code`4:olderprop:RARELY       5.785e+03  3.744e+03   1.545 0.122325
## `2013 code`5:olderprop:RARELY      -4.085e+03  4.114e+03  -0.993 0.320730
## `2013 code`6:olderprop:RARELY              NA         NA      NA       NA
## `2013 code`2:TrmpProp:RARELY        1.724e+01  1.167e+03   0.015 0.988207
## `2013 code`3:TrmpProp:RARELY        1.278e+03  6.759e+02   1.891 0.058640
```

```
## `2013 code`4:TrmpProp:RARELY            1.997e+03  1.050e+03   1.902 0.057180
## `2013 code`5:TrmpProp:RARELY           -6.723e+02  1.108e+03  -0.607 0.543971
## `2013 code`6:TrmpProp:RARELY                   NA         NA      NA       NA
## `2013 code`2:olderprop:TrmpProp:RARELY  1.450e+03  6.257e+03   0.232 0.816779
## `2013 code`3:olderprop:TrmpProp:RARELY         NA         NA      NA       NA
## `2013 code`4:olderprop:TrmpProp:RARELY -9.526e+03  5.321e+03  -1.790 0.073383
## `2013 code`5:olderprop:TrmpProp:RARELY  4.466e+03  5.716e+03   0.781 0.434659
## `2013 code`6:olderprop:TrmpProp:RARELY         NA         NA      NA       NA
##
## (Intercept)
## pop2021.x                              ***
## pop2021.y
## prop_cases                             ***
## COVID_COUNT.x                          **
## NEVER
## SOMETIMES
## COVID_COUNT.y                          ***
## COVID_TEST.y                           *
## fully_vaccinated.y                     **
## `Older (65 plus).y`                    *
## TrmpVote.x
## TrmpVote.y                             ***
## ClintVote.x
## ClintVote.y                            .
## TotalVote.x
## TotalVote.y                            ***
## FREQUENTLY
## ALWAYS
## all_doses_administered.x
## `2013 code`2
## `2013 code`3
## `2013 code`4
## `2013 code`5                           .
## `2013 code`6                           *
## `Older (65 plus).x`                    .
## olderprop
## TrmpProp
## RARELY
## olderprop:TrmpProp
## olderprop:RARELY
## TrmpProp:RARELY                        .
## `2013 code`2:olderprop
## `2013 code`3:olderprop
## `2013 code`4:olderprop
## `2013 code`5:olderprop                 *
## `2013 code`6:olderprop
## `2013 code`2:TrmpProp
## `2013 code`3:TrmpProp
## `2013 code`4:TrmpProp
## `2013 code`5:TrmpProp                  .
## `2013 code`6:TrmpProp
## `2013 code`2:RARELY
## `2013 code`3:RARELY
## `2013 code`4:RARELY                    .
```

```
## `2013 code`5:RARELY
## `2013 code`6:RARELY
## olderprop:TrmpProp:RARELY              .
## `2013 code`2:olderprop:TrmpProp
## `2013 code`3:olderprop:TrmpProp
## `2013 code`4:olderprop:TrmpProp
## `2013 code`5:olderprop:TrmpProp        .
## `2013 code`6:olderprop:TrmpProp
## `2013 code`2:olderprop:RARELY
## `2013 code`3:olderprop:RARELY
## `2013 code`4:olderprop:RARELY
## `2013 code`5:olderprop:RARELY
## `2013 code`6:olderprop:RARELY
## `2013 code`2:TrmpProp:RARELY
## `2013 code`3:TrmpProp:RARELY           .
## `2013 code`4:TrmpProp:RARELY           .
## `2013 code`5:TrmpProp:RARELY
## `2013 code`6:TrmpProp:RARELY
## `2013 code`2:olderprop:TrmpProp:RARELY
## `2013 code`3:olderprop:TrmpProp:RARELY
## `2013 code`4:olderprop:TrmpProp:RARELY .
## `2013 code`5:olderprop:TrmpProp:RARELY
## `2013 code`6:olderprop:TrmpProp:RARELY
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 16416.47  on 91  degrees of freedom
## Residual deviance:   109.43  on 32  degrees of freedom
## AIC: 799.39
##
## Number of Fisher Scoring iterations: 4
```

```
Anova(mod5.4)
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: COVID_DEATHS.x
##                                      LR Chisq Df Pr(>Chisq)
## pop2021.x                             13.054  1  0.0003026 ***
## pop2021.y                              1.637  1  0.2008014
## prop_cases                            18.736  1  1.501e-05 ***
## COVID_COUNT.x                          7.856  1  0.0050665 **
## NEVER                                  0.880  1  0.3480747
## SOMETIMES                              0.968  1  0.3251185
## COVID_COUNT.y                         14.979  1  0.0001087 ***
## COVID_TEST.y                           6.008  1  0.0142373 *
## fully_vaccinated.y                     7.012  1  0.0080952 **
## `Older (65 plus).y`                    4.358  1  0.0368442 *
## TrmpVote.x                             0.781  1  0.3769514
## TrmpVote.y                            11.829  1  0.0005832 ***
## ClintVote.x                            0.471  1  0.4924611
## ClintVote.y                            3.675  1  0.0552313 .
```

```
## TotalVote.x                                0.307  1  0.5794009
## TotalVote.y                               15.767  1  7.163e-05 ***
## FREQUENTLY                                 0.970  1  0.3247353
## ALWAYS                                     0.942  1  0.3316670
## all_doses_administered.x                   1.297  1  0.2547142
## `2013 code`                               36.642  5  7.064e-07 ***
## `Older (65 plus).x`                        3.430  1  0.0640268 .
## olderprop                                  8.668  1  0.0032391 **
## TrmpProp                                   0.791  1  0.3737125
## RARELY                                     5.231  1  0.0221847 *
## olderprop:TrmpProp                         2.089  1  0.1483845
## olderprop:RARELY                           2.857  1  0.0909900 .
## TrmpProp:RARELY                           18.597  1  1.614e-05 ***
## `2013 code`:olderprop                     33.558  4  9.182e-07 ***
## `2013 code`:TrmpProp                      14.500  4  0.0058599 **
## `2013 code`:RARELY                        48.743  4  6.605e-10 ***
## olderprop:TrmpProp:RARELY                  7.062  1  0.0078721 **
## `2013 code`:olderprop:TrmpProp            42.454  4  1.343e-08 ***
## `2013 code`:olderprop:RARELY              25.308  4  4.362e-05 ***
## `2013 code`:TrmpProp:RARELY               21.411  4  0.0002625 ***
## `2013 code`:olderprop:TrmpProp:RARELY     17.564  3  0.0005409 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
drop1(mod5.4, test = "Chi")
```

```
## Single term deletions
##
## Model:
## COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases + COVID_COUNT.x +
##     NEVER + SOMETIMES + COVID_COUNT.y + COVID_TEST.y + fully_vaccinated.y +
##     `Older (65 plus).y` + TrmpVote.x + TrmpVote.y + ClintVote.x +
##     ClintVote.y + TotalVote.x + TotalVote.y + FREQUENTLY + ALWAYS +
##     all_doses_administered.x + `2013 code` + `Older (65 plus).x` +
##     olderprop * TrmpProp * RARELY * `2013 code`
##                                    Df Deviance    AIC     LRT  Pr(>Chi)
## <none>                                  109.43 799.39
## pop2021.x                           1   122.48 810.44 13.0541 0.0003026 ***
## pop2021.y                           1   111.07 799.02  1.6365 0.2008014
## prop_cases                          1   128.17 816.12 18.7359 1.501e-05 ***
## COVID_COUNT.x                       1   117.28 805.24  7.8556 0.0050665 **
## NEVER                               1   110.31 798.27  0.8805 0.3480747
## SOMETIMES                           1   110.40 798.35  0.9682 0.3251185
## COVID_COUNT.y                       1   124.41 812.36 14.9790 0.0001087 ***
## COVID_TEST.y                        1   115.44 803.39  6.0085 0.0142373 *
## fully_vaccinated.y                  1   116.44 804.40  7.0123 0.0080952 **
## `Older (65 plus).y`                 1   113.79 801.74  4.3576 0.0368442 *
## TrmpVote.x                          1   110.21 798.17  0.7806 0.3769514
## TrmpVote.y                          1   121.26 809.21 11.8290 0.0005832 ***
## ClintVote.x                         1   109.90 797.86  0.4711 0.4924611
## ClintVote.y                         1   113.11 801.06  3.6751 0.0552313 .
## TotalVote.x                         1   109.74 797.69  0.3072 0.5794009
## TotalVote.y                         1   125.20 813.15 15.7674 7.163e-05 ***
## FREQUENTLY                          1   110.40 798.36  0.9698 0.3247353
```

```
## ALWAYS                                   1   110.37 798.33  0.9424 0.3316670
## all_doses_administered.x                 1   110.73 798.68  1.2973 0.2547142
## `Older (65 plus).x`                      1   112.86 800.82  3.4299 0.0640268 .
## `2013 code`:olderprop:TrmpProp:RARELY    3   126.99 810.95 17.5642 0.0005409 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop totalvote.x
mod5.5 <- glm(formula = COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases + COVID_COUNT.x +
    NEVER + SOMETIMES + COVID_COUNT.y + COVID_TEST.y + fully_vaccinated.y + `Older (65 plus).y` +
    TrmpVote.x + TrmpVote.y + ClintVote.x + ClintVote.y + TotalVote.y + FREQUENTLY +
    ALWAYS + all_doses_administered.x + `2013 code` + `Older (65 plus).x` + olderprop *
    TrmpProp * RARELY * `2013 code`, family = poisson, data = big_data3)
summary(mod5.5)
```

```
##
## Call:
## glm(formula = COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases +
##     COVID_COUNT.x + NEVER + SOMETIMES + COVID_COUNT.y + COVID_TEST.y +
##     fully_vaccinated.y + `Older (65 plus).y` + TrmpVote.x + TrmpVote.y +
##     ClintVote.x + ClintVote.y + TotalVote.y + FREQUENTLY + ALWAYS +
##     all_doses_administered.x + `2013 code` + `Older (65 plus).x` +
##     olderprop * TrmpProp * RARELY * `2013 code`, family = poisson,
##     data = big_data3)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -3.5288  -0.6137   0.0000   0.3521   3.1255
##
## Coefficients: (8 not defined because of singularities)
##                                      Estimate Std. Error z value Pr(>|z|)
## (Intercept)                         9.027e+00  7.266e+01   0.124 0.901128
## pop2021.x                           8.206e-05  2.269e-05   3.616 0.000299
## pop2021.y                          -5.663e+00  4.808e+00  -1.178 0.238868
## prop_cases                          6.863e+01  1.521e+01   4.512 6.42e-06
## COVID_COUNT.x                      -2.550e-04  8.358e-05  -3.051 0.002284
## NEVER                              -2.508e+01  3.018e+01  -0.831 0.405975
## SOMETIMES                          -2.653e+01  3.023e+01  -0.877 0.380271
## COVID_COUNT.y                      -6.449e+00  1.616e+00  -3.990 6.59e-05
## COVID_TEST.y                        6.308e-01  2.439e-01   2.587 0.009694
## fully_vaccinated.y                  7.476e-01  2.861e-01   2.613 0.008973
## `Older (65 plus).y`                 1.025e+01  4.768e+00   2.149 0.031620
## TrmpVote.x                         -9.262e-05  3.258e-05  -2.843 0.004467
## TrmpVote.y                          2.231e+01  6.346e+00   3.516 0.000438
## ClintVote.x                        -3.764e-05  2.803e-05  -1.343 0.179373
## ClintVote.y                         2.064e+00  1.000e+00   2.063 0.039069
## TotalVote.y                        -2.274e+01  5.785e+00  -3.931 8.48e-05
## FREQUENTLY                         -2.659e+01  3.029e+01  -0.878 0.380038
## ALWAYS                             -2.613e+01  3.027e+01  -0.863 0.387891
## all_doses_administered.x           -1.572e-05  1.488e-05  -1.056 0.290866
## `2013 code`2                       -4.265e+01  7.524e+01  -0.567 0.570873
## `2013 code`3                        4.647e+01  5.046e+01   0.921 0.357062
## `2013 code`4                        5.645e+01  7.103e+01   0.795 0.426753
## `2013 code`5                       -1.261e+02  7.394e+01  -1.706 0.088089
```

```
## `2013 code`6                              1.698e+01  7.967e+00   2.132 0.033018
## `Older (65 plus).x`                      -8.847e-05  4.703e-05  -1.881 0.059952
## olderprop                                 7.946e+01  3.874e+02   0.205 0.837471
## TrmpProp                                  3.819e+01  1.030e+02   0.371 0.710813
## RARELY                                    1.092e+03  6.959e+02   1.569 0.116693
## olderprop:TrmpProp                       -2.970e+02  5.268e+02  -0.564 0.572876
## olderprop:RARELY                         -5.610e+03  3.521e+03  -1.593 0.111131
## TrmpProp:RARELY                          -1.787e+03  9.828e+02  -1.819 0.068959
## `2013 code`2:olderprop                    3.801e+02  4.274e+02   0.889 0.373825
## `2013 code`3:olderprop                    4.016e+01  2.789e+02   0.144 0.885529
## `2013 code`4:olderprop                   -1.494e+02  3.954e+02  -0.378 0.705590
## `2013 code`5:olderprop                    7.949e+02  4.134e+02   1.923 0.054512
## `2013 code`6:olderprop                           NA         NA      NA       NA
## `2013 code`2:TrmpProp                     6.757e+01  1.133e+02   0.596 0.550866
## `2013 code`3:TrmpProp                    -1.027e+02  9.214e+01  -1.114 0.265101
## `2013 code`4:TrmpProp                    -8.953e+01  1.090e+02  -0.821 0.411626
## `2013 code`5:TrmpProp                     1.750e+02  1.112e+02   1.574 0.115480
## `2013 code`6:TrmpProp                            NA         NA      NA       NA
## `2013 code`2:RARELY                      -1.027e+00  8.229e+02  -0.001 0.999004
## `2013 code`3:RARELY                      -2.813e+02  1.819e+02  -1.547 0.121946
## `2013 code`4:RARELY                      -1.213e+03  7.373e+02  -1.645 0.099937
## `2013 code`5:RARELY                       5.625e+02  7.784e+02   0.723 0.469845
## `2013 code`6:RARELY                              NA         NA      NA       NA
## olderprop:TrmpProp:RARELY                 8.965e+03  4.931e+03   1.818 0.069024
## `2013 code`2:olderprop:TrmpProp          -4.619e+02  5.870e+02  -0.787 0.431341
## `2013 code`3:olderprop:TrmpProp           2.729e+02  3.725e+02   0.732 0.463910
## `2013 code`4:olderprop:TrmpProp           3.843e+02  5.520e+02   0.696 0.486285
## `2013 code`5:olderprop:TrmpProp          -9.851e+02  5.692e+02  -1.731 0.083521
## `2013 code`6:olderprop:TrmpProp                  NA         NA      NA       NA
## `2013 code`2:olderprop:RARELY            -8.208e+02  4.339e+03  -0.189 0.849954
## `2013 code`3:olderprop:RARELY            -3.210e+03  2.634e+03  -1.219 0.222990
## `2013 code`4:olderprop:RARELY             5.726e+03  3.741e+03   1.531 0.125880
## `2013 code`5:olderprop:RARELY            -3.537e+03  3.994e+03  -0.886 0.375785
## `2013 code`6:olderprop:RARELY                    NA         NA      NA       NA
## `2013 code`2:TrmpProp:RARELY              1.374e+02  1.146e+03   0.120 0.904590
## `2013 code`3:TrmpProp:RARELY              1.219e+03  6.670e+02   1.827 0.067673
## `2013 code`4:TrmpProp:RARELY              1.972e+03  1.048e+03   1.881 0.059905
## `2013 code`5:TrmpProp:RARELY             -5.494e+02  1.085e+03  -0.506 0.612747
## `2013 code`6:TrmpProp:RARELY                     NA         NA      NA       NA
## `2013 code`2:olderprop:TrmpProp:RARELY    5.603e+02  6.045e+03   0.093 0.926155
## `2013 code`3:olderprop:TrmpProp:RARELY           NA         NA      NA       NA
## `2013 code`4:olderprop:TrmpProp:RARELY   -9.417e+03  5.314e+03  -1.772 0.076352
## `2013 code`5:olderprop:TrmpProp:RARELY    3.755e+03  5.570e+03   0.674 0.500211
## `2013 code`6:olderprop:TrmpProp:RARELY           NA         NA      NA       NA
##
## (Intercept)
## pop2021.x                              ***
## pop2021.y
## prop_cases                             ***
## COVID_COUNT.x                          **
## NEVER
## SOMETIMES
## COVID_COUNT.y                          ***
## COVID_TEST.y                           **
```

```
## fully_vaccinated.y                     **
## `Older (65 plus).y`                    *
## TrmpVote.x                             **
## TrmpVote.y                             ***
## ClintVote.x
## ClintVote.y                            *
## TotalVote.y                            ***
## FREQUENTLY
## ALWAYS
## all_doses_administered.x
## `2013 code`2
## `2013 code`3
## `2013 code`4
## `2013 code`5                           .
## `2013 code`6                           *
## `Older (65 plus).x`                    .
## olderprop
## TrmpProp
## RARELY
## olderprop:TrmpProp
## olderprop:RARELY
## TrmpProp:RARELY                        .
## `2013 code`2:olderprop
## `2013 code`3:olderprop
## `2013 code`4:olderprop
## `2013 code`5:olderprop                 .
## `2013 code`6:olderprop
## `2013 code`2:TrmpProp
## `2013 code`3:TrmpProp
## `2013 code`4:TrmpProp
## `2013 code`5:TrmpProp
## `2013 code`6:TrmpProp
## `2013 code`2:RARELY
## `2013 code`3:RARELY
## `2013 code`4:RARELY                    .
## `2013 code`5:RARELY
## `2013 code`6:RARELY
## olderprop:TrmpProp:RARELY              .
## `2013 code`2:olderprop:TrmpProp
## `2013 code`3:olderprop:TrmpProp
## `2013 code`4:olderprop:TrmpProp
## `2013 code`5:olderprop:TrmpProp        .
## `2013 code`6:olderprop:TrmpProp
## `2013 code`2:olderprop:RARELY
## `2013 code`3:olderprop:RARELY
## `2013 code`4:olderprop:RARELY
## `2013 code`5:olderprop:RARELY
## `2013 code`6:olderprop:RARELY
## `2013 code`2:TrmpProp:RARELY
## `2013 code`3:TrmpProp:RARELY           .
## `2013 code`4:TrmpProp:RARELY           .
## `2013 code`5:TrmpProp:RARELY
## `2013 code`6:TrmpProp:RARELY
## `2013 code`2:olderprop:TrmpProp:RARELY
```

```
## `2013 code`3:olderprop:TrmpProp:RARELY
## `2013 code`4:olderprop:TrmpProp:RARELY .
## `2013 code`5:olderprop:TrmpProp:RARELY
## `2013 code`6:olderprop:TrmpProp:RARELY
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 16416.47  on 91  degrees of freedom
## Residual deviance:   109.74  on 33  degrees of freedom
## AIC: 797.69
##
## Number of Fisher Scoring iterations: 4
```

```
Anova(mod5.5)
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: COVID_DEATHS.x
##                                      LR Chisq Df Pr(>Chisq)
## pop2021.x                             13.256  1  0.0002717 ***
## pop2021.y                              1.384  1  0.2393394
## prop_cases                            20.120  1  7.272e-06 ***
## COVID_COUNT.x                          9.355  1  0.0022242 **
## NEVER                                  0.690  1  0.4060932
## SOMETIMES                              0.769  1  0.3803901
## COVID_COUNT.y                         15.830  1  6.931e-05 ***
## COVID_TEST.y                           6.719  1  0.0095405 **
## fully_vaccinated.y                     6.830  1  0.0089616 **
## `Older (65 plus).y`                    4.608  1  0.0318219 *
## TrmpVote.x                             8.165  1  0.0042712 **
## TrmpVote.y                            12.531  1  0.0004002 ***
## ClintVote.x                            1.811  1  0.1783585
## ClintVote.y                            4.251  1  0.0392174 *
## TotalVote.y                           15.723  1  7.334e-05 ***
## FREQUENTLY                             0.770  1  0.3801599
## ALWAYS                                 0.745  1  0.3880169
## all_doses_administered.x               1.116  1  0.2906818
## `2013 code`                           37.750  5  4.236e-07 ***
## `Older (65 plus).x`                    3.569  1  0.0588822 .
## olderprop                              8.406  1  0.0037394 **
## TrmpProp                               0.510  1  0.4749640
## RARELY                                 7.172  1  0.0074060 **
## olderprop:TrmpProp                     4.434  1  0.0352325 *
## olderprop:RARELY                       3.234  1  0.0721276 .
## TrmpProp:RARELY                       16.852  1  4.042e-05 ***
## `2013 code`:olderprop                 32.140  4  1.791e-06 ***
## `2013 code`:TrmpProp                  16.828  4  0.0020874 **
## `2013 code`:RARELY                    48.736  4  6.627e-10 ***
## olderprop:TrmpProp:RARELY             10.144  1  0.0014476 **
## `2013 code`:olderprop:TrmpProp        48.832  4  6.329e-10 ***
## `2013 code`:olderprop:RARELY          35.440  4  3.772e-07 ***
## `2013 code`:TrmpProp:RARELY           23.066  4  0.0001228 ***
```

```
## `2013 code`:olderprop:TrmpProp:RARELY   19.414  3  0.0002244 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
drop1(mod5.5, test = "Chi")
```

```
## Single term deletions
##
## Model:
## COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases + COVID_COUNT.x +
##     NEVER + SOMETIMES + COVID_COUNT.y + COVID_TEST.y + fully_vaccinated.y +
##     `Older (65 plus).y` + TrmpVote.x + TrmpVote.y + ClintVote.x +
##     ClintVote.y + TotalVote.y + FREQUENTLY + ALWAYS + all_doses_administered.x +
##     `2013 code` + `Older (65 plus).x` + olderprop * TrmpProp *
##     RARELY * `2013 code`
##                                       Df Deviance    AIC     LRT  Pr(>Chi)
## <none>                                     109.74 797.69
## pop2021.x                              1   122.99 808.95 13.2560 0.0002717 ***
## pop2021.y                              1   111.12 797.08  1.3845 0.2393394
## prop_cases                             1   129.86 815.81 20.1203 7.272e-06 ***
## COVID_COUNT.x                          1   119.09 805.05  9.3546 0.0022242 **
## NEVER                                  1   110.43 796.38  0.6902 0.4060932
## SOMETIMES                              1   110.51 796.46  0.7694 0.3803901
## COVID_COUNT.y                          1   125.57 811.52 15.8295 6.931e-05 ***
## COVID_TEST.y                           1   116.46 802.41  6.7187 0.0095405 **
## fully_vaccinated.y                     1   116.57 802.52  6.8305 0.0089616 **
## `Older (65 plus).y`                    1   114.34 800.30  4.6081 0.0318219 *
## TrmpVote.x                             1   117.90 803.86  8.1648 0.0042712 **
## TrmpVote.y                             1   122.27 808.22 12.5314 0.0004002 ***
## ClintVote.x                            1   111.55 797.50  1.8112 0.1783585
## ClintVote.y                            1   113.99 799.94  4.2514 0.0392174 *
## TotalVote.y                            1   125.46 811.42 15.7228 7.334e-05 ***
## FREQUENTLY                             1   110.51 796.46  0.7702 0.3801599
## ALWAYS                                 1   110.48 796.44  0.7451 0.3880169
## all_doses_administered.x               1   110.85 796.81  1.1165 0.2906818
## `Older (65 plus).x`                    1   113.31 799.26  3.5686 0.0588822 .
## `2013 code`:olderprop:TrmpProp:RARELY  3   129.15 811.11 19.4143 0.0002244 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# remove Never
mod5.6 <- glm(formula = COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases + COVID_COUNT.x +
    SOMETIMES + COVID_COUNT.y + COVID_TEST.y + fully_vaccinated.y + `Older (65 plus).y` +
    TrmpVote.x + TrmpVote.y + ClintVote.x + ClintVote.y + TotalVote.y + FREQUENTLY +
    ALWAYS + all_doses_administered.x + `2013 code` + `Older (65 plus).x` + olderprop *
    TrmpProp * RARELY * `2013 code`, family = poisson, data = big_data3)
summary(mod5.6)
```

```
##
## Call:
## glm(formula = COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases +
##     COVID_COUNT.x + SOMETIMES + COVID_COUNT.y + COVID_TEST.y +
##     fully_vaccinated.y + `Older (65 plus).y` + TrmpVote.x + TrmpVote.y +
```

```
##     ClintVote.x + ClintVote.y + TotalVote.y + FREQUENTLY + ALWAYS +
##     all_doses_administered.x + `2013 code` + `Older (65 plus).x` +
##     olderprop * TrmpProp * RARELY * `2013 code`, family = poisson,
##     data = big_data3)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -3.5805  -0.6635   0.0000   0.3348   3.3044
##
## Coefficients: (8 not defined because of singularities)
##                                      Estimate Std. Error z value Pr(>|z|)
## (Intercept)                         -5.790e+00  7.028e+01  -0.082 0.934340
## pop2021.x                            8.807e-05  2.153e-05   4.091 4.29e-05
## pop2021.y                           -6.207e+00  4.760e+00  -1.304 0.192175
## prop_cases                           6.756e+01  1.514e+01   4.462 8.10e-06
## COVID_COUNT.x                       -2.868e-04  7.434e-05  -3.857 0.000115
## SOMETIMES                           -1.407e+00  5.136e-01  -2.739 0.006159
## COVID_COUNT.y                       -6.241e+00  1.596e+00  -3.910 9.22e-05
## COVID_TEST.y                         6.310e-01  2.436e-01   2.590 0.009600
## fully_vaccinated.y                   7.490e-01  2.861e-01   2.618 0.008839
## `Older (65 plus).y`                  1.057e+01  4.750e+00   2.226 0.026003
## TrmpVote.x                          -9.116e-05  3.260e-05  -2.796 0.005173
## TrmpVote.y                           2.004e+01  5.733e+00   3.496 0.000472
## ClintVote.x                         -4.492e-05  2.666e-05  -1.685 0.091985
## ClintVote.y                          2.356e+00  9.353e-01   2.519 0.011760
## TotalVote.y                         -2.076e+01  5.280e+00  -3.933 8.40e-05
## FREQUENTLY                          -1.423e+00  5.248e-01  -2.711 0.006718
## ALWAYS                              -9.855e-01  5.004e-01  -1.969 0.048900
## all_doses_administered.x            -1.795e-05  1.465e-05  -1.226 0.220333
## `2013 code`2                        -5.665e+01  7.319e+01  -0.774 0.438885
## `2013 code`3                         4.141e+01  4.997e+01   0.829 0.407310
## `2013 code`4                         3.848e+01  6.749e+01   0.570 0.568564
## `2013 code`5                        -1.369e+02  7.263e+01  -1.885 0.059373
## `2013 code`6                         1.802e+01  7.861e+00   2.292 0.021897
## `Older (65 plus).x`                 -9.274e-05  4.673e-05  -1.985 0.047179
## olderprop                            1.072e+01  3.776e+02   0.028 0.977356
## TrmpProp                             2.354e+01  1.012e+02   0.233 0.816114
## RARELY                               9.870e+02  6.825e+02   1.446 0.148111
## olderprop:TrmpProp                  -2.013e+02  5.128e+02  -0.392 0.694708
## olderprop:RARELY                    -4.955e+03  3.423e+03  -1.448 0.147716
## TrmpProp:RARELY                     -1.600e+03  9.540e+02  -1.677 0.093447
## `2013 code`2:olderprop               4.629e+02  4.149e+02   1.116 0.264474
## `2013 code`3:olderprop               8.311e+01  2.737e+02   0.304 0.761360
## `2013 code`4:olderprop              -4.785e+01  3.752e+02  -0.128 0.898522
## `2013 code`5:olderprop               8.564e+02  4.060e+02   2.110 0.034888
## `2013 code`6:olderprop                      NA         NA      NA       NA
## `2013 code`2:TrmpProp                8.928e+01  1.100e+02   0.812 0.417038
## `2013 code`3:TrmpProp               -9.836e+01  9.184e+01  -1.071 0.284139
## `2013 code`4:TrmpProp               -6.166e+01  1.035e+02  -0.596 0.551433
## `2013 code`5:TrmpProp                1.921e+02  1.090e+02   1.762 0.078077
## `2013 code`6:TrmpProp                       NA         NA      NA       NA
## `2013 code`2:RARELY                  1.708e+02  7.951e+02   0.215 0.829918
## `2013 code`3:RARELY                 -2.615e+02  1.797e+02  -1.455 0.145741
## `2013 code`4:RARELY                 -1.014e+03  6.954e+02  -1.458 0.144719
```

```
## `2013 code`5:RARELY                       6.689e+02  7.660e+02   0.873 0.382511
## `2013 code`6:RARELY                              NA         NA      NA       NA
## olderprop:TrmpProp:RARELY                 8.022e+03  4.785e+03   1.676 0.093665
## `2013 code`2:olderprop:TrmpProp          -5.810e+02  5.682e+02  -1.022 0.306547
## `2013 code`3:olderprop:TrmpProp           2.357e+02  3.691e+02   0.639 0.523025
## `2013 code`4:olderprop:TrmpProp           2.358e+02  5.211e+02   0.452 0.650935
## `2013 code`5:olderprop:TrmpProp          -1.074e+03  5.581e+02  -1.924 0.054375
## `2013 code`6:olderprop:TrmpProp                  NA         NA      NA       NA
## `2013 code`2:olderprop:RARELY            -1.777e+03  4.177e+03  -0.425 0.670604
## `2013 code`3:olderprop:RARELY            -3.528e+03  2.606e+03  -1.353 0.175915
## `2013 code`4:olderprop:RARELY             4.657e+03  3.503e+03   1.329 0.183720
## `2013 code`5:olderprop:RARELY            -4.073e+03  3.933e+03  -1.035 0.300478
## `2013 code`6:olderprop:RARELY                    NA         NA      NA       NA
## `2013 code`2:TrmpProp:RARELY             -1.130e+02  1.104e+03  -0.102 0.918442
## `2013 code`3:TrmpProp:RARELY              1.273e+03  6.639e+02   1.917 0.055227
## `2013 code`4:TrmpProp:RARELY              1.681e+03  9.852e+02   1.706 0.087979
## `2013 code`5:TrmpProp:RARELY             -7.049e+02  1.067e+03  -0.661 0.508743
## `2013 code`6:TrmpProp:RARELY                     NA         NA      NA       NA
## `2013 code`2:olderprop:TrmpProp:RARELY    1.947e+03  5.801e+03   0.336 0.737183
## `2013 code`3:olderprop:TrmpProp:RARELY           NA         NA      NA       NA
## `2013 code`4:olderprop:TrmpProp:RARELY   -7.852e+03  4.955e+03  -1.585 0.113044
## `2013 code`5:olderprop:TrmpProp:RARELY    4.537e+03  5.478e+03   0.828 0.407552
## `2013 code`6:olderprop:TrmpProp:RARELY           NA         NA      NA       NA
##
## (Intercept)
## pop2021.x                               ***
## pop2021.y
## prop_cases                              ***
## COVID_COUNT.x                           ***
## SOMETIMES                               **
## COVID_COUNT.y                           ***
## COVID_TEST.y                            **
## fully_vaccinated.y                      **
## `Older (65 plus).y`                     *
## TrmpVote.x                              **
## TrmpVote.y                              ***
## ClintVote.x                             .
## ClintVote.y                             *
## TotalVote.y                             ***
## FREQUENTLY                              **
## ALWAYS                                  *
## all_doses_administered.x
## `2013 code`2
## `2013 code`3
## `2013 code`4
## `2013 code`5                            .
## `2013 code`6                            *
## `Older (65 plus).x`                     *
## olderprop
## TrmpProp
## RARELY
## olderprop:TrmpProp
## olderprop:RARELY
## TrmpProp:RARELY                         .
```

```
## `2013 code`2:olderprop
## `2013 code`3:olderprop
## `2013 code`4:olderprop
## `2013 code`5:olderprop                *
## `2013 code`6:olderprop
## `2013 code`2:TrmpProp
## `2013 code`3:TrmpProp
## `2013 code`4:TrmpProp
## `2013 code`5:TrmpProp                 .
## `2013 code`6:TrmpProp
## `2013 code`2:RARELY
## `2013 code`3:RARELY
## `2013 code`4:RARELY
## `2013 code`5:RARELY
## `2013 code`6:RARELY
## olderprop:TrmpProp:RARELY             .
## `2013 code`2:olderprop:TrmpProp
## `2013 code`3:olderprop:TrmpProp
## `2013 code`4:olderprop:TrmpProp
## `2013 code`5:olderprop:TrmpProp       .
## `2013 code`6:olderprop:TrmpProp
## `2013 code`2:olderprop:RARELY
## `2013 code`3:olderprop:RARELY
## `2013 code`4:olderprop:RARELY
## `2013 code`5:olderprop:RARELY
## `2013 code`6:olderprop:RARELY
## `2013 code`2:TrmpProp:RARELY
## `2013 code`3:TrmpProp:RARELY          .
## `2013 code`4:TrmpProp:RARELY          .
## `2013 code`5:TrmpProp:RARELY
## `2013 code`6:TrmpProp:RARELY
## `2013 code`2:olderprop:TrmpProp:RARELY
## `2013 code`3:olderprop:TrmpProp:RARELY
## `2013 code`4:olderprop:TrmpProp:RARELY
## `2013 code`5:olderprop:TrmpProp:RARELY
## `2013 code`6:olderprop:TrmpProp:RARELY
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 16416.47  on 91  degrees of freedom
## Residual deviance:   110.43  on 34  degrees of freedom
## AIC: 796.38
##
## Number of Fisher Scoring iterations: 4
```

```
Anova(mod5.6)
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: COVID_DEATHS.x
##                                    LR Chisq Df Pr(>Chisq)
## pop2021.x                            16.999  1  3.740e-05 ***
```

```
## pop2021.y                                1.698  1  0.1926062
## prop_cases                              19.662  1  9.240e-06 ***
## COVID_COUNT.x                           15.006  1  0.0001072 ***
## SOMETIMES                                7.513  1  0.0061257 **
## COVID_COUNT.y                           15.191  1  9.719e-05 ***
## COVID_TEST.y                             6.737  1  0.0094445 **
## fully_vaccinated.y                       6.858  1  0.0088252 **
## `Older (65 plus).y`                      4.945  1  0.0261703 *
## TrmpVote.x                               7.905  1  0.0049288 **
## TrmpVote.y                              12.492  1  0.0004087 ***
## ClintVote.x                              2.855  1  0.0910939 .
## ClintVote.y                              6.350  1  0.0117350 *
## TotalVote.y                             15.908  1  6.651e-05 ***
## FREQUENTLY                               7.389  1  0.0065629 **
## ALWAYS                                   3.888  1  0.0486301 *
## all_doses_administered.x                 1.503  1  0.2201574
## `2013 code`                             39.224  5  2.141e-07 ***
## `Older (65 plus).x`                      3.976  1  0.0461436 *
## olderprop                                8.130  1  0.0043540 **
## TrmpProp                                 0.879  1  0.3483622
## RARELY                                   1.692  1  0.1933717
## olderprop:TrmpProp                       4.999  1  0.0253640 *
## olderprop:RARELY                         3.165  1  0.0752539 .
## TrmpProp:RARELY                         18.140  1  2.053e-05 ***
## `2013 code`:olderprop                   33.889  4  7.853e-07 ***
## `2013 code`:TrmpProp                    17.461  4  0.0015721 **
## `2013 code`:RARELY                      51.673  4  1.615e-10 ***
## olderprop:TrmpProp:RARELY               10.562  1  0.0011545 **
## `2013 code`:olderprop:TrmpProp          48.441  4  7.636e-10 ***
## `2013 code`:olderprop:RARELY            35.424  4  3.800e-07 ***
## `2013 code`:TrmpProp:RARELY             22.701  4  0.0001453 ***
## `2013 code`:olderprop:TrmpProp:RARELY   19.149  3  0.0002547 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
drop1(mod5.6, test = "Chi")
```

```
## Single term deletions
##
## Model:
## COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases + COVID_COUNT.x +
##     SOMETIMES + COVID_COUNT.y + COVID_TEST.y + fully_vaccinated.y +
##     `Older (65 plus).y` + TrmpVote.x + TrmpVote.y + ClintVote.x +
##     ClintVote.y + TotalVote.y + FREQUENTLY + ALWAYS + all_doses_administered.x +
##     `2013 code` + `Older (65 plus).x` + olderprop * TrmpProp *
##     RARELY * `2013 code`
##                                    Df Deviance    AIC     LRT  Pr(>Chi)
## <none>                                  110.43 796.38
## pop2021.x                           1   127.43 811.38 16.9990 3.740e-05 ***
## pop2021.y                           1   112.12 796.08  1.6976 0.1926062
## prop_cases                          1   130.09 814.05 19.6625 9.240e-06 ***
## COVID_COUNT.x                       1   125.43 809.39 15.0063 0.0001072 ***
## SOMETIMES                           1   117.94 801.90  7.5130 0.0061257 **
## COVID_COUNT.y                       1   125.62 809.57 15.1906 9.719e-05 ***
```

```
## COVID_TEST.y                            1   117.16 801.12  6.7368 0.0094445 **
## fully_vaccinated.y                      1   117.28 801.24  6.8579 0.0088252 **
## `Older (65 plus).y`                     1   115.37 799.33  4.9447 0.0261703 *
## TrmpVote.x                              1   118.33 802.29  7.9054 0.0049288 **
## TrmpVote.y                              1   122.92 806.88 12.4920 0.0004087 ***
## ClintVote.x                             1   113.28 797.24  2.8549 0.0910939 .
## ClintVote.y                             1   116.78 800.73  6.3505 0.0117350 *
## TotalVote.y                             1   126.33 810.29 15.9078 6.651e-05 ***
## FREQUENTLY                              1   117.82 801.77  7.3889 0.0065629 **
## ALWAYS                                  1   114.31 798.27  3.8881 0.0486301 *
## all_doses_administered.x                1   111.93 795.89  1.5033 0.2201574
## `Older (65 plus).x`                     1   114.40 798.36  3.9763 0.0461436 *
## `2013 code`:olderprop:TrmpProp:RARELY   3   129.58 809.53 19.1492 0.0002547 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop all_doses_administered.x
mod5.7 <- glm(formula = COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases + COVID_COUNT.x +
    SOMETIMES + COVID_COUNT.y + COVID_TEST.y + fully_vaccinated.y + `Older (65 plus).y` +
    TrmpVote.x + TrmpVote.y + ClintVote.x + ClintVote.y + TotalVote.y + FREQUENTLY +
    ALWAYS + `2013 code` + `Older (65 plus).x` + olderprop * TrmpProp * RARELY *
    `2013 code`, family = poisson, data = big_data3)
summary(mod5.7)
```

```
##
## Call:
## glm(formula = COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases +
##     COVID_COUNT.x + SOMETIMES + COVID_COUNT.y + COVID_TEST.y +
##     fully_vaccinated.y + `Older (65 plus).y` + TrmpVote.x + TrmpVote.y +
##     ClintVote.x + ClintVote.y + TotalVote.y + FREQUENTLY + ALWAYS +
##     `2013 code` + `Older (65 plus).x` + olderprop * TrmpProp *
##     RARELY * `2013 code`, family = poisson, data = big_data3)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -3.5218  -0.6586   0.0000   0.3328   3.1680
##
## Coefficients: (8 not defined because of singularities)
##                                      Estimate Std. Error z value Pr(>|z|)
## (Intercept)                         1.892e+01  6.719e+01   0.282 0.778207
## pop2021.x                           7.397e-05  1.812e-05   4.082 4.46e-05
## pop2021.y                          -9.115e+00  4.120e+00  -2.213 0.026925
## prop_cases                          6.232e+01  1.453e+01   4.290 1.79e-05
## COVID_COUNT.x                      -2.323e-04  5.943e-05  -3.909 9.29e-05
## SOMETIMES                          -1.319e+00  5.074e-01  -2.600 0.009326
## COVID_COUNT.y                      -5.854e+00  1.565e+00  -3.742 0.000183
## COVID_TEST.y                        6.247e-01  2.436e-01   2.564 0.010350
## fully_vaccinated.y                  4.675e-01  1.702e-01   2.747 0.006015
## `Older (65 plus).y`                 1.327e+01  4.208e+00   3.154 0.001612
## TrmpVote.x                         -1.118e-04  2.789e-05  -4.010 6.07e-05
## TrmpVote.y                          2.064e+01  5.719e+00   3.610 0.000307
## ClintVote.x                        -6.065e-05  2.337e-05  -2.595 0.009452
## ClintVote.y                         2.507e+00  9.263e-01   2.707 0.006794
## TotalVote.y                        -2.143e+01  5.261e+00  -4.073 4.64e-05
```

```
## FREQUENTLY                                -1.271e+00  5.100e-01  -2.491 0.012728
## ALWAYS                                    -8.622e-01  4.906e-01  -1.757 0.078852
## `2013 code`2                              -8.722e+01  6.864e+01  -1.271 0.203825
## `2013 code`3                               2.626e+01  4.831e+01   0.544 0.586765
## `2013 code`4                               3.137e+01  6.710e+01   0.468 0.640129
## `2013 code`5                              -1.540e+02  7.112e+01  -2.165 0.030353
## `2013 code`6                               1.934e+01  7.772e+00   2.489 0.012806
## `Older (65 plus).x`                       -5.659e-05  3.606e-05  -1.569 0.116549
## olderprop                                 -8.879e+01  3.679e+02  -0.241 0.809277
## TrmpProp                                   2.186e+00  9.946e+01   0.022 0.982465
## RARELY                                     8.495e+02  6.720e+02   1.264 0.206151
## olderprop:TrmpProp                        -9.551e+01  5.042e+02  -0.189 0.849769
## olderprop:RARELY                          -4.272e+03  3.371e+03  -1.267 0.205075
## TrmpProp:RARELY                           -1.429e+03  9.420e+02  -1.516 0.129405
## `2013 code`2:olderprop                     6.339e+02  3.898e+02   1.626 0.103857
## `2013 code`3:olderprop                     3.004e+01  2.696e+02   0.111 0.911283
## `2013 code`4:olderprop                    -1.938e+01  3.736e+02  -0.052 0.958631
## `2013 code`5:olderprop                     9.448e+02  3.986e+02   2.371 0.017755
## `2013 code`6:olderprop                            NA         NA      NA       NA
## `2013 code`2:TrmpProp                      1.296e+02  1.047e+02   1.237 0.216020
## `2013 code`3:TrmpProp                     -3.497e+01  7.572e+01  -0.462 0.644209
## `2013 code`4:TrmpProp                     -5.158e+01  1.030e+02  -0.501 0.616438
## `2013 code`5:TrmpProp                      2.152e+02  1.071e+02   2.009 0.044533
## `2013 code`6:TrmpProp                             NA         NA      NA       NA
## `2013 code`2:RARELY                        5.393e+02  7.345e+02   0.734 0.462838
## `2013 code`3:RARELY                       -2.469e+02  1.790e+02  -1.379 0.167825
## `2013 code`4:RARELY                       -9.903e+02  6.940e+02  -1.427 0.153578
## `2013 code`5:RARELY                        8.342e+02  7.526e+02   1.108 0.267652
## `2013 code`6:RARELY                               NA         NA      NA       NA
## olderprop:TrmpProp:RARELY                  7.169e+03  4.726e+03   1.517 0.129293
## `2013 code`2:olderprop:TrmpProp           -7.977e+02  5.387e+02  -1.481 0.138673
## `2013 code`3:olderprop:TrmpProp            8.856e+01  3.482e+02   0.254 0.799239
## `2013 code`4:olderprop:TrmpProp            2.044e+02  5.193e+02   0.394 0.693933
## `2013 code`5:olderprop:TrmpProp           -1.184e+03  5.494e+02  -2.156 0.031121
## `2013 code`6:olderprop:TrmpProp                   NA         NA      NA       NA
## `2013 code`2:olderprop:RARELY             -3.812e+03  3.825e+03  -0.997 0.318949
## `2013 code`3:olderprop:RARELY             -8.545e+02  1.425e+03  -0.600 0.548780
## `2013 code`4:olderprop:RARELY              4.698e+03  3.497e+03   1.343 0.179128
## `2013 code`5:olderprop:RARELY             -4.890e+03  3.869e+03  -1.264 0.206192
## `2013 code`6:olderprop:RARELY                     NA         NA      NA       NA
## `2013 code`2:TrmpProp:RARELY              -5.887e+02  1.031e+03  -0.571 0.568073
## `2013 code`3:TrmpProp:RARELY               5.697e+02  3.337e+02   1.707 0.087819
## `2013 code`4:TrmpProp:RARELY               1.657e+03  9.836e+02   1.684 0.092113
## `2013 code`5:TrmpProp:RARELY              -9.130e+02  1.051e+03  -0.869 0.385086
## `2013 code`6:TrmpProp:RARELY                      NA         NA      NA       NA
## `2013 code`2:olderprop:TrmpProp:RARELY     4.587e+03  5.376e+03   0.853 0.393583
## `2013 code`3:olderprop:TrmpProp:RARELY            NA         NA      NA       NA
## `2013 code`4:olderprop:TrmpProp:RARELY    -7.956e+03  4.947e+03  -1.608 0.107807
## `2013 code`5:olderprop:TrmpProp:RARELY     5.565e+03  5.404e+03   1.030 0.303071
## `2013 code`6:olderprop:TrmpProp:RARELY            NA         NA      NA       NA
##
## (Intercept)
## pop2021.x                                 ***
## pop2021.y                                 *
```

```
## prop_cases                              ***
## COVID_COUNT.x                           ***
## SOMETIMES                               **
## COVID_COUNT.y                           ***
## COVID_TEST.y                            *
## fully_vaccinated.y                      **
## `Older (65 plus).y`                     **
## TrmpVote.x                              ***
## TrmpVote.y                              ***
## ClintVote.x                             **
## ClintVote.y                             **
## TotalVote.y                             ***
## FREQUENTLY                              *
## ALWAYS                                  .
## `2013 code`2
## `2013 code`3
## `2013 code`4
## `2013 code`5                            *
## `2013 code`6                            *
## `Older (65 plus).x`
## olderprop
## TrmpProp
## RARELY
## olderprop:TrmpProp
## olderprop:RARELY
## TrmpProp:RARELY
## `2013 code`2:olderprop
## `2013 code`3:olderprop
## `2013 code`4:olderprop
## `2013 code`5:olderprop                  *
## `2013 code`6:olderprop
## `2013 code`2:TrmpProp
## `2013 code`3:TrmpProp
## `2013 code`4:TrmpProp
## `2013 code`5:TrmpProp                   *
## `2013 code`6:TrmpProp
## `2013 code`2:RARELY
## `2013 code`3:RARELY
## `2013 code`4:RARELY
## `2013 code`5:RARELY
## `2013 code`6:RARELY
## olderprop:TrmpProp:RARELY
## `2013 code`2:olderprop:TrmpProp
## `2013 code`3:olderprop:TrmpProp
## `2013 code`4:olderprop:TrmpProp
## `2013 code`5:olderprop:TrmpProp         *
## `2013 code`6:olderprop:TrmpProp
## `2013 code`2:olderprop:RARELY
## `2013 code`3:olderprop:RARELY
## `2013 code`4:olderprop:RARELY
## `2013 code`5:olderprop:RARELY
## `2013 code`6:olderprop:RARELY
## `2013 code`2:TrmpProp:RARELY
## `2013 code`3:TrmpProp:RARELY            .
```

```
## `2013 code`4:TrmpProp:RARELY           .
## `2013 code`5:TrmpProp:RARELY
## `2013 code`6:TrmpProp:RARELY
## `2013 code`2:olderprop:TrmpProp:RARELY
## `2013 code`3:olderprop:TrmpProp:RARELY
## `2013 code`4:olderprop:TrmpProp:RARELY
## `2013 code`5:olderprop:TrmpProp:RARELY
## `2013 code`6:olderprop:TrmpProp:RARELY
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 16416.47  on 91  degrees of freedom
## Residual deviance:   111.93  on 35  degrees of freedom
## AIC: 795.89
##
## Number of Fisher Scoring iterations: 4
```

```
Anova(mod5.7)
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: COVID_DEATHS.x
##                                      LR Chisq Df Pr(>Chisq)
## pop2021.x                             16.790  1  4.176e-05 ***
## pop2021.y                              4.889  1  0.0270206 *
## prop_cases                            18.159  1  2.032e-05 ***
## COVID_COUNT.x                         15.313  1  9.108e-05 ***
## SOMETIMES                              6.759  1  0.0093294 **
## COVID_COUNT.y                         13.908  1  0.0001920 ***
## COVID_TEST.y                           6.603  1  0.0101808 *
## fully_vaccinated.y                     7.447  1  0.0063541 **
## `Older (65 plus).y`                    9.917  1  0.0016377 **
## TrmpVote.x                            16.523  1  4.807e-05 ***
## TrmpVote.y                            13.326  1  0.0002618 ***
## ClintVote.x                            6.821  1  0.0090080 **
## ClintVote.y                            7.335  1  0.0067622 **
## TotalVote.y                           17.075  1  3.593e-05 ***
## FREQUENTLY                             6.242  1  0.0124733 *
## ALWAYS                                 3.097  1  0.0784355 .
## `2013 code`                           39.154  5  2.211e-07 ***
## `Older (65 plus).x`                    2.475  1  0.1156820
## olderprop                              8.310  1  0.0039426 **
## TrmpProp                               1.966  1  0.1608885
## RARELY                                 1.914  1  0.1664958
## olderprop:TrmpProp                     4.967  1  0.0258290 *
## olderprop:RARELY                       2.327  1  0.1271320
## TrmpProp:RARELY                       18.656  1  1.566e-05 ***
## `2013 code`:olderprop                 31.634  4  2.272e-06 ***
## `2013 code`:TrmpProp                  34.425  4  6.097e-07 ***
## `2013 code`:RARELY                    51.782  4  1.532e-10 ***
## olderprop:TrmpProp:RARELY              2.338  1  0.1262655
## `2013 code`:olderprop:TrmpProp        33.906  4  7.791e-07 ***
```

```
## `2013 code`:olderprop:RARELY            24.504  4  6.330e-05 ***
## `2013 code`:TrmpProp:RARELY              8.220  4  0.0838584 .
## `2013 code`:olderprop:TrmpProp:RARELY   32.569  3  3.971e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
drop1(mod5.7, test = "Chi")
```

```
## Single term deletions
##
## Model:
## COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases + COVID_COUNT.x +
##     SOMETIMES + COVID_COUNT.y + COVID_TEST.y + fully_vaccinated.y +
##     `Older (65 plus).y` + TrmpVote.x + TrmpVote.y + ClintVote.x +
##     ClintVote.y + TotalVote.y + FREQUENTLY + ALWAYS + `2013 code` +
##     `Older (65 plus).x` + olderprop * TrmpProp * RARELY * `2013 code`
##                                     Df Deviance    AIC    LRT  Pr(>Chi)
## <none>                                   111.93 795.89
## pop2021.x                            1   128.72 810.68 16.790 4.176e-05 ***
## pop2021.y                            1   116.82 798.78  4.889 0.0270206 *
## prop_cases                           1   130.09 812.05 18.159 2.032e-05 ***
## COVID_COUNT.x                        1   127.24 809.20 15.313 9.108e-05 ***
## SOMETIMES                            1   118.69 800.65  6.759 0.0093294 **
## COVID_COUNT.y                        1   125.84 807.79 13.908 0.0001920 ***
## COVID_TEST.y                         1   118.53 800.49  6.603 0.0101808 *
## fully_vaccinated.y                   1   119.38 801.33  7.447 0.0063541 **
## `Older (65 plus).y`                  1   121.85 803.80  9.917 0.0016377 **
## TrmpVote.x                           1   128.45 810.41 16.523 4.807e-05 ***
## TrmpVote.y                           1   125.26 807.21 13.326 0.0002618 ***
## ClintVote.x                          1   118.75 800.71  6.821 0.0090080 **
## ClintVote.y                          1   119.27 801.22  7.335 0.0067622 **
## TotalVote.y                          1   129.01 810.96 17.075 3.593e-05 ***
## FREQUENTLY                           1   118.17 800.13  6.242 0.0124733 *
## ALWAYS                               1   115.03 796.98  3.097 0.0784355 .
## `Older (65 plus).x`                  1   114.41 796.36  2.475 0.1156820
## `2013 code`:olderprop:TrmpProp:RARELY  3   144.50 822.46 32.569 3.971e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# remove Older.x
mod5.8 <- glm(formula = COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases + COVID_COUNT.x +
    SOMETIMES + COVID_COUNT.y + COVID_TEST.y + fully_vaccinated.y + `Older (65 plus).y` +
    TrmpVote.x + TrmpVote.y + ClintVote.x + ClintVote.y + TotalVote.y + FREQUENTLY +
    ALWAYS + `2013 code` + olderprop * TrmpProp * RARELY * `2013 code`, family = poisson,
    data = big_data3)
summary(mod5.8)
```

```
##
## Call:
## glm(formula = COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases +
##     COVID_COUNT.x + SOMETIMES + COVID_COUNT.y + COVID_TEST.y +
##     fully_vaccinated.y + `Older (65 plus).y` + TrmpVote.x + TrmpVote.y +
##     ClintVote.x + ClintVote.y + TotalVote.y + FREQUENTLY + ALWAYS +
```

```
##     `2013 code` + olderprop * TrmpProp * RARELY * `2013 code`,
##     family = poisson, data = big_data3)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -3.4086  -0.7058   0.0000   0.3743   3.1041
##
## Coefficients: (8 not defined because of singularities)
##                                      Estimate Std. Error z value Pr(>|z|)
## (Intercept)                        -2.026e+00  6.589e+01  -0.031 0.975471
## pop2021.x                           5.336e-05  1.245e-05   4.287 1.81e-05
## pop2021.y                          -4.401e+00  2.833e+00  -1.553 0.120369
## prop_cases                          5.998e+01  1.443e+01   4.155 3.25e-05
## COVID_COUNT.x                      -1.863e-04  5.161e-05  -3.610 0.000306
## SOMETIMES                          -1.466e+00  4.991e-01  -2.937 0.003311
## COVID_COUNT.y                      -5.692e+00  1.559e+00  -3.652 0.000261
## COVID_TEST.y                        5.868e-01  2.420e-01   2.425 0.015327
## fully_vaccinated.y                  4.687e-01  1.700e-01   2.757 0.005842
## `Older (65 plus).y`                 8.525e+00  2.942e+00   2.897 0.003762
## TrmpVote.x                         -8.545e-05  2.201e-05  -3.882 0.000103
## TrmpVote.y                          1.744e+01  5.308e+00   3.286 0.001016
## ClintVote.x                        -5.167e-05  2.252e-05  -2.294 0.021767
## ClintVote.y                         2.594e+00  9.244e-01   2.806 0.005018
## TotalVote.y                        -1.854e+01  4.893e+00  -3.789 0.000151
## FREQUENTLY                         -1.467e+00  4.952e-01  -2.962 0.003055
## ALWAYS                             -1.094e+00  4.687e-01  -2.333 0.019636
## `2013 code`2                       -5.888e+01  6.630e+01  -0.888 0.374507
## `2013 code`3                        2.971e+01  4.822e+01   0.616 0.537786
## `2013 code`4                        3.735e+01  6.699e+01   0.557 0.577189
## `2013 code`5                       -1.431e+02  7.082e+01  -2.020 0.043371
## `2013 code`6                        1.479e+01  7.219e+00   2.049 0.040428
## olderprop                          -1.530e+01  3.649e+02  -0.042 0.966548
## TrmpProp                            1.984e+01  9.888e+01   0.201 0.841006
## RARELY                              8.995e+02  6.716e+02   1.339 0.180419
## olderprop:TrmpProp                 -1.556e+02  5.028e+02  -0.309 0.756948
## olderprop:RARELY                   -4.485e+03  3.369e+03  -1.331 0.183120
## TrmpProp:RARELY                    -1.482e+03  9.420e+02  -1.574 0.115546
## `2013 code`2:olderprop              4.510e+02  3.723e+02   1.211 0.225758
## `2013 code`3:olderprop             -3.267e+01  2.664e+02  -0.123 0.902420
## `2013 code`4:olderprop             -7.401e+01  3.720e+02  -0.199 0.842306
## `2013 code`5:olderprop              8.694e+02  3.958e+02   2.196 0.028061
## `2013 code`6:olderprop                     NA         NA      NA       NA
## `2013 code`2:TrmpProp               8.454e+01  1.009e+02   0.838 0.401947
## `2013 code`3:TrmpProp              -3.576e+01  7.566e+01  -0.473 0.636496
## `2013 code`4:TrmpProp              -6.342e+01  1.027e+02  -0.618 0.536860
## `2013 code`5:TrmpProp               1.954e+02  1.065e+02   1.835 0.066484
## `2013 code`6:TrmpProp                      NA         NA      NA       NA
## `2013 code`2:RARELY                 1.946e+02  7.021e+02   0.277 0.781654
## `2013 code`3:RARELY                -2.620e+02  1.788e+02  -1.465 0.142880
## `2013 code`4:RARELY                -1.025e+03  6.939e+02  -1.476 0.139827
## `2013 code`5:RARELY                 7.498e+02  7.510e+02   0.998 0.318129
## `2013 code`6:RARELY                        NA         NA      NA       NA
## olderprop:TrmpProp:RARELY           7.385e+03  4.726e+03   1.563 0.118162
## `2013 code`2:olderprop:TrmpProp    -5.460e+02  5.148e+02  -1.061 0.288888
```

```
## `2013 code`3:olderprop:TrmpProp          1.201e+02  3.473e+02   0.346 0.729475
## `2013 code`4:olderprop:TrmpProp          2.664e+02  5.178e+02   0.515 0.606892
## `2013 code`5:olderprop:TrmpProp         -1.088e+03  5.463e+02  -1.991 0.046435
## `2013 code`6:olderprop:TrmpProp                 NA         NA      NA       NA
## `2013 code`2:olderprop:RARELY           -1.852e+03  3.621e+03  -0.511 0.609082
## `2013 code`3:olderprop:RARELY           -2.698e+02  1.375e+03  -0.196 0.844437
## `2013 code`4:olderprop:RARELY            4.880e+03  3.497e+03   1.396 0.162825
## `2013 code`5:olderprop:RARELY           -4.492e+03  3.862e+03  -1.163 0.244771
## `2013 code`6:olderprop:RARELY                   NA         NA      NA       NA
## `2013 code`2:TrmpProp:RARELY            -1.092e+02  9.866e+02  -0.111 0.911850
## `2013 code`3:TrmpProp:RARELY             4.403e+02  3.230e+02   1.363 0.172802
## `2013 code`4:TrmpProp:RARELY             1.689e+03  9.834e+02   1.717 0.085966
## `2013 code`5:TrmpProp:RARELY            -8.086e+02  1.050e+03  -0.770 0.441112
## `2013 code`6:TrmpProp:RARELY                    NA         NA      NA       NA
## `2013 code`2:olderprop:TrmpProp:RARELY   1.849e+03  5.093e+03   0.363 0.716575
## `2013 code`3:olderprop:TrmpProp:RARELY          NA         NA      NA       NA
## `2013 code`4:olderprop:TrmpProp:RARELY -8.134e+03  4.947e+03  -1.644 0.100098
## `2013 code`5:olderprop:TrmpProp:RARELY  5.076e+03  5.397e+03   0.941 0.346937
## `2013 code`6:olderprop:TrmpProp:RARELY          NA         NA      NA       NA
##
## (Intercept)
## pop2021.x                               ***
## pop2021.y
## prop_cases                              ***
## COVID_COUNT.x                           ***
## SOMETIMES                               **
## COVID_COUNT.y                           ***
## COVID_TEST.y                            *
## fully_vaccinated.y                      **
## `Older (65 plus).y`                     **
## TrmpVote.x                              ***
## TrmpVote.y                              **
## ClintVote.x                             *
## ClintVote.y                             **
## TotalVote.y                             ***
## FREQUENTLY                              **
## ALWAYS                                  *
## `2013 code`2
## `2013 code`3
## `2013 code`4
## `2013 code`5                            *
## `2013 code`6                            *
## olderprop
## TrmpProp
## RARELY
## olderprop:TrmpProp
## olderprop:RARELY
## TrmpProp:RARELY
## `2013 code`2:olderprop
## `2013 code`3:olderprop
## `2013 code`4:olderprop
## `2013 code`5:olderprop                  *
## `2013 code`6:olderprop
## `2013 code`2:TrmpProp
```

```
## `2013 code`3:TrmpProp
## `2013 code`4:TrmpProp
## `2013 code`5:TrmpProp                  .
## `2013 code`6:TrmpProp
## `2013 code`2:RARELY
## `2013 code`3:RARELY
## `2013 code`4:RARELY
## `2013 code`5:RARELY
## `2013 code`6:RARELY
## olderprop:TrmpProp:RARELY
## `2013 code`2:olderprop:TrmpProp
## `2013 code`3:olderprop:TrmpProp
## `2013 code`4:olderprop:TrmpProp
## `2013 code`5:olderprop:TrmpProp        *
## `2013 code`6:olderprop:TrmpProp
## `2013 code`2:olderprop:RARELY
## `2013 code`3:olderprop:RARELY
## `2013 code`4:olderprop:RARELY
## `2013 code`5:olderprop:RARELY
## `2013 code`6:olderprop:RARELY
## `2013 code`2:TrmpProp:RARELY
## `2013 code`3:TrmpProp:RARELY
## `2013 code`4:TrmpProp:RARELY           .
## `2013 code`5:TrmpProp:RARELY
## `2013 code`6:TrmpProp:RARELY
## `2013 code`2:olderprop:TrmpProp:RARELY
## `2013 code`3:olderprop:TrmpProp:RARELY
## `2013 code`4:olderprop:TrmpProp:RARELY
## `2013 code`5:olderprop:TrmpProp:RARELY
## `2013 code`6:olderprop:TrmpProp:RARELY
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 16416.47  on 91  degrees of freedom
## Residual deviance:   114.41  on 36  degrees of freedom
## AIC: 796.36
##
## Number of Fisher Scoring iterations: 4
```

```
Anova(mod5.8)
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: COVID_DEATHS.x
##                                      LR Chisq Df Pr(>Chisq)
## pop2021.x                             18.293  1  1.894e-05 ***
## pop2021.y                              2.418  1  0.1199817
## prop_cases                            17.023  1  3.694e-05 ***
## COVID_COUNT.x                         12.987  1  0.0003137 ***
## SOMETIMES                              8.623  1  0.0033190 **
## COVID_COUNT.y                         13.238  1  0.0002743 ***
## COVID_TEST.y                           5.900  1  0.0151425 *
```

```
## fully_vaccinated.y                        7.498  1  0.0061756 **
## `Older (65 plus).y`                       8.426  1  0.0036983 **
## TrmpVote.x                               15.180  1  9.772e-05 ***
## TrmpVote.y                               10.949  1  0.0009366 ***
## ClintVote.x                               5.301  1  0.0213182 *
## ClintVote.y                               7.885  1  0.0049856 **
## TotalVote.y                              14.629  1  0.0001309 ***
## FREQUENTLY                                8.832  1  0.0029603 **
## ALWAYS                                    5.461  1  0.0194426 *
## `2013 code`                              27.168  5  5.291e-05 ***
## olderprop                                 0.109  1  0.7414869
## TrmpProp                                  0.259  1  0.6110030
## RARELY                                    1.392  1  0.2379864
## olderprop:TrmpProp                       10.659  1  0.0010954 **
## olderprop:RARELY                          2.582  1  0.1080867
## TrmpProp:RARELY                          18.956  1  1.337e-05 ***
## `2013 code`:olderprop                    38.896  4  7.319e-08 ***
## `2013 code`:TrmpProp                     35.082  4  4.468e-07 ***
## `2013 code`:RARELY                       52.451  4  1.110e-10 ***
## olderprop:TrmpProp:RARELY                 2.456  1  0.1170468
## `2013 code`:olderprop:TrmpProp           34.393  4  6.191e-07 ***
## `2013 code`:olderprop:RARELY             26.253  4  2.814e-05 ***
## `2013 code`:TrmpProp:RARELY               9.009  4  0.0608672 .
## `2013 code`:olderprop:TrmpProp:RARELY    30.326  3  1.178e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
drop1(mod5.8, test = "Chi")
```

```
## Single term deletions
##
## Model:
## COVID_DEATHS.x ~ pop2021.x + pop2021.y + prop_cases + COVID_COUNT.x +
##     SOMETIMES + COVID_COUNT.y + COVID_TEST.y + fully_vaccinated.y +
##     `Older (65 plus).y` + TrmpVote.x + TrmpVote.y + ClintVote.x +
##     ClintVote.y + TotalVote.y + FREQUENTLY + ALWAYS + `2013 code` +
##     olderprop * TrmpProp * RARELY * `2013 code`
##                                      Df Deviance    AIC     LRT  Pr(>Chi)
## <none>                                    114.41 796.36
## pop2021.x                             1   132.70 812.65 18.2931 1.894e-05 ***
## pop2021.y                             1   116.82 796.78  2.4176 0.1199817
## prop_cases                            1   131.43 811.38 17.0225 3.694e-05 ***
## COVID_COUNT.x                         1   127.39 807.35 12.9866 0.0003137 ***
## SOMETIMES                             1   123.03 802.98  8.6232 0.0033190 **
## COVID_COUNT.y                         1   127.64 807.60 13.2381 0.0002743 ***
## COVID_TEST.y                          1   120.31 800.26  5.8998 0.0151425 *
## fully_vaccinated.y                    1   121.90 801.86  7.4983 0.0061756 **
## `Older (65 plus).y`                   1   122.83 802.79  8.4263 0.0036983 **
## TrmpVote.x                            1   129.59 809.54 15.1803 9.772e-05 ***
## TrmpVote.y                            1   125.35 805.31 10.9488 0.0009366 ***
## ClintVote.x                           1   119.71 799.66  5.3006 0.0213182 *
## ClintVote.y                           1   122.29 802.25  7.8847 0.0049856 **
## TotalVote.y                           1   129.03 808.99 14.6286 0.0001309 ***
## FREQUENTLY                            1   123.24 803.19  8.8318 0.0029603 **
```

```
## ALWAYS                                    1   119.87 799.82  5.4613 0.0194426 *
## `2013 code`:olderprop:TrmpProp:RARELY  3   144.73 820.69 30.3265 1.178e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# remove pop2021.y
mod5.9 <- glm(formula = COVID_DEATHS.x ~ pop2021.x + prop_cases + COVID_COUNT.x +
    SOMETIMES + COVID_COUNT.y + COVID_TEST.y + fully_vaccinated.y + `Older (65 plus).y` +
    TrmpVote.x + TrmpVote.y + ClintVote.x + ClintVote.y + TotalVote.y + FREQUENTLY +
    ALWAYS + `2013 code` + olderprop * TrmpProp * RARELY * `2013 code`, family = poisson,
    data = big_data3)
summary(mod5.9)
```

```
##
## Call:
## glm(formula = COVID_DEATHS.x ~ pop2021.x + prop_cases + COVID_COUNT.x +
##     SOMETIMES + COVID_COUNT.y + COVID_TEST.y + fully_vaccinated.y +
##     `Older (65 plus).y` + TrmpVote.x + TrmpVote.y + ClintVote.x +
##     ClintVote.y + TotalVote.y + FREQUENTLY + ALWAYS + `2013 code` +
##     olderprop * TrmpProp * RARELY * `2013 code`, family = poisson,
##     data = big_data3)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -3.5257  -0.5685  -0.0075   0.4336   3.0973
##
## Coefficients: (8 not defined because of singularities)
##                                        Estimate Std. Error z value Pr(>|z|)
## (Intercept)                          -2.293e+01  6.473e+01  -0.354 0.723143
## pop2021.x                             4.530e-05  1.136e-05   3.987 6.69e-05
## prop_cases                            6.115e+01  1.443e+01   4.238 2.25e-05
## COVID_COUNT.x                        -1.497e-04  4.595e-05  -3.257 0.001126
## SOMETIMES                            -1.551e+00  4.960e-01  -3.127 0.001767
## COVID_COUNT.y                        -5.933e+00  1.554e+00  -3.818 0.000134
## COVID_TEST.y                          6.414e-01  2.397e-01   2.676 0.007445
## fully_vaccinated.y                    4.945e-01  1.701e-01   2.907 0.003648
## `Older (65 plus).y`                   4.468e+00  1.351e+00   3.309 0.000938
## TrmpVote.x                           -8.394e-05  2.210e-05  -3.798 0.000146
## TrmpVote.y                            1.450e+01  4.930e+00   2.942 0.003261
## ClintVote.x                          -3.894e-05  2.107e-05  -1.848 0.064633
## ClintVote.y                           2.795e+00  9.167e-01   3.049 0.002297
## TotalVote.y                          -1.588e+01  4.553e+00  -3.487 0.000488
## FREQUENTLY                           -1.532e+00  4.931e-01  -3.107 0.001887
## ALWAYS                               -1.100e+00  4.689e-01  -2.347 0.018941
## `2013 code`2                         -4.028e+01  6.545e+01  -0.616 0.538201
## `2013 code`3                          2.683e+01  4.837e+01   0.555 0.579085
## `2013 code`4                          3.899e+01  6.721e+01   0.580 0.561800
## `2013 code`5                         -1.275e+02  7.030e+01  -1.814 0.069736
## `2013 code`6                          1.373e+01  7.222e+00   1.901 0.057285
## olderprop                             3.265e+01  3.650e+02   0.089 0.928730
## TrmpProp                              3.005e+01  9.904e+01   0.303 0.761610
## RARELY                                9.317e+02  6.730e+02   1.384 0.166220
## olderprop:TrmpProp                   -1.823e+02  5.044e+02  -0.361 0.717833
## olderprop:RARELY                     -4.656e+03  3.375e+03  -1.379 0.167793
```

```
## TrmpProp:RARELY                          -1.511e+03  9.443e+02  -1.600 0.109545
## `2013 code`2:olderprop                    3.317e+02  3.656e+02   0.907 0.364254
## `2013 code`3:olderprop                   -7.857e+00  2.671e+02  -0.029 0.976529
## `2013 code`4:olderprop                   -9.379e+01  3.731e+02  -0.251 0.801538
## `2013 code`5:olderprop                    7.781e+02  3.925e+02   1.982 0.047439
## `2013 code`6:olderprop                           NA         NA      NA       NA
## `2013 code`2:TrmpProp                     5.914e+01  9.991e+01   0.592 0.553889
## `2013 code`3:TrmpProp                    -3.842e+01  7.594e+01  -0.506 0.612956
## `2013 code`4:TrmpProp                    -6.387e+01  1.030e+02  -0.620 0.535324
## `2013 code`5:TrmpProp                     1.739e+02  1.059e+02   1.642 0.100499
## `2013 code`6:TrmpProp                            NA         NA      NA       NA
## `2013 code`2:RARELY                      -9.151e+01  6.796e+02  -0.135 0.892886
## `2013 code`3:RARELY                      -2.407e+02  1.787e+02  -1.347 0.177983
## `2013 code`4:RARELY                      -1.074e+03  6.949e+02  -1.545 0.122345
## `2013 code`5:RARELY                       5.840e+02  7.447e+02   0.784 0.432957
## `2013 code`6:RARELY                              NA         NA      NA       NA
## olderprop:TrmpProp:RARELY                 7.544e+03  4.737e+03   1.593 0.111252
## `2013 code`2:olderprop:TrmpProp          -3.898e+02  5.068e+02  -0.769 0.441761
## `2013 code`3:olderprop:TrmpProp           1.145e+02  3.487e+02   0.328 0.742668
## `2013 code`4:olderprop:TrmpProp           2.772e+02  5.194e+02   0.534 0.593560
## `2013 code`5:olderprop:TrmpProp          -9.690e+02  5.424e+02  -1.787 0.073996
## `2013 code`6:olderprop:TrmpProp                  NA         NA      NA       NA
## `2013 code`2:olderprop:RARELY            -1.235e+02  3.455e+03  -0.036 0.971495
## `2013 code`3:olderprop:RARELY            -6.861e+02  1.351e+03  -0.508 0.611438
## `2013 code`4:olderprop:RARELY             5.204e+03  3.499e+03   1.487 0.136936
## `2013 code`5:olderprop:RARELY            -3.579e+03  3.822e+03  -0.936 0.349060
## `2013 code`6:olderprop:RARELY                    NA         NA      NA       NA
## `2013 code`2:TrmpProp:RARELY              2.785e+02  9.575e+02   0.291 0.771174
## `2013 code`3:TrmpProp:RARELY              5.164e+02  3.199e+02   1.614 0.106507
## `2013 code`4:TrmpProp:RARELY              1.733e+03  9.852e+02   1.759 0.078615
## `2013 code`5:TrmpProp:RARELY             -5.916e+02  1.042e+03  -0.568 0.570256
## `2013 code`6:TrmpProp:RARELY                     NA         NA      NA       NA
## `2013 code`2:olderprop:TrmpProp:RARELY -5.077e+02  4.876e+03  -0.104 0.917077
## `2013 code`3:olderprop:TrmpProp:RARELY           NA         NA      NA       NA
## `2013 code`4:olderprop:TrmpProp:RARELY -8.466e+03  4.953e+03  -1.709 0.087414
## `2013 code`5:olderprop:TrmpProp:RARELY  3.872e+03  5.349e+03   0.724 0.469129
## `2013 code`6:olderprop:TrmpProp:RARELY           NA         NA      NA       NA
##
## (Intercept)
## pop2021.x                               ***
## prop_cases                              ***
## COVID_COUNT.x                           **
## SOMETIMES                               **
## COVID_COUNT.y                           ***
## COVID_TEST.y                            **
## fully_vaccinated.y                      **
## `Older (65 plus).y`                     ***
## TrmpVote.x                              ***
## TrmpVote.y                              **
## ClintVote.x                             .
## ClintVote.y                             **
## TotalVote.y                             ***
## FREQUENTLY                              **
## ALWAYS                                  *
```

```
## `2013 code`2
## `2013 code`3
## `2013 code`4
## `2013 code`5                          .
## `2013 code`6                          .
## olderprop
## TrmpProp
## RARELY
## olderprop:TrmpProp
## olderprop:RARELY
## TrmpProp:RARELY
## `2013 code`2:olderprop
## `2013 code`3:olderprop
## `2013 code`4:olderprop
## `2013 code`5:olderprop                *
## `2013 code`6:olderprop
## `2013 code`2:TrmpProp
## `2013 code`3:TrmpProp
## `2013 code`4:TrmpProp
## `2013 code`5:TrmpProp
## `2013 code`6:TrmpProp
## `2013 code`2:RARELY
## `2013 code`3:RARELY
## `2013 code`4:RARELY
## `2013 code`5:RARELY
## `2013 code`6:RARELY
## olderprop:TrmpProp:RARELY
## `2013 code`2:olderprop:TrmpProp
## `2013 code`3:olderprop:TrmpProp
## `2013 code`4:olderprop:TrmpProp
## `2013 code`5:olderprop:TrmpProp       .
## `2013 code`6:olderprop:TrmpProp
## `2013 code`2:olderprop:RARELY
## `2013 code`3:olderprop:RARELY
## `2013 code`4:olderprop:RARELY
## `2013 code`5:olderprop:RARELY
## `2013 code`6:olderprop:RARELY
## `2013 code`2:TrmpProp:RARELY
## `2013 code`3:TrmpProp:RARELY
## `2013 code`4:TrmpProp:RARELY          .
## `2013 code`5:TrmpProp:RARELY
## `2013 code`6:TrmpProp:RARELY
## `2013 code`2:olderprop:TrmpProp:RARELY
## `2013 code`3:olderprop:TrmpProp:RARELY
## `2013 code`4:olderprop:TrmpProp:RARELY .
## `2013 code`5:olderprop:TrmpProp:RARELY
## `2013 code`6:olderprop:TrmpProp:RARELY
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 16416.47  on 91  degrees of freedom
## Residual deviance:   116.82  on 37  degrees of freedom
```

```
## AIC: 796.78
##
## Number of Fisher Scoring iterations: 4
```

```
Anova(mod5.9)
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: COVID_DEATHS.x
##                                       LR Chisq Df Pr(>Chisq)
## pop2021.x                              15.956  1  6.484e-05 ***
## prop_cases                             17.712  1  2.570e-05 ***
## COVID_COUNT.x                          10.580  1  0.0011433 **
## SOMETIMES                               9.774  1  0.0017703 **
## COVID_COUNT.y                          14.462  1  0.0001430 ***
## COVID_TEST.y                            7.188  1  0.0073392 **
## fully_vaccinated.y                      8.316  1  0.0039303 **
## `Older (65 plus).y`                    10.816  1  0.0010063 **
## TrmpVote.x                             14.552  1  0.0001363 ***
## TrmpVote.y                              8.709  1  0.0031661 **
## ClintVote.x                             3.453  1  0.0631433 .
## ClintVote.y                             9.303  1  0.0022881 **
## TotalVote.y                            12.278  1  0.0004583 ***
## FREQUENTLY                              9.726  1  0.0018164 **
## ALWAYS                                  5.525  1  0.0187484 *
## `2013 code`                            21.404  5  0.0006792 ***
## olderprop                               9.324  1  0.0022614 **
## TrmpProp                                0.568  1  0.4510861
## RARELY                                  1.384  1  0.2394408
## olderprop:TrmpProp                      7.025  1  0.0080366 **
## olderprop:RARELY                        2.192  1  0.1387198
## TrmpProp:RARELY                        17.584  1  2.749e-05 ***
## `2013 code`:olderprop                  41.170  4  2.479e-08 ***
## `2013 code`:TrmpProp                   32.988  4  1.201e-06 ***
## `2013 code`:RARELY                     55.147  4  3.027e-11 ***
## olderprop:TrmpProp:RARELY               3.716  1  0.0539063 .
## `2013 code`:olderprop:TrmpProp         36.322  4  2.485e-07 ***
## `2013 code`:olderprop:RARELY           28.803  4  8.570e-06 ***
## `2013 code`:TrmpProp:RARELY             9.290  4  0.0542406 .
## `2013 code`:olderprop:TrmpProp:RARELY  28.620  3  2.691e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
drop1(mod5.9, test = "Chi")
```

```
## Single term deletions
##
## Model:
## COVID_DEATHS.x ~ pop2021.x + prop_cases + COVID_COUNT.x + SOMETIMES +
##     COVID_COUNT.y + COVID_TEST.y + fully_vaccinated.y + `Older (65 plus).y` +
##     TrmpVote.x + TrmpVote.y + ClintVote.x + ClintVote.y + TotalVote.y +
##     FREQUENTLY + ALWAYS + `2013 code` + olderprop * TrmpProp *
##     RARELY * `2013 code`
```

```
##                                        Df Deviance    AIC     LRT  Pr(>Chi)
## <none>                                      116.82 796.78
## pop2021.x                               1   132.78 810.73 15.9558 6.484e-05 ***
## prop_cases                              1   134.53 812.49 17.7120 2.570e-05 ***
## COVID_COUNT.x                           1   127.40 805.36 10.5798 0.0011433 **
## SOMETIMES                               1   126.60 804.55  9.7737 0.0017703 **
## COVID_COUNT.y                           1   131.28 809.24 14.4621 0.0001430 ***
## COVID_TEST.y                            1   124.01 801.97  7.1880 0.0073392 **
## fully_vaccinated.y                      1   125.14 803.09  8.3158 0.0039303 **
## `Older (65 plus).y`                     1   127.64 805.60 10.8160 0.0010063 **
## TrmpVote.x                              1   131.38 809.33 14.5523 0.0001363 ***
## TrmpVote.y                              1   125.53 803.49  8.7092 0.0031661 **
## ClintVote.x                             1   120.28 798.23  3.4528 0.0631433 .
## ClintVote.y                             1   126.13 804.08  9.3027 0.0022881 **
## TotalVote.y                             1   129.10 807.06 12.2781 0.0004583 ***
## FREQUENTLY                              1   126.55 804.51  9.7264 0.0018164 **
## ALWAYS                                  1   122.35 800.30  5.5248 0.0187484 *
## `2013 code`:olderprop:TrmpProp:RARELY   3   145.44 819.40 28.6204 2.691e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# remove clintVote.x
mod5.10 <- glm(formula = COVID_DEATHS.x ~ pop2021.x + prop_cases + COVID_COUNT.x +
    SOMETIMES + COVID_COUNT.y + COVID_TEST.y + fully_vaccinated.y + `Older (65 plus).y` +
    TrmpVote.x + TrmpVote.y + ClintVote.y + TotalVote.y + FREQUENTLY + ALWAYS + `2013 code` +
    olderprop * TrmpProp * RARELY * `2013 code`, family = poisson, data = big_data3)
summary(mod5.10)
```

```
##
## Call:
## glm(formula = COVID_DEATHS.x ~ pop2021.x + prop_cases + COVID_COUNT.x +
##     SOMETIMES + COVID_COUNT.y + COVID_TEST.y + fully_vaccinated.y +
##     `Older (65 plus).y` + TrmpVote.x + TrmpVote.y + ClintVote.y +
##     TotalVote.y + FREQUENTLY + ALWAYS + `2013 code` + olderprop *
##     TrmpProp * RARELY * `2013 code`, family = poisson, data = big_data3)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -4.0077  -0.6866   0.0000   0.4394   3.2130
##
## Coefficients: (8 not defined because of singularities)
##                                          Estimate Std. Error z value Pr(>|z|)
## (Intercept)                            -2.015e+01  6.469e+01  -0.312 0.755384
## pop2021.x                               2.803e-05  6.523e-06   4.298 1.72e-05
## prop_cases                              4.987e+01  1.312e+01   3.802 0.000144
## COVID_COUNT.x                          -1.017e-04  3.798e-05  -2.677 0.007434
## SOMETIMES                              -1.345e+00  4.820e-01  -2.791 0.005256
## COVID_COUNT.y                          -4.855e+00  1.442e+00  -3.367 0.000761
## COVID_TEST.y                            5.109e-01  2.285e-01   2.236 0.025351
## fully_vaccinated.y                      5.366e-01  1.689e-01   3.178 0.001484
## `Older (65 plus).y`                     3.938e+00  1.323e+00   2.976 0.002923
## TrmpVote.x                             -5.639e-05  1.629e-05  -3.462 0.000537
## TrmpVote.y                              1.869e+01  4.411e+00   4.238 2.26e-05
## ClintVote.y                             2.542e+00  9.054e-01   2.808 0.004987
```

```
## TotalVote.y                                -2.029e+01  3.912e+00  -5.186 2.14e-07
## FREQUENTLY                                 -1.480e+00  4.915e-01  -3.011 0.002604
## ALWAYS                                     -9.270e-01  4.586e-01  -2.021 0.043252
## `2013 code`2                               -3.727e+01  6.540e+01  -0.570 0.568750
## `2013 code`3                                2.978e+01  4.834e+01   0.616 0.537944
## `2013 code`4                                5.274e+01  6.679e+01   0.790 0.429741
## `2013 code`5                               -1.178e+02  7.011e+01  -1.681 0.092849
## `2013 code`6                                1.224e+01  7.180e+00   1.705 0.088279
## olderprop                                   6.257e+01  3.645e+02   0.172 0.863687
## TrmpProp                                    3.241e+01  9.900e+01   0.327 0.743387
## RARELY                                      1.019e+03  6.713e+02   1.518 0.128973
## olderprop:TrmpProp                         -2.211e+02  5.037e+02  -0.439 0.660674
## olderprop:RARELY                           -5.047e+03  3.368e+03  -1.499 0.133934
## TrmpProp:RARELY                            -1.636e+03  9.417e+02  -1.737 0.082369
## `2013 code`2:olderprop                      3.148e+02  3.653e+02   0.862 0.388825
## `2013 code`3:olderprop                      1.798e-01  2.670e+02   0.001 0.999463
## `2013 code`4:olderprop                     -1.642e+02  3.711e+02  -0.442 0.658162
## `2013 code`5:olderprop                      7.267e+02  3.915e+02   1.856 0.063428
## `2013 code`6:olderprop                             NA         NA      NA       NA
## `2013 code`2:TrmpProp                       5.332e+01  9.982e+01   0.534 0.593261
## `2013 code`3:TrmpProp                      -5.623e+01  7.526e+01  -0.747 0.454976
## `2013 code`4:TrmpProp                      -8.989e+01  1.020e+02  -0.881 0.378317
## `2013 code`5:TrmpProp                       1.581e+02  1.055e+02   1.498 0.134180
## `2013 code`6:TrmpProp                              NA         NA      NA       NA
## `2013 code`2:RARELY                        -1.990e+02  6.769e+02  -0.294 0.768764
## `2013 code`3:RARELY                        -2.317e+02  1.788e+02  -1.296 0.195075
## `2013 code`4:RARELY                        -1.233e+03  6.896e+02  -1.788 0.073817
## `2013 code`5:RARELY                         4.274e+02  7.397e+02   0.578 0.563456
## `2013 code`6:RARELY                                NA         NA      NA       NA
## olderprop:TrmpProp:RARELY                   8.104e+03  4.725e+03   1.715 0.086326
## `2013 code`2:olderprop:TrmpProp            -3.691e+02  5.064e+02  -0.729 0.465992
## `2013 code`3:olderprop:TrmpProp             1.665e+02  3.474e+02   0.479 0.631821
## `2013 code`4:olderprop:TrmpProp             3.996e+02  5.150e+02   0.776 0.437796
## `2013 code`5:olderprop:TrmpProp            -8.962e+02  5.409e+02  -1.657 0.097535
## `2013 code`6:olderprop:TrmpProp                    NA         NA      NA       NA
## `2013 code`2:olderprop:RARELY               3.968e+02  3.442e+03   0.115 0.908244
## `2013 code`3:olderprop:RARELY              -1.371e+03  1.296e+03  -1.058 0.290061
## `2013 code`4:olderprop:RARELY               5.961e+03  3.474e+03   1.716 0.086222
## `2013 code`5:olderprop:RARELY              -2.813e+03  3.798e+03  -0.741 0.458911
## `2013 code`6:olderprop:RARELY                      NA         NA      NA       NA
## `2013 code`2:TrmpProp:RARELY                4.287e+02  9.537e+02   0.449 0.653092
## `2013 code`3:TrmpProp:RARELY                6.795e+02  3.065e+02   2.217 0.026636
## `2013 code`4:TrmpProp:RARELY                2.021e+03  9.726e+02   2.078 0.037709
## `2013 code`5:TrmpProp:RARELY               -3.688e+02  1.035e+03  -0.356 0.721563
## `2013 code`6:TrmpProp:RARELY                       NA         NA      NA       NA
## `2013 code`2:olderprop:TrmpProp:RARELY     -1.230e+03  4.858e+03  -0.253 0.800141
## `2013 code`3:olderprop:TrmpProp:RARELY             NA         NA      NA       NA
## `2013 code`4:olderprop:TrmpProp:RARELY     -9.861e+03  4.894e+03  -2.015 0.043917
## `2013 code`5:olderprop:TrmpProp:RARELY      2.783e+03  5.314e+03   0.524 0.600486
## `2013 code`6:olderprop:TrmpProp:RARELY             NA         NA      NA       NA
##
## (Intercept)
## pop2021.x                                  ***
## prop_cases                                 ***
```

```
## COVID_COUNT.x                          **
## SOMETIMES                              **
## COVID_COUNT.y                          ***
## COVID_TEST.y                           *
## fully_vaccinated.y                     **
## `Older (65 plus).y`                    **
## TrmpVote.x                             ***
## TrmpVote.y                             ***
## ClintVote.y                            **
## TotalVote.y                            ***
## FREQUENTLY                             **
## ALWAYS                                 *
## `2013 code`2
## `2013 code`3
## `2013 code`4
## `2013 code`5                           .
## `2013 code`6                           .
## olderprop
## TrmpProp
## RARELY
## olderprop:TrmpProp
## olderprop:RARELY
## TrmpProp:RARELY                        .
## `2013 code`2:olderprop
## `2013 code`3:olderprop
## `2013 code`4:olderprop
## `2013 code`5:olderprop                 .
## `2013 code`6:olderprop
## `2013 code`2:TrmpProp
## `2013 code`3:TrmpProp
## `2013 code`4:TrmpProp
## `2013 code`5:TrmpProp
## `2013 code`6:TrmpProp
## `2013 code`2:RARELY
## `2013 code`3:RARELY
## `2013 code`4:RARELY                    .
## `2013 code`5:RARELY
## `2013 code`6:RARELY
## olderprop:TrmpProp:RARELY              .
## `2013 code`2:olderprop:TrmpProp
## `2013 code`3:olderprop:TrmpProp
## `2013 code`4:olderprop:TrmpProp
## `2013 code`5:olderprop:TrmpProp        .
## `2013 code`6:olderprop:TrmpProp
## `2013 code`2:olderprop:RARELY
## `2013 code`3:olderprop:RARELY
## `2013 code`4:olderprop:RARELY          .
## `2013 code`5:olderprop:RARELY
## `2013 code`6:olderprop:RARELY
## `2013 code`2:TrmpProp:RARELY
## `2013 code`3:TrmpProp:RARELY           *
## `2013 code`4:TrmpProp:RARELY           *
## `2013 code`5:TrmpProp:RARELY
## `2013 code`6:TrmpProp:RARELY
```

```
## ‘2013 code‘2:olderprop:TrmpProp:RARELY
## ‘2013 code‘3:olderprop:TrmpProp:RARELY
## ‘2013 code‘4:olderprop:TrmpProp:RARELY *
## ‘2013 code‘5:olderprop:TrmpProp:RARELY
## ‘2013 code‘6:olderprop:TrmpProp:RARELY
## ---
## Signif. codes:  0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 16416.47  on 91  degrees of freedom
## Residual deviance:   120.28  on 38  degrees of freedom
## AIC: 798.23
##
## Number of Fisher Scoring iterations: 4
```

```
Anova(mod5.10)
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: COVID_DEATHS.x
##                                       LR Chisq Df Pr(>Chisq)
## pop2021.x                              18.612  1  1.602e-05 ***
## prop_cases                             14.270  1  0.0001584 ***
## COVID_COUNT.x                           7.129  1  0.0075847 **
## SOMETIMES                               7.770  1  0.0053115 **
## COVID_COUNT.y                          11.239  1  0.0008011 ***
## COVID_TEST.y                            5.006  1  0.0252529 *
## fully_vaccinated.y                      9.911  1  0.0016426 **
## ‘Older (65 plus).y‘                     8.765  1  0.0030704 **
## TrmpVote.x                             11.982  1  0.0005373 ***
## TrmpVote.y                             17.930  1  2.292e-05 ***
## ClintVote.y                             7.885  1  0.0049851 **
## TotalVote.y                            26.895  1  2.149e-07 ***
## FREQUENTLY                              9.128  1  0.0025173 **
## ALWAYS                                  4.094  1  0.0430377 *
## ‘2013 code‘                            21.009  5  0.0008067 ***
## olderprop                              10.308  1  0.0013244 **
## TrmpProp                                0.428  1  0.5130953
## RARELY                                  2.199  1  0.1381211
## olderprop:TrmpProp                      3.204  1  0.0734362 .
## olderprop:RARELY                        2.009  1  0.1564066
## TrmpProp:RARELY                        13.561  1  0.0002309 ***
## ‘2013 code‘:olderprop                  23.649  4  9.390e-05 ***
## ‘2013 code‘:TrmpProp                   24.756  4  5.632e-05 ***
## ‘2013 code‘:RARELY                     56.060  4  1.948e-11 ***
## olderprop:TrmpProp:RARELY               0.641  1  0.4234411
## ‘2013 code‘:olderprop:TrmpProp         62.007  4  1.098e-12 ***
## ‘2013 code‘:olderprop:RARELY           31.326  4  2.627e-06 ***
## ‘2013 code‘:TrmpProp:RARELY            14.313  4  0.0063591 **
## ‘2013 code‘:olderprop:TrmpProp:RARELY  32.257  3  4.621e-07 ***
## ---
## Signif. codes:  0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1
```

```
drop1(mod5.10, test = "Chi")
```

```
## Single term deletions
##
## Model:
## COVID_DEATHS.x ~ pop2021.x + prop_cases + COVID_COUNT.x + SOMETIMES +
##     COVID_COUNT.y + COVID_TEST.y + fully_vaccinated.y + `Older (65 plus).y` +
##     TrmpVote.x + TrmpVote.y + ClintVote.y + TotalVote.y + FREQUENTLY +
##     ALWAYS + `2013 code` + olderprop * TrmpProp * RARELY * `2013 code`
##                                      Df Deviance    AIC    LRT  Pr(>Chi)
## <none>                                    120.28 798.23
## pop2021.x                             1   138.89 814.84 18.612 1.602e-05 ***
## prop_cases                            1   134.54 810.50 14.270 0.0001584 ***
## COVID_COUNT.x                         1   127.41 803.36  7.129 0.0075847 **
## SOMETIMES                             1   128.05 804.00  7.770 0.0053115 **
## COVID_COUNT.y                         1   131.51 807.47 11.239 0.0008011 ***
## COVID_TEST.y                          1   125.28 801.24  5.006 0.0252529 *
## fully_vaccinated.y                    1   130.19 806.14  9.911 0.0016426 **
## `Older (65 plus).y`                   1   129.04 805.00  8.765 0.0030704 **
## TrmpVote.x                            1   132.26 808.21 11.982 0.0005373 ***
## TrmpVote.y                            1   138.21 814.16 17.930 2.292e-05 ***
## ClintVote.y                           1   128.16 804.12  7.885 0.0049851 **
## TotalVote.y                           1   147.17 823.13 26.895 2.149e-07 ***
## FREQUENTLY                            1   129.40 805.36  9.128 0.0025173 **
## ALWAYS                                1   124.37 800.33  4.094 0.0430377 *
## `2013 code`:olderprop:TrmpProp:RARELY  3   152.53 824.49 32.257 4.621e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
## Mod5.10 is our final Poisson model with only Fixed Effects AIC = 798.23
```

Poisson Mixed Effects

```
## if 2013 code is a RE, it can't be a FE or interraction. Without population as
## predictor, need to use `offset()` to make it poisson proportions and not counts


mod6.0 <- glm(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + 1, family = poisson,
    data = big_data3)
summary(mod6.0)
```

```
##
## Call:
## glm(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + 1, family = poisson,
##     data = big_data3)
##
## Deviance Residuals:
##      Min        1Q    Median        3Q       Max
## -10.8915   -1.3104    0.3246    2.4239    6.1877
##
```

```
## Coefficients:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept) -6.276925   0.008843  -709.8   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 793.82  on 91  degrees of freedom
## Residual deviance: 793.82  on 91  degrees of freedom
## AIC: 1365.8
##
## Number of Fisher Scoring iterations: 4
```

```
mod6.0.1 <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | LOCATION_ID) +
    (1 | `2013 code`), family = poisson, data = big_data3)
summary(mod6.0.1)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | LOCATION_ID) +
##     (1 | `2013 code`)
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    848.7    856.3   -421.4    842.7       89
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.64837 -0.34252  0.01253  0.28136  1.12117
##
## Random effects:
##  Groups      Name        Variance Std.Dev.
##  LOCATION_ID (Intercept) 0.066472 0.25782
##  2013 code   (Intercept) 0.003688 0.06073
## Number of obs: 92, groups:  LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept) -6.24597    0.04126  -151.4   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# confint(mod6.0.1, method = 'boot') random effect of LOCATION_ID is non-zero

mod6.0.3 <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | LOCATION_ID),
    family = poisson, data = big_data3)

summary(mod6.0.3)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
```

```
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | LOCATION_ID)
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    848.1    853.1   -422.0    844.1       90
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.5773 -0.3035 -0.0065  0.2986  1.1003
##
## Random effects:
##  Groups      Name        Variance Std.Dev.
##  LOCATION_ID (Intercept) 0.07102  0.2665
## Number of obs: 92, groups:  LOCATION_ID, 92
##
## Fixed effects:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept) -6.23907    0.03086  -202.2   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
mod6.0.4 <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`),
    family = poisson, data = big_data3)
summary(mod6.0.4)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`)
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##   1279.7   1284.7   -637.9   1275.7       90
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -9.0284 -1.7715  0.1334  1.9315  6.9555
##
## Random effects:
##  Groups    Name        Variance Std.Dev.
##  2013 code (Intercept) 0.009181 0.09582
## Number of obs: 92, groups:  2013 code, 6
##
## Fixed effects:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept) -6.25820    0.04028  -155.4   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
mod6.0.5 <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID), family = poisson, data = big_data3)
summary(mod6.0.5)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID)
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    848.7    856.3   -421.4    842.7       89
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.64837 -0.34252  0.01253  0.28136  1.12117
##
## Random effects:
##  Groups                  Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.066472 0.25782
##  2013 code               (Intercept) 0.003688 0.06073
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept) -6.24597    0.04126  -151.4   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# test Location_ID as a random effect
y <- simulate(mod6.0)
lrt.vec <- numeric(1000)
set.seed(123)
for (i in 1:1000) {
    y <- unlist(simulate(mod6.0))
    b0 <- glm(y ~ offset(log(pop2021.x)) + 1, family = poisson, data = big_data3)
    b1 <- glmer(y ~ offset(log(pop2021.x)) + 1 + (1 | LOCATION_ID), family = poisson,
        data = big_data3)
    lrt.vec[i] <- as.numeric(2 * (logLik(b1) - logLik(b0)))
}
lrtstat <- as.numeric(2 * (logLik(mod6.0.3) - logLik(mod6.0)))
lrtstat
```

```
## [1] 519.7055
```

```
summary(lrt.vec)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.0000  0.0000  0.0000  0.3768  0.1797 13.3408
```

```
phat <- mean(lrt.vec > lrtstat)
se_phat <- sqrt(phat * (1 - phat)/1000)
c(phat, se_phat)
```

```
## [1] 0 0
```

```
# pvalue = 0. Reject H0: sigma2_LID = 0


# test 2013 code as a random effect
y <- simulate(mod6.0)
lrt.vec <- numeric(1000)
set.seed(123)
for (i in 1:1000) {
    y <- unlist(simulate(mod6.0))
    b0 <- glm(y ~ offset(log(pop2021.x)) + 1, family = poisson, data = big_data3)
    b1 <- glmer(y ~ offset(log(pop2021.x)) + 1 + (1 | `2013 code`), family = poisson,
        data = big_data3)
    lrt.vec[i] <- as.numeric(2 * (logLik(b1) - logLik(b0)))
}
lrtstat <- as.numeric(2 * (logLik(mod6.0.4) - logLik(mod6.0)))
lrtstat
```

```
## [1] 88.07679
```

```
summary(lrt.vec)
```

```
##     Min.  1st Qu.   Median     Mean  3rd Qu.     Max.
##  0.00000  0.00000  0.00000  0.22893  0.01941 10.20890
```

```
phat <- mean(lrt.vec > lrtstat)
se_phat <- sqrt(phat * (1 - phat)/1000)
c(phat, se_phat)
```

```
## [1] 0 0
```

```
# pvalue = 0. Reject H0: sigma2_2013code = 0


# test to see if LID is significant in a model that contains 2013 code
y <- simulate(mod6.0.4)
lrt.vec <- numeric(1000)
set.seed(123)
for (i in 1:1000) {
    y <- unlist(simulate(mod6.0.4))
    b0 <- glmer(y ~ offset(log(pop2021.x)) + 1 + (1 | `2013 code`), family = poisson,
        data = big_data3)
    b1 <- glmer(y ~ offset(log(pop2021.x)) + 1 + (1 | `2013 code`) + (1 | LOCATION_ID),
        family = poisson, data = big_data3)
    lrt.vec[i] <- as.numeric(2 * (logLik(b1) - logLik(b0)))
}
lrtstat <- as.numeric(2 * (logLik(mod6.0.1) - logLik(mod6.0.4)))
lrtstat
```

```
## [1] 432.9589
```

```
summary(lrt.vec)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##  0.0000  0.0000  0.0000  0.3817  0.2687  7.9651
```

```
phat <- mean(lrt.vec > lrtstat)
se_phat <- sqrt(phat * (1 - phat)/1000)
c(phat, se_phat)
```

```
## [1] 0 0
```

```
## 95% conf p-value in [0.115 +- .02]. We are 95% confident that the p-value is
## more than 0.05, so we will fail to reject H0, and conclude that LOCATION_ID as
## a separate RE is not significant when added to a model already containing 2013
## code.


# Test nested effect of LOCATIONID instead of RE?
y <- simulate(mod6.0.4)
lrt.vec <- numeric(1000)
set.seed(123)
for (i in 1:1000) {
    y <- unlist(simulate(mod6.0.4))
    b0 <- glmer(y ~ offset(log(pop2021.x)) + 1 + (1 | `2013 code`) + (1 | LOCATION_ID),
        family = poisson, data = big_data3)
    b1 <- glmer(y ~ offset(log(pop2021.x)) + 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID),
        family = poisson, data = big_data3)
    lrt.vec[i] <- as.numeric(2 * (logLik(b1) - logLik(b0)))
}
lrtstat <- as.numeric(2 * (logLik(mod6.0.5) - logLik(mod6.0.4)))
lrtstat
```

```
## [1] 432.9589
```

```
summary(lrt.vec)
```

```
##       Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
## -3.557e-09  0.000e+00  0.000e+00 -1.762e-12  0.000e+00  2.750e-09
```

```
phat <- mean(lrt.vec > lrtstat)
se_phat <- sqrt(phat * (1 - phat)/1000)
c(phat, se_phat)
```

```
## [1] 0 0
```

```
# P-value basically 0. Reject H0: sigma2_LID = 0

# we are going to keep nested effects of 2013code:Location_ID

mod6.1 <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + 1 + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID), family = poisson, data = big_data3)
summary(mod6.1)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + 1 + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID)
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    848.7    856.3   -421.4    842.7       89
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.64837 -0.34252  0.01253  0.28136  1.12117
##
## Random effects:
##  Groups                  Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.066472 0.25782
##  2013 code               (Intercept) 0.003688 0.06073
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept) -6.24597    0.04126  -151.4   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
mod6 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.x + pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases +
    `Older (65 plus).x` + olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y +
    all_doses_administered.y + `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y +
    ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x + COVID_TEST.x + all_doses_administered.x +
    fully_vaccinated.x + fully_vaccinated.y + RARELY * olderprop * TrmpProp, family = poisson,
    data = big_data3)
summary(mod6)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.x + pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY +
##     ALWAYS + prop_cases + `Older (65 plus).x` + olderprop + TrmpProp +
##     ClintProp + COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y +
##     `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y +
##     ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x +
##     COVID_TEST.x + all_doses_administered.x + fully_vaccinated.x +
##     fully_vaccinated.y + RARELY * olderprop * TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    846.2    931.9   -389.1    778.2       58
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
```

```
## -1.87755 -0.51254  0.04633  0.43334  1.59803
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.383e-02 1.544e-01
##  2013 code               (Intercept) 4.959e-10 2.227e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                               Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -8.665e+01  3.923e+01  -2.209  0.02719 *
## pop2021.x                   1.690e-06  6.216e-06   0.272  0.78573
## pop2021.y                   9.556e+00  3.280e+00   2.913  0.00357 **
## NEVER                       4.753e+01  3.495e+01   1.360  0.17383
## RARELY                     -2.677e+01  1.114e+02  -0.240  0.81004
## SOMETIMES                   4.638e+01  3.502e+01   1.325  0.18533
## FREQUENTLY                  4.723e+01  3.506e+01   1.347  0.17798
## ALWAYS                      4.696e+01  3.506e+01   1.340  0.18038
## prop_cases                  3.307e+01  1.699e+01   1.946  0.05164 .
## `Older (65 plus).x`         5.141e-05  4.462e-05   1.152  0.24922
## olderprop                   1.764e+01  4.928e+01   0.358  0.72043
## TrmpProp                    1.913e+00  2.772e+01   0.069  0.94496
## ClintProp                   1.833e+01  1.177e+01   1.558  0.11924
## COVID_COUNT.y              -3.257e+00  1.864e+00  -1.747  0.08057 .
## COVID_TEST.y                6.155e-01  3.889e-01   1.583  0.11350
## all_doses_administered.y   -3.226e-01  1.219e+00  -0.265  0.79125
## `Older (65 plus).y`        -6.159e+00  3.419e+00  -1.801  0.07168 .
## ClintVote.y                -2.060e+00  2.554e+00  -0.807  0.41983
## TrmpVote.y                  6.062e+00  1.029e+01   0.589  0.55575
## TotalVote.y                -4.184e+00  7.952e+00  -0.526  0.59876
## ClintVote.x                -1.385e-04  2.256e-04  -0.614  0.53907
## TrmpVote.x                 -1.529e-04  2.315e-04  -0.660  0.50911
## TotalVote.x                 1.334e-04  2.168e-04   0.615  0.53829
## COVID_COUNT.x              -2.490e-05  6.053e-05  -0.411  0.68083
## COVID_TEST.x               -1.398e-06  1.298e-05  -0.108  0.91419
## all_doses_administered.x   -2.228e-05  2.353e-05  -0.947  0.34385
## fully_vaccinated.x          3.600e-05  5.046e-05   0.713  0.47555
## fully_vaccinated.y          8.549e-01  1.145e+00   0.746  0.45547
## RARELY:olderprop            5.074e+02  5.946e+02   0.853  0.39351
## RARELY:TrmpProp             8.524e+01  1.544e+02   0.552  0.58103
## olderprop:TrmpProp          1.851e+01  7.559e+01   0.245  0.80660
## RARELY:olderprop:TrmpProp -6.134e+02  8.600e+02  -0.713  0.47574
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod6)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
```

```
##                              Chisq Df Pr(>Chisq)
## pop2021.x                   0.0739  1   0.785729
## pop2021.y                   8.4881  1   0.003575 **
## NEVER                       1.8496  1   0.173825
## RARELY                      2.0220  1   0.155035
## SOMETIMES                   1.7543  1   0.185333
## FREQUENTLY                  1.8144  1   0.177984
## ALWAYS                      1.7945  1   0.180377
## prop_cases                  3.7874  1   0.051640 .
## `Older (65 plus).x`         1.3277  1   0.249216
## olderprop                   4.0400  1   0.044433 *
## TrmpProp                    0.1187  1   0.730405
## ClintProp                   2.4273  1   0.119241
## COVID_COUNT.y               3.0533  1   0.080575 .
## COVID_TEST.y                2.5047  1   0.113504
## all_doses_administered.y    0.0701  1   0.791252
## `Older (65 plus).y`         3.2441  1   0.071683 .
## ClintVote.y                 0.6508  1   0.419830
## TrmpVote.y                  0.3471  1   0.555749
## TotalVote.y                 0.2769  1   0.598758
## ClintVote.x                 0.3773  1   0.539067
## TrmpVote.x                  0.4359  1   0.509111
## TotalVote.x                 0.3787  1   0.538286
## COVID_COUNT.x               0.1692  1   0.680829
## COVID_TEST.x                0.0116  1   0.914192
## all_doses_administered.x    0.8960  1   0.343847
## fully_vaccinated.x          0.5090  1   0.475553
## fully_vaccinated.y          0.5570  1   0.455472
## RARELY:olderprop            4.9243  1   0.026482 *
## RARELY:TrmpProp             2.7983  1   0.094366 .
## olderprop:TrmpProp          2.0994  1   0.147355
## RARELY:olderprop:TrmpProp   0.5086  1   0.475742
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod6, test = 'Chi')

# interaction term caused error in offset model. May try to add in later.
mod6.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
    prop_cases + `Older (65 plus).x` + olderprop + TrmpProp + ClintProp + COVID_COUNT.y +
    COVID_TEST.y + all_doses_administered.y + `Older (65 plus).y` + ClintVote.y +
    TrmpVote.y + TotalVote.y + ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x +
    COVID_TEST.x + all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y,
    family = poisson, data = big_data3)
summary(mod6.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES +
##     FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
##     olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y +
```

```
##     all_doses_administered.y + `Older (65 plus).y` + ClintVote.y +
##     TrmpVote.y + TotalVote.y + ClintVote.x + TrmpVote.x + TotalVote.x +
##     COVID_COUNT.x + COVID_TEST.x + all_doses_administered.x +
##     fully_vaccinated.x + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    848.7    919.4   -396.4    792.7       64
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.91723 -0.42815  0.01753  0.36205  1.62556
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 3.026e-02 1.739e-01
##  2013 code               (Intercept) 3.293e-10 1.815e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -6.300e+01  3.777e+01  -1.668   0.0953 .
## NEVER                       5.168e+01  3.765e+01   1.373   0.1698
## RARELY                      5.172e+01  3.783e+01   1.367   0.1716
## SOMETIMES                   5.121e+01  3.772e+01   1.357   0.1746
## FREQUENTLY                  5.202e+01  3.778e+01   1.377   0.1684
## ALWAYS                      5.159e+01  3.778e+01   1.366   0.1720
## prop_cases                  1.470e+01  1.506e+01   0.977   0.3288
## `Older (65 plus).x`        -6.935e-06  3.823e-05  -0.181   0.8561
## olderprop                  -1.052e+00  8.243e+00  -0.128   0.8984
## TrmpProp                   -9.372e-01  1.032e+01  -0.091   0.9276
## ClintProp                   1.124e+01  8.451e+00   1.330   0.1835
## COVID_COUNT.y              -1.335e+00  1.706e+00  -0.782   0.4341
## COVID_TEST.y                1.795e-01  3.767e-01   0.476   0.6338
## all_doses_administered.y -3.869e-01  1.217e+00  -0.318   0.7506
## `Older (65 plus).y`         1.638e+00  1.552e+00   1.055   0.2914
## ClintVote.y                -1.549e+00  1.776e+00  -0.872   0.3831
## TrmpVote.y                  4.903e+00  5.010e+00   0.979   0.3278
## TotalVote.y                -4.367e+00  3.643e+00  -1.199   0.2307
## ClintVote.x                -4.214e-05  1.941e-04  -0.217   0.8282
## TrmpVote.x                 -4.968e-05  1.987e-04  -0.250   0.8026
## TotalVote.x                 5.651e-05  1.853e-04   0.305   0.7604
## COVID_COUNT.x              -5.020e-06  6.038e-05  -0.083   0.9337
## COVID_TEST.x               -2.568e-07  1.249e-05  -0.021   0.9836
## all_doses_administered.x -9.867e-06  1.918e-05  -0.515   0.6069
## fully_vaccinated.x          8.833e-06  4.043e-05   0.218   0.8271
## fully_vaccinated.y          1.058e+00  1.146e+00   0.923   0.3559
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod6.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                            Chisq Df Pr(>Chisq)
## NEVER                     1.8845  1     0.1698
## RARELY                    1.8693  1     0.1716
## SOMETIMES                 1.8426  1     0.1746
## FREQUENTLY                1.8967  1     0.1684
## ALWAYS                    1.8651  1     0.1720
## prop_cases                0.9536  1     0.3288
## `Older (65 plus).x`       0.0329  1     0.8561
## olderprop                 0.0163  1     0.8984
## TrmpProp                  0.0083  1     0.9276
## ClintProp                 1.7689  1     0.1835
## COVID_COUNT.y             0.6119  1     0.4341
## COVID_TEST.y              0.2270  1     0.6338
## all_doses_administered.y 0.1010  1     0.7506
## `Older (65 plus).y`       1.1130  1     0.2914
## ClintVote.y               0.7608  1     0.3831
## TrmpVote.y                0.9577  1     0.3278
## TotalVote.y               1.4366  1     0.2307
## ClintVote.x               0.0471  1     0.8282
## TrmpVote.x                0.0625  1     0.8026
## TotalVote.x               0.0930  1     0.7604
## COVID_COUNT.x             0.0069  1     0.9337
## COVID_TEST.x              0.0004  1     0.9836
## all_doses_administered.x 0.2647  1     0.6069
## fully_vaccinated.x        0.0477  1     0.8271
## fully_vaccinated.y        0.8523  1     0.3559
```

```
# drop1(mod6.off, test = 'Chi')

# drop covidtest.x
mod7 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.x + pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases +
    `Older (65 plus).x` + olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y +
    all_doses_administered.y + `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y +
    ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x + all_doses_administered.x +
    fully_vaccinated.x + fully_vaccinated.y + RARELY * olderprop * TrmpProp, family = poisson,
    data = big_data3)
summary(mod7)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.x + pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY +
##     ALWAYS + prop_cases + `Older (65 plus).x` + olderprop + TrmpProp +
##     ClintProp + COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y +
##     `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y +
```

```
##     ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x +
##     all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y +
##     RARELY * olderprop * TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    844.2    927.4   -389.1    778.2       59
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.87197 -0.51011  0.04518  0.43388  1.59114
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.385e-02 1.544e-01
##  2013 code                (Intercept) 1.140e-09 3.377e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -8.738e+01  3.866e+01  -2.260  0.02382 *
## pop2021.x                   1.510e-06  6.028e-06   0.251  0.80218
## pop2021.y                   9.531e+00  3.273e+00   2.912  0.00359 **
## NEVER                       4.800e+01  3.469e+01   1.384  0.16647
## RARELY                     -2.164e+01  1.009e+02  -0.215  0.83014
## SOMETIMES                   4.685e+01  3.477e+01   1.348  0.17776
## FREQUENTLY                  4.771e+01  3.480e+01   1.371  0.17043
## ALWAYS                      4.744e+01  3.479e+01   1.363  0.17272
## prop_cases                  3.306e+01  1.699e+01   1.945  0.05173 .
## `Older (65 plus).x`         5.262e-05  4.342e-05   1.212  0.22555
## olderprop                   1.924e+01  4.700e+01   0.409  0.68227
## TrmpProp                    2.571e+00  2.704e+01   0.095  0.92425
## ClintProp                   1.796e+01  1.126e+01   1.595  0.11081
## COVID_COUNT.y              -3.235e+00  1.854e+00  -1.745  0.08095 .
## COVID_TEST.y                5.910e-01  3.143e-01   1.880  0.06006 .
## all_doses_administered.y   -3.034e-01  1.205e+00  -0.252  0.80126
## `Older (65 plus).y`        -6.140e+00  3.416e+00  -1.798  0.07225 .
## ClintVote.y                -2.003e+00  2.499e+00  -0.802  0.42282
## TrmpVote.y                  5.843e+00  1.009e+01   0.579  0.56243
## TotalVote.y                -4.019e+00  7.804e+00  -0.515  0.60651
## ClintVote.x                -1.280e-04  2.033e-04  -0.629  0.52907
## TrmpVote.x                 -1.416e-04  2.065e-04  -0.686  0.49297
## TotalVote.x                 1.228e-04  1.933e-04   0.635  0.52525
## COVID_COUNT.x              -3.000e-05  3.793e-05  -0.791  0.42901
## all_doses_administered.x   -2.268e-05  2.322e-05  -0.977  0.32863
## fully_vaccinated.x          3.675e-05  5.004e-05   0.735  0.46262
## fully_vaccinated.y          8.387e-01  1.136e+00   0.738  0.46038
## RARELY:olderprop            4.830e+02  5.500e+02   0.878  0.37988
## RARELY:TrmpProp             7.855e+01  1.416e+02   0.555  0.57906
## olderprop:TrmpProp          1.593e+01  7.172e+01   0.222  0.82425
## RARELY:olderprop:TrmpProp -5.782e+02  7.961e+02  -0.726  0.46761
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
```

```
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 4 (failure to converge in 10000 evaluations)
## boundary (singular) fit: see ?isSingular
## failure to converge in 10000 evaluations
```

```
Anova(mod7)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                              Chisq Df Pr(>Chisq)
## pop2021.x                   0.0628  1   0.802180
## pop2021.y                   8.4811  1   0.003589 **
## NEVER                       1.9144  1   0.166470
## RARELY                      2.1527  1   0.142321
## SOMETIMES                   1.8162  1   0.177761
## FREQUENTLY                  1.8791  1   0.170434
## ALWAYS                      1.8591  1   0.172725
## prop_cases                  3.7846  1   0.051727 .
## `Older (65 plus).x`         1.4687  1   0.225547
## olderprop                   3.9089  1   0.048030 *
## TrmpProp                    0.1299  1   0.718516
## ClintProp                   2.5427  1   0.110809
## COVID_COUNT.y               3.0457  1   0.080949 .
## COVID_TEST.y                3.5358  1   0.060059 .
## all_doses_administered.y    0.0634  1   0.801257
## `Older (65 plus).y`         3.2312  1   0.072247 .
## ClintVote.y                 0.6425  1   0.422820
## TrmpVote.y                  0.3355  1   0.562427
## TotalVote.y                 0.2653  1   0.606515
## ClintVote.x                 0.3962  1   0.529074
## TrmpVote.x                  0.4700  1   0.492974
## TotalVote.x                 0.4036  1   0.525251
## COVID_COUNT.x               0.6255  1   0.429007
## all_doses_administered.x    0.9543  1   0.328630
## fully_vaccinated.x          0.5395  1   0.462620
## fully_vaccinated.y          0.5450  1   0.460380
## RARELY:olderprop            4.9575  1   0.025978 *
## RARELY:TrmpProp             2.8441  1   0.091708 .
## olderprop:TrmpProp          2.2393  1   0.134544
## RARELY:olderprop:TrmpProp   0.5276  1   0.467605
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod7, test = 'Chi')

# drop alldosesadministered.y from mod7
mod8 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.x + pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases +
    `Older (65 plus).x` + olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y +
    `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y + ClintVote.x +
    TrmpVote.x + TotalVote.x + COVID_COUNT.x + all_doses_administered.x + fully_vaccinated.x +
    fully_vaccinated.y + RARELY * olderprop * TrmpProp, family = poisson, data = big_data3)
summary(mod8)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.x + pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY +
##     ALWAYS + prop_cases + `Older (65 plus).x` + olderprop + TrmpProp +
##     ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` +
##     ClintVote.y + TrmpVote.y + TotalVote.y + ClintVote.x + TrmpVote.x +
##     TotalVote.x + COVID_COUNT.x + all_doses_administered.x +
##     fully_vaccinated.x + fully_vaccinated.y + RARELY * olderprop *
##     TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    842.2    922.9   -389.1    778.2       60
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.88587 -0.53218  0.04568  0.43401  1.58989
##
## Random effects:
##  Groups                  Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.02394  0.1547
##  2013 code               (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)               -8.993e+01  3.734e+01  -2.408   0.0160 *
## pop2021.x                  1.110e-06  5.780e-06   0.192   0.8477
## pop2021.y                  9.721e+00  3.189e+00   3.049   0.0023 **
## NEVER                      4.953e+01  3.419e+01   1.449   0.1475
## RARELY                    -2.024e+01  1.008e+02  -0.201   0.8410
## SOMETIMES                  4.839e+01  3.427e+01   1.412   0.1580
## FREQUENTLY                 4.922e+01  3.432e+01   1.434   0.1515
## ALWAYS                     4.895e+01  3.431e+01   1.427   0.1537
## prop_cases                 3.270e+01  1.696e+01   1.928   0.0538 .
## `Older (65 plus).x`        5.433e-05  4.295e-05   1.265   0.2059
## olderprop                  1.971e+01  4.702e+01   0.419   0.6751
## TrmpProp                   2.901e+00  2.704e+01   0.107   0.9145
## ClintProp                  1.853e+01  1.105e+01   1.677   0.0936 .
## COVID_COUNT.y             -3.187e+00  1.846e+00  -1.726   0.0844 .
## COVID_TEST.y               5.791e-01  3.103e-01   1.867   0.0620 .
## `Older (65 plus).y`       -6.363e+00  3.304e+00  -1.926   0.0541 .
## ClintVote.y               -2.022e+00  2.501e+00  -0.808   0.4189
## TrmpVote.y                 5.850e+00  1.010e+01   0.579   0.5625
## TotalVote.y               -4.041e+00  7.814e+00  -0.517   0.6051
## ClintVote.x               -1.330e-04  2.026e-04  -0.656   0.5116
## TrmpVote.x                -1.468e-04  2.057e-04  -0.714   0.4753
## TotalVote.x                1.285e-04  1.921e-04   0.669   0.5034
## COVID_COUNT.x             -3.006e-05  3.798e-05  -0.791   0.4287
## all_doses_administered.x  -2.647e-05  1.794e-05  -1.475   0.1402
## fully_vaccinated.x         4.457e-05  3.962e-05   1.125   0.2606
```

```
## fully_vaccinated.y         5.596e-01  2.430e-01   2.303   0.0213 *
## RARELY:olderprop           4.846e+02  5.507e+02   0.880   0.3789
## RARELY:TrmpProp            7.912e+01  1.418e+02   0.558   0.5768
## olderprop:TrmpProp         1.704e+01  7.168e+01   0.238   0.8120
## RARELY:olderprop:TrmpProp -5.827e+02  7.969e+02  -0.731   0.4646
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod8)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                             Chisq Df Pr(>Chisq)
## pop2021.x                  0.0369  1   0.847717
## pop2021.y                  9.2939  1   0.002299 **
## NEVER                      2.0984  1   0.147454
## RARELY                     2.2625  1   0.132541
## SOMETIMES                  1.9935  1   0.157979
## FREQUENTLY                 2.0566  1   0.151546
## ALWAYS                     2.0352  1   0.153693
## prop_cases                 3.7189  1   0.053798 .
## `Older (65 plus).x`        1.6002  1   0.205869
## olderprop                  3.9336  1   0.047329 *
## TrmpProp                   0.0989  1   0.753129
## ClintProp                  2.8116  1   0.093583 .
## COVID_COUNT.y              2.9790  1   0.084351 .
## COVID_TEST.y               3.4843  1   0.061953 .
## `Older (65 plus).y`        3.7097  1   0.054097 .
## ClintVote.y                0.6534  1   0.418904
## TrmpVote.y                 0.3354  1   0.562522
## TotalVote.y                0.2674  1   0.605082
## ClintVote.x                0.4308  1   0.511579
## TrmpVote.x                 0.5097  1   0.475272
## TotalVote.x                0.4477  1   0.503410
## COVID_COUNT.x              0.6263  1   0.428711
## all_doses_administered.x   2.1760  1   0.140178
## fully_vaccinated.x         1.2655  1   0.260609
## fully_vaccinated.y         5.3050  1   0.021264 *
## RARELY:olderprop           4.8716  1   0.027303 *
## RARELY:TrmpProp            2.9146  1   0.087783 .
## olderprop:TrmpProp         2.1670  1   0.141003
## RARELY:olderprop:TrmpProp  0.5347  1   0.464639
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod8, test = 'Chi')

# drop pop2021.x from mod8
```

```
mod9 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
    olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` +
    ClintVote.y + TrmpVote.y + TotalVote.y + ClintVote.x + TrmpVote.x + TotalVote.x +
    COVID_COUNT.x + all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y +
    RARELY * olderprop * TrmpProp, family = poisson, data = big_data3)
summary(mod9)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
##     prop_cases + `Older (65 plus).x` + olderprop + TrmpProp +
##     ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` +
##     ClintVote.y + TrmpVote.y + TotalVote.y + ClintVote.x + TrmpVote.x +
##     TotalVote.x + COVID_COUNT.x + all_doses_administered.x +
##     fully_vaccinated.x + fully_vaccinated.y + RARELY * olderprop *
##     TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    840.3    918.4   -389.1    778.3       61
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.89443 -0.53822  0.04067  0.43310  1.58836
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.02392  0.1547
##  2013 code                (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -9.062e+01  3.716e+01  -2.438  0.01475 *
## pop2021.y                   9.794e+00  3.165e+00   3.095  0.00197 **
## NEVER                       4.937e+01  3.417e+01   1.445  0.14853
## RARELY                     -1.752e+01  9.982e+01  -0.176  0.86067
## SOMETIMES                   4.822e+01  3.425e+01   1.408  0.15918
## FREQUENTLY                  4.906e+01  3.430e+01   1.430  0.15268
## ALWAYS                      4.879e+01  3.429e+01   1.423  0.15481
## prop_cases                  3.201e+01  1.654e+01   1.936  0.05292 .
## `Older (65 plus).x`         5.502e-05  4.276e-05   1.287  0.19816
## olderprop                   2.071e+01  4.673e+01   0.443  0.65762
## TrmpProp                    4.236e+00  2.611e+01   0.162  0.87113
## ClintProp                   1.776e+01  1.029e+01   1.725  0.08445 .
## COVID_COUNT.y              -3.129e+00  1.820e+00  -1.719  0.08557 .
## COVID_TEST.y                5.751e-01  3.098e-01   1.856  0.06339 .
## `Older (65 plus).y`        -6.461e+00  3.261e+00  -1.981  0.04756 *
## ClintVote.y                -1.819e+00  2.260e+00  -0.805  0.42092
```

```
## TrmpVote.y                 5.098e+00  9.289e+00   0.549  0.58313
## TotalVote.y               -3.522e+00  7.317e+00  -0.481  0.63031
## ClintVote.x               -1.428e-04  1.957e-04  -0.730  0.46542
## TrmpVote.x                -1.574e-04  1.980e-04  -0.795  0.42664
## TotalVote.x                1.396e-04  1.831e-04   0.762  0.44598
## COVID_COUNT.x             -2.534e-05  2.899e-05  -0.874  0.38214
## all_doses_administered.x  -2.791e-05  1.601e-05  -1.743  0.08138 .
## fully_vaccinated.x         4.783e-05  3.520e-05   1.359  0.17421
## fully_vaccinated.y         5.592e-01  2.429e-01   2.302  0.02132 *
## RARELY:olderprop           4.728e+02  5.471e+02   0.864  0.38746
## RARELY:TrmpProp            7.544e+01  1.404e+02   0.537  0.59114
## olderprop:TrmpProp         1.659e+01  7.163e+01   0.232  0.81684
## RARELY:olderprop:TrmpProp -5.681e+02  7.930e+02  -0.716  0.47380
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod9)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                             Chisq Df Pr(>Chisq)
## pop2021.y                  9.5774  1    0.00197 **
## NEVER                      2.0873  1    0.14853
## RARELY                     2.2875  1    0.13042
## SOMETIMES                  1.9820  1    0.15918
## FREQUENTLY                 2.0453  1    0.15268
## ALWAYS                     2.0242  1    0.15481
## prop_cases                 3.7465  1    0.05292 .
## `Older (65 plus).x`        1.6559  1    0.19816
## olderprop                  3.3747  1    0.06620 .
## TrmpProp                   0.0023  1    0.96168
## ClintProp                  2.9771  1    0.08445 .
## COVID_COUNT.y              2.9558  1    0.08557 .
## COVID_TEST.y               3.4463  1    0.06339 .
## `Older (65 plus).y`        3.9253  1    0.04756 *
## ClintVote.y                0.6478  1    0.42092
## TrmpVote.y                 0.3012  1    0.58313
## TotalVote.y                0.2316  1    0.63031
## ClintVote.x                0.5328  1    0.46542
## TrmpVote.x                 0.6320  1    0.42664
## TotalVote.x                0.5808  1    0.44598
## COVID_COUNT.x              0.7638  1    0.38214
## all_doses_administered.x   3.0372  1    0.08138 .
## fully_vaccinated.x         1.8464  1    0.17421
## fully_vaccinated.y         5.3008  1    0.02132 *
## RARELY:olderprop           5.0565  1    0.02453 *
## RARELY:TrmpProp            3.6751  1    0.05523 .
## olderprop:TrmpProp         2.1931  1    0.13863
## RARELY:olderprop:TrmpProp 0.5131  1    0.47380
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod9, test = 'Chi')

# drop totalvote.y
mod10 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
    olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` +
    ClintVote.y + TrmpVote.y + ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x +
    all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y + RARELY *
    olderprop * TrmpProp, family = poisson, data = big_data3)
summary(mod10)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
##     prop_cases + `Older (65 plus).x` + olderprop + TrmpProp +
##     ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` +
##     ClintVote.y + TrmpVote.y + ClintVote.x + TrmpVote.x + TotalVote.x +
##     COVID_COUNT.x + all_doses_administered.x + fully_vaccinated.x +
##     fully_vaccinated.y + RARELY * olderprop * TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    838.5    914.2   -389.2    778.5       62
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.9058 -0.5315  0.0374  0.4309  1.5683
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.398e-02 1.548e-01
##  2013 code               (Intercept) 8.200e-09 9.055e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)               -9.448e+01  3.631e+01  -2.602  0.00928 **
## pop2021.y                  9.287e+00  2.986e+00   3.111  0.00187 **
## NEVER                      4.712e+01  3.388e+01   1.391  0.16431
## RARELY                     1.542e+01  7.267e+01   0.212  0.83195
## SOMETIMES                  4.597e+01  3.396e+01   1.354  0.17585
## FREQUENTLY                 4.683e+01  3.402e+01   1.377  0.16863
## ALWAYS                     4.659e+01  3.401e+01   1.370  0.17083
## prop_cases                 3.097e+01  1.641e+01   1.887  0.05910 .
## `Older (65 plus).x`        4.685e-05  3.915e-05   1.197  0.23140
## olderprop                  3.830e+01  2.908e+01   1.317  0.18773
## TrmpProp                   1.574e+01  1.051e+01   1.498  0.13414
## ClintProp                  1.397e+01  6.583e+00   2.122  0.03383 *
```

```
## COVID_COUNT.y             -3.038e+00  1.811e+00  -1.677  0.09351 .
## COVID_TEST.y               5.946e-01  3.075e-01   1.933  0.05318 .
## `Older (65 plus).y`       -6.027e+00  3.135e+00  -1.923  0.05454 .
## ClintVote.y               -8.966e-01  1.197e+00  -0.749  0.45383
## TrmpVote.y                 6.641e-01  1.186e+00   0.560  0.57544
## ClintVote.x               -1.343e-04  1.951e-04  -0.688  0.49119
## TrmpVote.x                -1.476e-04  1.972e-04  -0.749  0.45413
## TotalVote.x                1.302e-04  1.823e-04   0.714  0.47511
## COVID_COUNT.x             -2.031e-05  2.695e-05  -0.754  0.45098
## all_doses_administered.x  -3.061e-05  1.504e-05  -2.035  0.04183 *
## fully_vaccinated.x         5.692e-05  2.986e-05   1.906  0.05664 .
## fully_vaccinated.y         5.230e-01  2.308e-01   2.266  0.02344 *
## RARELY:olderprop           2.823e+02  3.779e+02   0.747  0.45500
## RARELY:TrmpProp            2.495e+01  9.324e+01   0.268  0.78900
## olderprop:TrmpProp        -1.170e+01  4.080e+01  -0.287  0.77424
## RARELY:olderprop:TrmpProp -2.945e+02  5.526e+02  -0.533  0.59411
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod10)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                            Chisq Df Pr(>Chisq)
## pop2021.y                 9.6762  1   0.001867 **
## NEVER                     1.9341  1   0.164314
## RARELY                    2.1628  1   0.141384
## SOMETIMES                 1.8324  1   0.175846
## FREQUENTLY                1.8951  1   0.168628
## ALWAYS                    1.8757  1   0.170825
## prop_cases                3.5626  1   0.059096 .
## `Older (65 plus).x`       1.4322  1   0.231398
## olderprop                 3.0242  1   0.082029 .
## TrmpProp                  3.7015  1   0.054363 .
## ClintProp                 4.5032  1   0.033831 *
## COVID_COUNT.y             2.8129  1   0.093509 .
## COVID_TEST.y              3.7382  1   0.053182 .
## `Older (65 plus).y`       3.6961  1   0.054541 .
## ClintVote.y               0.5611  1   0.453830
## TrmpVote.y                0.3137  1   0.575437
## ClintVote.x               0.4739  1   0.491187
## TrmpVote.x                0.5603  1   0.454134
## TotalVote.x               0.5101  1   0.475113
## COVID_COUNT.x             0.5682  1   0.450975
## all_doses_administered.x  4.1420  1   0.041831 *
## fully_vaccinated.x        3.6330  1   0.056643 .
## fully_vaccinated.y        5.1354  1   0.023443 *
## RARELY:olderprop          5.1935  1   0.022672 *
## RARELY:TrmpProp           4.9225  1   0.026509 *
```

```
## olderprop:TrmpProp        3.6609  1   0.055704 .
## RARELY:olderprop:TrmpProp 0.2840  1   0.594105
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod10, test = 'Chi')

## drop 3-way interraction
mod11 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
    olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` +
    ClintVote.y + TrmpVote.y + ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x +
    all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y + RARELY *
    olderprop * TrmpProp - RARELY:olderprop:TrmpProp, family = poisson, data = big_data3)
summary(mod11)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
##     prop_cases + `Older (65 plus).x` + olderprop + TrmpProp +
##     ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` +
##     ClintVote.y + TrmpVote.y + ClintVote.x + TrmpVote.x + TotalVote.x +
##     COVID_COUNT.x + all_doses_administered.x + fully_vaccinated.x +
##     fully_vaccinated.y + RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    836.8    909.9   -389.4    778.8       63
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.96331 -0.51427  0.05787  0.39877  1.51386
##
## Random effects:
##  Groups                  Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.408e-02 1.552e-01
##  2013 code               (Intercept) 5.518e-09 7.428e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                            Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -9.700e+01  3.606e+01  -2.690  0.00714 **
## pop2021.y                 9.049e+00  2.955e+00   3.062  0.00220 **
## NEVER                     4.751e+01  3.392e+01   1.401  0.16131
## RARELY                    4.931e+01  3.503e+01   1.408  0.15916
## SOMETIMES                 4.635e+01  3.400e+01   1.363  0.17284
## FREQUENTLY                4.728e+01  3.406e+01   1.388  0.16510
## ALWAYS                    4.704e+01  3.406e+01   1.381  0.16721
## prop_cases                3.359e+01  1.566e+01   2.145  0.03198 *
## `Older (65 plus).x`       3.905e-05  3.645e-05   1.071  0.28398
## olderprop                 4.888e+01  2.124e+01   2.301  0.02140 *
```

```
## TrmpProp                  1.925e+01  8.194e+00   2.349  0.01880 *
## ClintProp                 1.419e+01  6.578e+00   2.158  0.03096 *
## COVID_COUNT.y            -3.356e+00  1.711e+00  -1.961  0.04989 *
## COVID_TEST.y              6.450e-01  2.924e-01   2.206  0.02741 *
## `Older (65 plus).y`      -5.441e+00  2.938e+00  -1.852  0.06405 .
## ClintVote.y              -9.106e-01  1.198e+00  -0.760  0.44736
## TrmpVote.y                5.957e-01  1.180e+00   0.505  0.61373
## ClintVote.x              -1.296e-04  1.953e-04  -0.664  0.50682
## TrmpVote.x               -1.436e-04  1.974e-04  -0.728  0.46686
## TotalVote.x               1.292e-04  1.826e-04   0.708  0.47922
## COVID_COUNT.x            -1.927e-05  2.694e-05  -0.715  0.47448
## all_doses_administered.x -3.154e-05  1.496e-05  -2.108  0.03503 *
## fully_vaccinated.x        5.769e-05  2.988e-05   1.931  0.05352 .
## fully_vaccinated.y        5.398e-01  2.285e-01   2.362  0.01816 *
## RARELY:olderprop          8.209e+01  3.596e+01   2.283  0.02243 *
## RARELY:TrmpProp          -2.439e+01  1.101e+01  -2.215  0.02677 *
## olderprop:TrmpProp       -3.156e+01  1.653e+01  -1.909  0.05628 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod11)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                            Chisq Df Pr(>Chisq)
## pop2021.y                 9.3763  1   0.002198 **
## NEVER                     1.9619  1   0.161310
## RARELY                    2.1541  1   0.142194
## SOMETIMES                 1.8581  1   0.172840
## FREQUENTLY                1.9269  1   0.165096
## ALWAYS                    1.9077  1   0.167214
## prop_cases                4.5993  1   0.031985 *
## `Older (65 plus).x`       1.1480  1   0.283976
## olderprop                 3.0266  1   0.081909 .
## TrmpProp                  3.6948  1   0.054583 .
## ClintProp                 4.6552  1   0.030960 *
## COVID_COUNT.y             3.8452  1   0.049890 *
## COVID_TEST.y              4.8645  1   0.027415 *
## `Older (65 plus).y`       3.4292  1   0.064052 .
## ClintVote.y               0.5773  1   0.447363
## TrmpVote.y                0.2548  1   0.613735
## ClintVote.x               0.4406  1   0.506820
## TrmpVote.x                0.5294  1   0.466864
## TotalVote.x               0.5006  1   0.479221
## COVID_COUNT.x             0.5115  1   0.474479
## all_doses_administered.x 4.4438  1   0.035027 *
## fully_vaccinated.x        3.7277  1   0.053516 .
## fully_vaccinated.y        5.5804  1   0.018163 *
## RARELY:olderprop          5.2120  1   0.022432 *
```

```
## RARELY:TrmpProp          4.9054  1   0.026773 *
## olderprop:TrmpProp       3.6436  1   0.056284 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod11, test = 'Chi')

# drop TrmpVote.x
mod12 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
    olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` +
    ClintVote.y + TrmpVote.y + ClintVote.x + TotalVote.x + COVID_COUNT.x + all_doses_administered.x +
    fully_vaccinated.x + fully_vaccinated.y + RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
    family = poisson, data = big_data3)
summary(mod12)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
##     prop_cases + `Older (65 plus).x` + olderprop + TrmpProp +
##     ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` +
##     ClintVote.y + TrmpVote.y + ClintVote.x + TotalVote.x + COVID_COUNT.x +
##     all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y +
##     RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    835.3    905.9   -389.7    779.3       64
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.94255 -0.52111  0.05612  0.41777  1.44407
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.450e-02 1.565e-01
##  2013 code               (Intercept) 4.607e-09 6.787e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                            Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -9.497e+01  3.616e+01  -2.627  0.00862 **
## pop2021.y                 8.578e+00  2.895e+00   2.963  0.00305 **
## NEVER                     4.993e+01  3.396e+01   1.470  0.14144
## RARELY                    5.482e+01  3.440e+01   1.594  0.11104
## SOMETIMES                 4.880e+01  3.403e+01   1.434  0.15157
## FREQUENTLY                4.970e+01  3.409e+01   1.458  0.14490
## ALWAYS                    4.947e+01  3.409e+01   1.451  0.14673
## prop_cases                3.146e+01  1.547e+01   2.034  0.04199 *
## `Older (65 plus).x`       2.147e-05  2.727e-05   0.787  0.43105
## olderprop                 4.558e+01  2.085e+01   2.187  0.02876 *
```

```
## TrmpProp                  1.522e+01  6.057e+00   2.512  0.01200 *
## ClintProp                 1.147e+01  5.421e+00   2.116  0.03433 *
## COVID_COUNT.y            -3.152e+00  1.698e+00  -1.857  0.06338 .
## COVID_TEST.y              6.138e-01  2.908e-01   2.111  0.03479 *
## `Older (65 plus).y`      -4.998e+00  2.886e+00  -1.732  0.08331 .
## ClintVote.y              -1.122e+00  1.171e+00  -0.958  0.33802
## TrmpVote.y                7.061e-01  1.178e+00   0.600  0.54882
## ClintVote.x               1.220e-05  1.046e-05   1.166  0.24346
## TotalVote.x              -3.201e-06  1.454e-05  -0.220  0.82570
## COVID_COUNT.x            -1.497e-05  2.638e-05  -0.567  0.57044
## all_doses_administered.x -3.008e-05  1.492e-05  -2.016  0.04375 *
## fully_vaccinated.x        5.718e-05  3.006e-05   1.902  0.05717 .
## fully_vaccinated.y        5.244e-01  2.288e-01   2.292  0.02193 *
## RARELY:olderprop          7.752e+01  3.561e+01   2.177  0.02948 *
## RARELY:TrmpProp          -2.765e+01  1.012e+01  -2.732  0.00630 **
## olderprop:TrmpProp       -2.822e+01  1.597e+01  -1.766  0.07732 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod12)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                            Chisq Df Pr(>Chisq)
## pop2021.y                 8.7767  1   0.003051 **
## NEVER                     2.1622  1   0.141444
## RARELY                    2.6689  1   0.102327
## SOMETIMES                 2.0564  1   0.151568
## FREQUENTLY                2.1252  1   0.144896
## ALWAYS                    2.1059  1   0.146727
## prop_cases                4.1357  1   0.041987 *
## `Older (65 plus).x`       0.6200  1   0.431055
## olderprop                 3.0557  1   0.080452 .
## TrmpProp                  2.0542  1   0.151787
## ClintProp                 4.4783  1   0.034327 *
## COVID_COUNT.y             3.4467  1   0.063378 .
## COVID_TEST.y              4.4557  1   0.034786 *
## `Older (65 plus).y`       2.9991  1   0.083310 .
## ClintVote.y               0.9179  1   0.338022
## TrmpVote.y                0.3594  1   0.548824
## ClintVote.x               1.3604  1   0.243464
## TotalVote.x               0.0485  1   0.825701
## COVID_COUNT.x             0.3219  1   0.570444
## all_doses_administered.x 4.0662  1   0.043749 *
## fully_vaccinated.x        3.6176  1   0.057171 .
## fully_vaccinated.y        5.2512  1   0.021931 *
## RARELY:olderprop          4.7396  1   0.029475 *
## RARELY:TrmpProp           7.4629  1   0.006298 **
## olderprop:TrmpProp        3.1204  1   0.077315 .
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod12, test = 'Chi')

# drop totalvote.x
mod13 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
    olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` +
    ClintVote.y + TrmpVote.y + ClintVote.x + COVID_COUNT.x + all_doses_administered.x +
    fully_vaccinated.x + fully_vaccinated.y + RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
    family = poisson, data = big_data3)
summary(mod13)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
##     prop_cases + `Older (65 plus).x` + olderprop + TrmpProp +
##     ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` +
##     ClintVote.y + TrmpVote.y + ClintVote.x + COVID_COUNT.x +
##     all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y +
##     RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    833.4    901.4   -389.7    779.4       65
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.94079 -0.51739  0.05371  0.41847  1.46424
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.0245   0.1565
##  2013 code               (Intercept) 0.0000   0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -9.208e+01  3.377e+01  -2.727  0.00639 **
## pop2021.y                 8.499e+00  2.873e+00   2.959  0.00309 **
## NEVER                     4.760e+01  3.231e+01   1.473  0.14076
## RARELY                    5.222e+01  3.229e+01   1.617  0.10580
## SOMETIMES                 4.646e+01  3.238e+01   1.435  0.15132
## FREQUENTLY                4.734e+01  3.242e+01   1.460  0.14420
## ALWAYS                    4.710e+01  3.240e+01   1.454  0.14602
## prop_cases                3.153e+01  1.547e+01   2.038  0.04151 *
## `Older (65 plus).x`       1.775e-05  2.113e-05   0.840  0.40085
## olderprop                 4.476e+01  2.052e+01   2.181  0.02920 *
## TrmpProp                  1.472e+01  5.635e+00   2.613  0.00897 **
## ClintProp                 1.153e+01  5.417e+00   2.128  0.03334 *
```

```
## COVID_COUNT.y            -3.158e+00  1.698e+00  -1.860  0.06288 .
## COVID_TEST.y              6.030e-01  2.865e-01   2.104  0.03535 *
## `Older (65 plus).y`      -4.874e+00  2.832e+00  -1.721  0.08519 .
## ClintVote.y              -1.205e+00  1.111e+00  -1.084  0.27817
## TrmpVote.y                7.279e-01  1.174e+00   0.620  0.53511
## ClintVote.x               1.035e-05  6.320e-06   1.638  0.10134
## COVID_COUNT.x            -1.257e-05  2.379e-05  -0.528  0.59722
## all_doses_administered.x -3.092e-05  1.442e-05  -2.145  0.03198 *
## fully_vaccinated.x        5.682e-05  3.001e-05   1.893  0.05830 .
## fully_vaccinated.y        5.509e-01  1.991e-01   2.767  0.00566 **
## RARELY:olderprop          7.688e+01  3.555e+01   2.163  0.03056 *
## RARELY:TrmpProp          -2.721e+01  9.901e+00  -2.748  0.00599 **
## olderprop:TrmpProp       -2.758e+01  1.574e+01  -1.753  0.07967 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod13)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                           Chisq Df Pr(>Chisq)
## pop2021.y                8.7528  1   0.003091 **
## NEVER                    2.1696  1   0.140764
## RARELY                   3.4468  1   0.063373 .
## SOMETIMES                2.0589  1   0.151318
## FREQUENTLY               2.1326  1   0.144195
## ALWAYS                   2.1134  1   0.146017
## prop_cases               4.1553  1   0.041505 *
## `Older (65 plus).x`      0.7058  1   0.400846
## olderprop                3.1493  1   0.075961 .
## TrmpProp                 3.0282  1   0.081828 .
## ClintProp                4.5280  1   0.033344 *
## COVID_COUNT.y            3.4597  1   0.062882 .
## COVID_TEST.y             4.4284  1   0.035346 *
## `Older (65 plus).y`      2.9630  1   0.085192 .
## ClintVote.y              1.1760  1   0.278172
## TrmpVote.y               0.3847  1   0.535106
## ClintVote.x              2.6843  1   0.101339
## COVID_COUNT.x            0.2792  1   0.597222
## all_doses_administered.x 4.5997  1   0.031978 *
## fully_vaccinated.x       3.5850  1   0.058304 .
## fully_vaccinated.y       7.6555  1   0.005660 **
## RARELY:olderprop         4.6777  1   0.030557 *
## RARELY:TrmpProp          7.5542  1   0.005987 **
## olderprop:TrmpProp       3.0717  1   0.079668 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
# drop1(mod13, test = 'Chi')

# drop covidcount.x
mod14 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
    olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` +
    ClintVote.y + TrmpVote.y + ClintVote.x + all_doses_administered.x + fully_vaccinated.x +
    fully_vaccinated.y + RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp,
    family = poisson, data = big_data3)
summary(mod14)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
##     prop_cases + `Older (65 plus).x` + olderprop + TrmpProp +
##     ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` +
##     ClintVote.y + TrmpVote.y + ClintVote.x + all_doses_administered.x +
##     fully_vaccinated.x + fully_vaccinated.y + RARELY * olderprop *
##     TrmpProp - RARELY:olderprop:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    831.6    897.2   -389.8    779.6       66
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.94610 -0.52130  0.06104  0.39567  1.42571
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.456e-02 0.1567195
##  2013 code               (Intercept) 5.919e-08 0.0002433
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                            Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -8.878e+01  3.319e+01  -2.675  0.00747 **
## pop2021.y                 7.997e+00  2.705e+00   2.956  0.00312 **
## NEVER                     4.552e+01  3.209e+01   1.418  0.15610
## RARELY                    4.969e+01  3.195e+01   1.555  0.11991
## SOMETIMES                 4.441e+01  3.216e+01   1.381  0.16738
## FREQUENTLY                4.522e+01  3.219e+01   1.405  0.16003
## ALWAYS                    4.500e+01  3.217e+01   1.399  0.16195
## prop_cases                3.145e+01  1.548e+01   2.031  0.04222 *
## `Older (65 plus).x`       1.014e-05  1.544e-05   0.656  0.51152
## olderprop                 4.289e+01  2.020e+01   2.124  0.03371 *
## TrmpProp                  1.459e+01  5.634e+00   2.589  0.00963 **
## ClintProp                 1.162e+01  5.416e+00   2.145  0.03191 *
## COVID_COUNT.y            -3.238e+00  1.692e+00  -1.914  0.05563 .
## COVID_TEST.y              6.022e-01  2.868e-01   2.099  0.03579 *
```

```
## `Older (65 plus).y`      -4.335e+00  2.634e+00  -1.646  0.09976 .
## ClintVote.y              -1.293e+00  1.099e+00  -1.176  0.23959
## TrmpVote.y                8.551e-01  1.150e+00   0.744  0.45701
## ClintVote.x               1.014e-05  6.312e-06   1.607  0.10809
## all_doses_administered.x -2.842e-05  1.356e-05  -2.095  0.03614 *
## fully_vaccinated.x        5.031e-05  2.721e-05   1.849  0.06447 .
## fully_vaccinated.y        5.701e-01  1.951e-01   2.922  0.00347 **
## RARELY:olderprop          8.028e+01  3.501e+01   2.293  0.02185 *
## RARELY:TrmpProp          -2.756e+01  9.886e+00  -2.787  0.00531 **
## olderprop:TrmpProp       -2.919e+01  1.545e+01  -1.889  0.05883 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## unable to evaluate scaled gradient
## Model failed to converge: degenerate  Hessian with 1 negative eigenvalues
```

```
Anova(mod14)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                           Chisq Df Pr(>Chisq)
## pop2021.y                8.7368  1   0.003119 **
## NEVER                    2.0116  1   0.156103
## RARELY                   3.0618  1   0.080154 .
## SOMETIMES                1.9063  1   0.167380
## FREQUENTLY               1.9739  1   0.160032
## ALWAYS                   1.9560  1   0.161945
## prop_cases               4.1262  1   0.042224 *
## `Older (65 plus).x`      0.4309  1   0.511524
## olderprop                1.8211  1   0.177187
## TrmpProp                 2.4656  1   0.116364
## ClintProp                4.6031  1   0.031914 *
## COVID_COUNT.y            3.6630  1   0.055635 .
## COVID_TEST.y             4.4073  1   0.035785 *
## `Older (65 plus).y`      2.7093  1   0.099763 .
## ClintVote.y              1.3830  1   0.239587
## TrmpVote.y               0.5532  1   0.457009
## ClintVote.x              2.5819  1   0.108091
## all_doses_administered.x 4.3903  1   0.036143 *
## fully_vaccinated.x       3.4186  1   0.064467 .
## fully_vaccinated.y       8.5407  1   0.003473 **
## RARELY:olderprop         5.2574  1   0.021854 *
## RARELY:TrmpProp          7.7700  1   0.005312 **
## olderprop:TrmpProp       3.5701  1   0.058827 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod14, test = 'Chi')

# drop older.x
```

```r
mod15 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + olderprop +
    TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` + ClintVote.y +
    TrmpVote.y + ClintVote.x + all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y +
    RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp, family = poisson,
    data = big_data3)
summary(mod15)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
##     prop_cases + olderprop + TrmpProp + ClintProp + COVID_COUNT.y +
##     COVID_TEST.y + `Older (65 plus).y` + ClintVote.y + TrmpVote.y +
##     ClintVote.x + all_doses_administered.x + fully_vaccinated.x +
##     fully_vaccinated.y + RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    830.0    893.1   -390.0    780.0       67
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.93879 -0.51465  0.06047  0.40525  1.44624
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.485e-02 1.576e-01
##  2013 code                (Intercept) 1.504e-10 1.227e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -9.115e+01  3.313e+01  -2.751  0.00593 **
## pop2021.y                   7.355e+00  2.526e+00   2.911  0.00360 **
## NEVER                       4.814e+01  3.196e+01   1.506  0.13202
## RARELY                      5.423e+01  3.131e+01   1.732  0.08332 .
## SOMETIMES                   4.710e+01  3.202e+01   1.471  0.14133
## FREQUENTLY                  4.797e+01  3.204e+01   1.497  0.13427
## ALWAYS                      4.772e+01  3.202e+01   1.490  0.13616
## prop_cases                  2.988e+01  1.535e+01   1.946  0.05163 .
## olderprop                   4.286e+01  2.027e+01   2.114  0.03452 *
## TrmpProp                    1.590e+01  5.292e+00   3.004  0.00267 **
## ClintProp                   1.238e+01  5.318e+00   2.328  0.01993 *
## COVID_COUNT.y              -3.052e+00  1.674e+00  -1.823  0.06834 .
## COVID_TEST.y                5.702e-01  2.837e-01   2.010  0.04448 *
## `Older (65 plus).y`        -3.724e+00  2.468e+00  -1.509  0.13134
## ClintVote.y                -1.309e+00  1.103e+00  -1.186  0.23548
## TrmpVote.y                  7.963e-01  1.150e+00   0.692  0.48887
## ClintVote.x                 1.281e-05  4.906e-06   2.611  0.00902 **
## all_doses_administered.x -2.417e-05  1.196e-05  -2.021  0.04327 *
```

```
## fully_vaccinated.x        4.342e-05  2.522e-05   1.721  0.08517 .
## fully_vaccinated.y        5.623e-01  1.955e-01   2.876  0.00402 **
## RARELY:olderprop          7.261e+01  3.309e+01   2.194  0.02820 *
## RARELY:TrmpProp          -2.802e+01  9.907e+00  -2.829  0.00467 **
## olderprop:TrmpProp       -3.202e+01  1.488e+01  -2.153  0.03135 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod15)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                            Chisq Df Pr(>Chisq)
## pop2021.y                 8.4762  1   0.003598 **
## NEVER                     2.2686  1   0.132022
## RARELY                    3.3599  1   0.066803 .
## SOMETIMES                 2.1634  1   0.141334
## FREQUENTLY                2.2424  1   0.134272
## ALWAYS                    2.2209  1   0.136157
## prop_cases                3.7879  1   0.051626 .
## olderprop                 1.6236  1   0.202591
## TrmpProp                  4.0667  1   0.043737 *
## ClintProp                 5.4184  1   0.019925 *
## COVID_COUNT.y             3.3225  1   0.068338 .
## COVID_TEST.y              4.0384  1   0.044477 *
## `Older (65 plus).y`       2.2766  1   0.131336
## ClintVote.y               1.4074  1   0.235482
## TrmpVote.y                0.4790  1   0.488869
## ClintVote.x               6.8188  1   0.009020 **
## all_doses_administered.x 4.0849  1   0.043268 *
## fully_vaccinated.x        2.9633  1   0.085173 .
## fully_vaccinated.y        8.2741  1   0.004021 **
## RARELY:olderprop          4.8156  1   0.028203 *
## RARELY:TrmpProp           8.0016  1   0.004673 **
## olderprop:TrmpProp        4.6338  1   0.031348 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod15, test = 'Chi')

# drop Trmpvote.y
mod16 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + olderprop +
    TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` + ClintVote.y +
    ClintVote.x + all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y +
    RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp, family = poisson,
    data = big_data3)
summary(mod16)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
##     prop_cases + olderprop + TrmpProp + ClintProp + COVID_COUNT.y +
##     COVID_TEST.y + `Older (65 plus).y` + ClintVote.y + ClintVote.x +
##     all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y +
##     RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    828.5    889.1   -390.3    780.5       68
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.96629 -0.52844  0.06225  0.41572  1.42526
##
## Random effects:
##  Groups                  Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.487e-02 0.1576968
##  2013 code               (Intercept) 1.820e-07 0.0004266
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -8.964e+01  3.307e+01  -2.711  0.00672 **
## pop2021.y                 6.907e+00  2.444e+00   2.826  0.00471 **
## NEVER                     4.857e+01  3.197e+01   1.519  0.12869
## RARELY                    5.334e+01  3.131e+01   1.704  0.08843 .
## SOMETIMES                 4.757e+01  3.203e+01   1.485  0.13745
## FREQUENTLY                4.845e+01  3.204e+01   1.512  0.13050
## ALWAYS                    4.825e+01  3.203e+01   1.506  0.13198
## prop_cases                2.971e+01  1.536e+01   1.935  0.05303 .
## olderprop                 3.805e+01  1.905e+01   1.997  0.04580 *
## TrmpProp                  1.674e+01  5.151e+00   3.251  0.00115 **
## ClintProp                 1.013e+01  4.211e+00   2.405  0.01617 *
## COVID_COUNT.y            -3.071e+00  1.675e+00  -1.834  0.06668 .
## COVID_TEST.y              5.697e-01  2.838e-01   2.008  0.04467 *
## `Older (65 plus).y`      -3.210e+00  2.355e+00  -1.363  0.17289
## ClintVote.y              -5.764e-01  3.062e-01  -1.883  0.05975 .
## ClintVote.x               1.367e-05  4.739e-06   2.884  0.00393 **
## all_doses_administered.x -2.174e-05  1.145e-05  -1.898  0.05768 .
## fully_vaccinated.x        3.748e-05  2.376e-05   1.578  0.11468
## fully_vaccinated.y        5.834e-01  1.929e-01   3.025  0.00249 **
## RARELY:olderprop          7.238e+01  3.309e+01   2.187  0.02872 *
## RARELY:TrmpProp          -2.603e+01  9.503e+00  -2.739  0.00616 **
## olderprop:TrmpProp       -2.904e+01  1.422e+01  -2.042  0.04114 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
```

```
## unable to evaluate scaled gradient
## Model failed to converge: degenerate  Hessian with 1 negative eigenvalues
```

```
Anova(mod16)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                            Chisq Df Pr(>Chisq)
## pop2021.y                 7.9882  1   0.004708 **
## NEVER                     2.3082  1   0.128689
## RARELY                    3.3516  1   0.067140 .
## SOMETIMES                 2.2063  1   0.137450
## FREQUENTLY                2.2866  1   0.130497
## ALWAYS                    2.2690  1   0.131983
## prop_cases                3.7430  1   0.053029 .
## olderprop                 1.6563  1   0.198100
## TrmpProp                  2.8430  1   0.091773 .
## ClintProp                 5.7848  1   0.016165 *
## COVID_COUNT.y             3.3630  1   0.066676 .
## COVID_TEST.y              4.0309  1   0.044673 *
## `Older (65 plus).y`       1.8577  1   0.172892
## ClintVote.y               3.5442  1   0.059753 .
## ClintVote.x               8.3167  1   0.003928 **
## all_doses_administered.x 3.6030  1   0.057677 .
## fully_vaccinated.x        2.4886  1   0.114677
## fully_vaccinated.y        9.1499  1   0.002487 **
## RARELY:olderprop          4.7846  1   0.028716 *
## RARELY:TrmpProp           7.5019  1   0.006163 **
## olderprop:TrmpProp        4.1701  1   0.041144 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod16, test = 'Chi')

# drop older.y
mod17 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + olderprop +
    TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + ClintVote.y + ClintVote.x +
    all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y + RARELY *
    olderprop * TrmpProp - RARELY:olderprop:TrmpProp, family = poisson, data = big_data3)
summary(mod17)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
##     prop_cases + olderprop + TrmpProp + ClintProp + COVID_COUNT.y +
##     COVID_TEST.y + ClintVote.y + ClintVote.x + all_doses_administered.x +
##     fully_vaccinated.x + fully_vaccinated.y + RARELY * olderprop *
##     TrmpProp - RARELY:olderprop:TrmpProp
```

```
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    828.4    886.4   -391.2    782.4       69
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.97590 -0.52317  0.05774  0.36846  1.42254
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.0255   0.1597
##  2013 code               (Intercept) 0.0000   0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -7.790e+01  3.221e+01  -2.418  0.01560 *
## pop2021.y                   4.218e+00  1.459e+00   2.890  0.00385 **
## NEVER                       4.661e+01  3.220e+01   1.447  0.14783
## RARELY                      5.205e+01  3.155e+01   1.650  0.09904 .
## SOMETIMES                   4.567e+01  3.226e+01   1.416  0.15689
## FREQUENTLY                  4.655e+01  3.228e+01   1.442  0.14927
## ALWAYS                      4.637e+01  3.227e+01   1.437  0.15073
## prop_cases                  3.371e+01  1.519e+01   2.219  0.02650 *
## olderprop                   1.496e+01  8.951e+00   1.672  0.09461 .
## TrmpProp                    1.360e+01  4.646e+00   2.928  0.00341 **
## ClintProp                   8.545e+00  4.078e+00   2.095  0.03614 *
## COVID_COUNT.y              -3.509e+00  1.656e+00  -2.119  0.03409 *
## COVID_TEST.y                4.999e-01  2.811e-01   1.778  0.07537 .
## ClintVote.y                -6.488e-01  3.038e-01  -2.136  0.03271 *
## ClintVote.x                 1.074e-05  4.264e-06   2.518  0.01179 *
## all_doses_administered.x   -1.646e-05  1.088e-05  -1.512  0.13047
## fully_vaccinated.x          2.868e-05  2.310e-05   1.242  0.21431
## fully_vaccinated.y          6.223e-01  1.918e-01   3.244  0.00118 **
## RARELY:olderprop            7.343e+01  3.341e+01   2.198  0.02794 *
## RARELY:TrmpProp            -2.738e+01  9.543e+00  -2.869  0.00412 **
## olderprop:TrmpProp         -2.068e+01  1.300e+01  -1.591  0.11158
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod17)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                              Chisq Df Pr(>Chisq)
## pop2021.y                   8.3526  1   0.003851 **
## NEVER                       2.0945  1   0.147831
## RARELY                      3.1416  1   0.076321 .
```

```
## SOMETIMES                 2.0039  1   0.156895
## FREQUENTLY                2.0797  1   0.149266
## ALWAYS                    2.0648  1   0.150734
## prop_cases                4.9230  1   0.026502 *
## olderprop                20.0475  1  7.554e-06 ***
## TrmpProp                  2.5606  1   0.109556
## ClintProp                 4.3905  1   0.036141 *
## COVID_COUNT.y             4.4903  1   0.034087 *
## COVID_TEST.y              3.1620  1   0.075371 .
## ClintVote.y               4.5610  1   0.032707 *
## ClintVote.x               6.3424  1   0.011789 *
## all_doses_administered.x  2.2869  1   0.130474
## fully_vaccinated.x        1.5421  1   0.214310
## fully_vaccinated.y       10.5222  1   0.001179 **
## RARELY:olderprop          4.8317  1   0.027940 *
## RARELY:TrmpProp           8.2287  1   0.004123 **
## olderprop:TrmpProp        2.5317  1   0.111577
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod17, test = 'Chi')

# drope fullyvaccinated.x
mod18 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + olderprop +
    TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + ClintVote.y + ClintVote.x +
    all_doses_administered.x + fully_vaccinated.y + RARELY * olderprop * TrmpProp -
    RARELY:olderprop:TrmpProp, family = poisson, data = big_data3)
summary(mod18)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
##     prop_cases + olderprop + TrmpProp + ClintProp + COVID_COUNT.y +
##     COVID_TEST.y + ClintVote.y + ClintVote.x + all_doses_administered.x +
##     fully_vaccinated.y + RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    827.9    883.4   -392.0    783.9       70
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.96649 -0.50207  0.04067  0.37935  1.34887
##
## Random effects:
##  Groups                  Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.02648  0.1627
##  2013 code               (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
```

```
## Fixed effects:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -7.577e+01  3.259e+01  -2.325 0.020092 *
## pop2021.y                   4.424e+00  1.467e+00   3.016 0.002558 **
## NEVER                       4.257e+01  3.246e+01   1.311 0.189779
## RARELY                      4.747e+01  3.177e+01   1.494 0.135106
## SOMETIMES                   4.171e+01  3.253e+01   1.282 0.199764
## FREQUENTLY                  4.247e+01  3.254e+01   1.305 0.191753
## ALWAYS                      4.225e+01  3.252e+01   1.299 0.193872
## prop_cases                  3.640e+01  1.521e+01   2.393 0.016721 *
## olderprop                   1.633e+01  9.000e+00   1.815 0.069593 .
## TrmpProp                    1.500e+01  4.565e+00   3.286 0.001018 **
## ClintProp                   9.417e+00  4.067e+00   2.316 0.020584 *
## COVID_COUNT.y              -3.802e+00  1.658e+00  -2.293 0.021827 *
## COVID_TEST.y                5.173e-01  2.842e-01   1.821 0.068680 .
## ClintVote.y                -6.204e-01  3.067e-01  -2.023 0.043082 *
## ClintVote.x                 9.557e-06  4.220e-06   2.265 0.023533 *
## all_doses_administered.x -3.118e-06  1.753e-06  -1.779 0.075196 .
## fully_vaccinated.y          6.603e-01  1.913e-01   3.451 0.000559 ***
## RARELY:olderprop            7.512e+01  3.377e+01   2.224 0.026142 *
## RARELY:TrmpProp            -2.718e+01  9.672e+00  -2.810 0.004951 **
## olderprop:TrmpProp         -2.285e+01  1.305e+01  -1.751 0.079979 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod18)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                              Chisq Df Pr(>Chisq)
## pop2021.y                   9.0983  1  0.0025585 **
## NEVER                       1.7193  1  0.1897795
## RARELY                      2.6129  1  0.1060011
## SOMETIMES                   1.6441  1  0.1997644
## FREQUENTLY                  1.7041  1  0.1917533
## ALWAYS                      1.6879  1  0.1938719
## prop_cases                  5.7254  1  0.0167213 *
## olderprop                  20.1866  1  7.024e-06 ***
## TrmpProp                    3.7722  1  0.0521097 .
## ClintProp                   5.3617  1  0.0205842 *
## COVID_COUNT.y               5.2595  1  0.0218273 *
## COVID_TEST.y                3.3143  1  0.0686800 .
## ClintVote.y                 4.0922  1  0.0430820 *
## ClintVote.x                 5.1287  1  0.0235333 *
## all_doses_administered.x  3.1658  1  0.0751959 .
## fully_vaccinated.y         11.9083  1  0.0005588 ***
## RARELY:olderprop            4.9466  1  0.0261423 *
## RARELY:TrmpProp             7.8971  1  0.0049513 **
## olderprop:TrmpProp          3.0653  1  0.0799791 .
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod18, test = 'Chi')

# drop sometimes
mod19 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + NEVER + RARELY + FREQUENTLY + ALWAYS + prop_cases + olderprop + TrmpProp +
    ClintProp + COVID_COUNT.y + COVID_TEST.y + ClintVote.y + ClintVote.x + all_doses_administered.x +
    fully_vaccinated.y + RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp,
    family = poisson, data = big_data3)
summary(mod19)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + NEVER + RARELY + FREQUENTLY + ALWAYS + prop_cases +
##     olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y +
##     ClintVote.y + ClintVote.x + all_doses_administered.x + fully_vaccinated.y +
##     RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    827.5    880.5   -392.8    785.5       71
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.87478 -0.50409  0.04195  0.39001  1.43194
##
## Random effects:
##  Groups                  Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.758e-02 0.1660593
##  2013 code               (Intercept) 1.179e-08 0.0001086
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -3.494e+01  7.130e+00  -4.900 9.59e-07 ***
## pop2021.y                   4.899e+00  1.436e+00   3.412 0.000646 ***
## NEVER                       9.526e-01  6.871e-01   1.386 0.165653
## RARELY                      7.593e+00  6.837e+00   1.111 0.266696
## FREQUENTLY                  7.699e-01  6.743e-01   1.142 0.253593
## ALWAYS                      5.594e-01  5.639e-01   0.992 0.321209
## prop_cases                  4.139e+01  1.489e+01   2.779 0.005457 **
## olderprop                   1.411e+01  8.958e+00   1.575 0.115208
## TrmpProp                    1.407e+01  4.571e+00   3.077 0.002088 **
## ClintProp                   8.877e+00  4.101e+00   2.165 0.030413 *
## COVID_COUNT.y              -4.311e+00  1.630e+00  -2.645 0.008171 **
## COVID_TEST.y                5.399e-01  2.874e-01   1.879 0.060292 .
## ClintVote.y                -5.820e-01  3.094e-01  -1.881 0.060020 .
## ClintVote.x                 9.389e-06  4.289e-06   2.189 0.028569 *
## all_doses_administered.x -3.038e-06  1.780e-06  -1.707 0.087814 .
```

```
## fully_vaccinated.y        6.279e-01  1.918e-01   3.274 0.001060 **
## RARELY:olderprop          7.264e+01  3.418e+01   2.126 0.033538 *
## RARELY:TrmpProp          -2.907e+01  9.692e+00  -3.000 0.002703 **
## olderprop:TrmpProp       -1.902e+01  1.288e+01  -1.476 0.139884
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## unable to evaluate scaled gradient
## Model failed to converge: degenerate  Hessian with 1 negative eigenvalues
```

```
Anova(mod19)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                            Chisq Df Pr(>Chisq)
## pop2021.y                11.6384  1   0.000646 ***
## NEVER                     1.9218  1   0.165653
## RARELY                    0.3353  1   0.562565
## FREQUENTLY                1.3034  1   0.253593
## ALWAYS                    0.9840  1   0.321209
## prop_cases                7.7213  1   0.005457 **
## olderprop                19.8519  1  8.368e-06 ***
## TrmpProp                  3.2076  1   0.073298 .
## ClintProp                 4.6858  1   0.030413 *
## COVID_COUNT.y             6.9955  1   0.008171 **
## COVID_TEST.y              3.5293  1   0.060292 .
## ClintVote.y               3.5368  1   0.060020 .
## ClintVote.x               4.7934  1   0.028569 *
## all_doses_administered.x  2.9140  1   0.087814 .
## fully_vaccinated.y       10.7200  1   0.001060 **
## RARELY:olderprop          4.5181  1   0.033538 *
## RARELY:TrmpProp           8.9980  1   0.002703 **
## olderprop:TrmpProp        2.1792  1   0.139884
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod19, test = 'Chi')

# drop always
mod20 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + NEVER + RARELY + FREQUENTLY + prop_cases + olderprop + TrmpProp +
    ClintProp + COVID_COUNT.y + COVID_TEST.y + ClintVote.y + ClintVote.x + all_doses_administered.x +
    fully_vaccinated.y + RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp,
    family = poisson, data = big_data3)
summary(mod20)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
```

```
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + NEVER + RARELY + FREQUENTLY + prop_cases + olderprop +
##     TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + ClintVote.y +
##     ClintVote.x + all_doses_administered.x + fully_vaccinated.y +
##     RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    826.5    877.0   -393.3    786.5       72
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.92186 -0.47165  0.04876  0.37094  1.44782
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.788e-02 1.670e-01
##  2013 code                (Intercept) 2.845e-09 5.334e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -3.354e+01  7.015e+00  -4.781 1.74e-06 ***
## pop2021.y                   4.754e+00  1.433e+00   3.317 0.000911 ***
## NEVER                       5.627e-01  5.637e-01   0.998 0.318171
## RARELY                      7.133e+00  6.854e+00   1.041 0.297998
## FREQUENTLY                  2.781e-01  4.580e-01   0.607 0.543622
## prop_cases                  3.980e+01  1.486e+01   2.678 0.007405 **
## olderprop                   1.471e+01  8.973e+00   1.640 0.101029
## TrmpProp                    1.356e+01  4.561e+00   2.974 0.002942 **
## ClintProp                   8.602e+00  4.107e+00   2.094 0.036220 *
## COVID_COUNT.y              -4.133e+00  1.626e+00  -2.542 0.011018 *
## COVID_TEST.y                4.967e-01  2.853e-01   1.741 0.081719 .
## ClintVote.y                -5.465e-01  3.086e-01  -1.771 0.076552 .
## ClintVote.x                 8.175e-06  4.137e-06   1.976 0.048145 *
## all_doses_administered.x -2.516e-06  1.709e-06  -1.472 0.140963
## fully_vaccinated.y          5.931e-01  1.893e-01   3.133 0.001730 **
## RARELY:olderprop            6.333e+01  3.297e+01   1.921 0.054767 .
## RARELY:TrmpProp            -2.697e+01  9.509e+00  -2.836 0.004568 **
## olderprop:TrmpProp         -1.870e+01  1.293e+01  -1.446 0.148234
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod20)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                              Chisq Df Pr(>Chisq)
## pop2021.y                  11.0008  1  0.0009107 ***
```

```
## NEVER                     0.9965  1  0.3181708
## RARELY                    0.4637  1  0.4959175
## FREQUENTLY                0.3689  1  0.5436225
## prop_cases                7.1720  1  0.0074049 **
## olderprop                19.7577  1  8.791e-06 ***
## TrmpProp                  3.1616  1  0.0753903 .
## ClintProp                 4.3867  1  0.0362198 *
## COVID_COUNT.y             6.4625  1  0.0110178 *
## COVID_TEST.y              3.0304  1  0.0817190 .
## ClintVote.y               3.1366  1  0.0765524 .
## ClintVote.x               3.9049  1  0.0481454 *
## all_doses_administered.x  2.1674  1  0.1409630
## fully_vaccinated.y        9.8160  1  0.0017300 **
## RARELY:olderprop          3.6892  1  0.0547666 .
## RARELY:TrmpProp           8.0430  1  0.0045681 **
## olderprop:TrmpProp        2.0903  1  0.1482341
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod20, test = 'Chi')

# drop frequently
mod21 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + NEVER + RARELY + prop_cases + olderprop + TrmpProp + ClintProp +
    COVID_COUNT.y + COVID_TEST.y + ClintVote.y + ClintVote.x + all_doses_administered.x +
    fully_vaccinated.y + RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp,
    family = poisson, data = big_data3)
summary(mod21)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + NEVER + RARELY + prop_cases + olderprop + TrmpProp +
##     ClintProp + COVID_COUNT.y + COVID_TEST.y + ClintVote.y +
##     ClintVote.x + all_doses_administered.x + fully_vaccinated.y +
##     RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    824.9    872.8   -393.5    786.9       73
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.9495 -0.4730  0.0311  0.3460  1.4969
##
## Random effects:
##  Groups                  Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.779e-02 1.667e-01
##  2013 code               (Intercept) 1.162e-10 1.078e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
```

```
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -3.353e+01  7.005e+00  -4.787 1.69e-06 ***
## pop2021.y                   4.752e+00  1.432e+00   3.320 0.000902 ***
## NEVER                       5.673e-01  5.630e-01   1.008 0.313682
## RARELY                      7.134e+00  6.846e+00   1.042 0.297366
## prop_cases                  4.012e+01  1.483e+01   2.704 0.006843 **
## olderprop                   1.406e+01  8.907e+00   1.578 0.114452
## TrmpProp                    1.377e+01  4.541e+00   3.032 0.002431 **
## ClintProp                   8.635e+00  4.101e+00   2.106 0.035234 *
## COVID_COUNT.y              -4.168e+00  1.623e+00  -2.569 0.010210 *
## COVID_TEST.y                5.075e-01  2.844e-01   1.784 0.074380 .
## ClintVote.y                -5.034e-01  2.992e-01  -1.682 0.092493 .
## ClintVote.x                 8.483e-06  4.102e-06   2.068 0.038661 *
## all_doses_administered.x -2.646e-06  1.694e-06  -1.562 0.118318
## fully_vaccinated.y          5.750e-01  1.864e-01   3.084 0.002042 **
## RARELY:olderprop            6.589e+01  3.269e+01   2.016 0.043851 *
## RARELY:TrmpProp            -2.782e+01  9.404e+00  -2.958 0.003096 **
## olderprop:TrmpProp         -1.848e+01  1.291e+01  -1.431 0.152411
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod21)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                              Chisq Df Pr(>Chisq)
## pop2021.y                  11.0191  1  0.0009018 ***
## NEVER                       1.0151  1  0.3136822
## RARELY                      0.1524  1  0.6962514
## prop_cases                  7.3137  1  0.0068431 **
## olderprop                  19.3659  1  1.079e-05 ***
## TrmpProp                    3.3812  1  0.0659434 .
## ClintProp                   4.4338  1  0.0352337 *
## COVID_COUNT.y               6.5980  1  0.0102096 *
## COVID_TEST.y                3.1836  1  0.0743798 .
## ClintVote.y                 2.8304  1  0.0924928 .
## ClintVote.x                 4.2757  1  0.0386606 *
## all_doses_administered.x  2.4394  1  0.1183181
## fully_vaccinated.y          9.5112  1  0.0020422 **
## RARELY:olderprop            4.0623  1  0.0438509 *
## RARELY:TrmpProp             8.7498  1  0.0030964 **
## olderprop:TrmpProp          2.0479  1  0.1524113
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod21, test = 'Chi')

# drop never
```

```
mod22 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + RARELY + prop_cases + olderprop + TrmpProp + ClintProp + COVID_COUNT.y +
    COVID_TEST.y + ClintVote.y + ClintVote.x + all_doses_administered.x + fully_vaccinated.y +
    RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp, family = poisson,
    data = big_data3)
summary(mod22)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + RARELY + prop_cases + olderprop + TrmpProp +
##     ClintProp + COVID_COUNT.y + COVID_TEST.y + ClintVote.y +
##     ClintVote.x + all_doses_administered.x + fully_vaccinated.y +
##     RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    823.9    869.3   -394.0    787.9       74
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.92734 -0.49861  0.03068  0.34184  1.53522
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.814e-02 0.1677461
##  2013 code               (Intercept) 7.837e-08 0.0002799
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -3.212e+01  6.890e+00  -4.662 3.14e-06 ***
## pop2021.y                 4.336e+00  1.376e+00   3.150  0.00163 **
## RARELY                    7.388e+00  6.875e+00   1.075  0.28253
## prop_cases                3.552e+01  1.417e+01   2.507  0.01218 *
## olderprop                 1.391e+01  8.945e+00   1.555  0.11986
## TrmpProp                  1.380e+01  4.560e+00   3.027  0.00247 **
## ClintProp                 8.835e+00  4.112e+00   2.148  0.03168 *
## COVID_COUNT.y            -3.710e+00  1.564e+00  -2.373  0.01767 *
## COVID_TEST.y              4.975e-01  2.852e-01   1.744  0.08114 .
## ClintVote.y              -5.560e-01  2.955e-01  -1.882  0.05990 .
## ClintVote.x               8.413e-06  4.123e-06   2.041  0.04130 *
## all_doses_administered.x -2.645e-06  1.703e-06  -1.554  0.12028
## fully_vaccinated.y        5.902e-01  1.863e-01   3.169  0.00153 **
## RARELY:olderprop          6.589e+01  3.283e+01   2.007  0.04473 *
## RARELY:TrmpProp          -2.816e+01  9.443e+00  -2.982  0.00286 **
## olderprop:TrmpProp       -1.810e+01  1.296e+01  -1.397  0.16247
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
```

```
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## unable to evaluate scaled gradient
## Model failed to converge: degenerate  Hessian with 1 negative eigenvalues
```

```
Anova(mod22)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                             Chisq Df Pr(>Chisq)
## pop2021.y                  9.9250  1   0.001630 **
## RARELY                     0.1805  1   0.670978
## prop_cases                 6.2847  1   0.012178 *
## olderprop                 19.7381  1  8.881e-06 ***
## TrmpProp                   3.4098  1   0.064810 .
## ClintProp                  4.6159  1   0.031677 *
## COVID_COUNT.y              5.6288  1   0.017668 *
## COVID_TEST.y               3.0419  1   0.081139 .
## ClintVote.y                3.5402  1   0.059897 .
## ClintVote.x                4.1637  1   0.041299 *
## all_doses_administered.x   2.4136  1   0.120284
## fully_vaccinated.y        10.0407  1   0.001531 **
## RARELY:olderprop           4.0286  1   0.044734 *
## RARELY:TrmpProp            8.8926  1   0.002863 **
## olderprop:TrmpProp         1.9511  1   0.162468
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod22, test = 'Chi')

# drop olderprop:Trmpprop
mod23 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + RARELY + prop_cases + olderprop + TrmpProp + ClintProp + COVID_COUNT.y +
    COVID_TEST.y + ClintVote.y + ClintVote.x + all_doses_administered.x + fully_vaccinated.y +
    RARELY:olderprop + RARELY:TrmpProp, family = poisson, data = big_data3)
summary(mod23)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + RARELY + prop_cases + olderprop + TrmpProp +
##     ClintProp + COVID_COUNT.y + COVID_TEST.y + ClintVote.y +
##     ClintVote.x + all_doses_administered.x + fully_vaccinated.y +
##     RARELY:olderprop + RARELY:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    823.9    866.7   -394.9    789.9       75
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
```

```
## -1.91972 -0.44904  0.03192  0.31244  1.57024
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.938e-02 1.714e-01
##  2013 code                (Intercept) 2.546e-10 1.596e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -3.063e+01  6.909e+00  -4.434 9.27e-06 ***
## pop2021.y                   4.302e+00  1.396e+00   3.081 0.002063 **
## RARELY                      9.632e+00  6.780e+00   1.421 0.155386
## prop_cases                  3.484e+01  1.437e+01   2.424 0.015339 *
## olderprop                   2.238e+00  3.288e+00   0.681 0.496163
## TrmpProp                    1.135e+01  4.279e+00   2.653 0.007983 **
## ClintProp                   9.045e+00  4.172e+00   2.168 0.030154 *
## COVID_COUNT.y              -3.579e+00  1.584e+00  -2.260 0.023821 *
## COVID_TEST.y                3.984e-01  2.806e-01   1.420 0.155605
## ClintVote.y                -4.941e-01  2.965e-01  -1.667 0.095570 .
## ClintVote.x                 8.682e-06  4.194e-06   2.070 0.038466 *
## all_doses_administered.x -3.245e-06  1.679e-06  -1.933 0.053240 .
## fully_vaccinated.y          5.705e-01  1.882e-01   3.031 0.002438 **
## RARELY:olderprop            6.442e+01  3.330e+01   1.934 0.053076 .
## RARELY:TrmpProp            -3.104e+01  9.365e+00  -3.314 0.000919 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod23)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                             Chisq Df Pr(>Chisq)
## pop2021.y                  9.4922  1  0.0020635 **
## RARELY                     0.1958  1  0.6581537
## prop_cases                 5.8771  1  0.0153393 *
## olderprop                 19.1771  1  1.191e-05 ***
## TrmpProp                   3.3011  1  0.0692340 .
## ClintProp                  4.7005  1  0.0301537 *
## COVID_COUNT.y              5.1076  1  0.0238208 *
## COVID_TEST.y               2.0164  1  0.1556045
## ClintVote.y                2.7780  1  0.0955704 .
## ClintVote.x                4.2843  1  0.0384661 *
## all_doses_administered.x   3.7364  1  0.0532398 .
## fully_vaccinated.y         9.1866  1  0.0024380 **
## RARELY:olderprop           3.7415  1  0.0530764 .
## RARELY:TrmpProp           10.9843  1  0.0009189 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
# drop1(mod23, test = 'Chi')

# drop covidtest.y
mod24 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + RARELY + prop_cases + olderprop + TrmpProp + ClintProp + COVID_COUNT.y +
    ClintVote.y + ClintVote.x + all_doses_administered.x + fully_vaccinated.y + RARELY:olderprop +
    RARELY:TrmpProp, family = poisson, data = big_data3)
summary(mod24)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + RARELY + prop_cases + olderprop + TrmpProp +
##     ClintProp + COVID_COUNT.y + ClintVote.y + ClintVote.x + all_doses_administered.x +
##     fully_vaccinated.y + RARELY:olderprop + RARELY:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    823.9    864.2   -395.9    791.9       76
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.8090 -0.4845  0.0320  0.2928  1.5498
##
## Random effects:
##  Groups                  Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.03071  0.1752
##  2013 code               (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)               -2.532e+01  5.887e+00  -4.300 1.71e-05 ***
## pop2021.y                  3.431e+00  1.272e+00   2.698  0.00697 **
## RARELY                     7.682e+00  6.763e+00   1.136  0.25599
## prop_cases                 2.495e+01  1.276e+01   1.955  0.05061 .
## olderprop                  2.510e+00  3.329e+00   0.754  0.45090
## TrmpProp                   9.417e+00  4.117e+00   2.288  0.02217 *
## ClintProp                  7.766e+00  4.137e+00   1.877  0.06046 .
## COVID_COUNT.y             -2.296e+00  1.321e+00  -1.738  0.08218 .
## ClintVote.y               -5.180e-01  3.005e-01  -1.724  0.08478 .
## ClintVote.x                7.376e-06  4.171e-06   1.768  0.07698 .
## all_doses_administered.x -2.833e-06  1.683e-06  -1.683  0.09235 .
## fully_vaccinated.y         5.685e-01  1.907e-01   2.981  0.00287 **
## RARELY:olderprop           6.118e+01  3.368e+01   1.816  0.06929 .
## RARELY:TrmpProp           -2.741e+01  9.136e+00  -3.000  0.00270 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
```

```
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod24)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                             Chisq Df Pr(>Chisq)
## pop2021.y                  7.2815  1   0.006967 **
## RARELY                     0.1567  1   0.692176
## prop_cases                 3.8210  1   0.050614 .
## olderprop                 18.5866  1  1.624e-05 ***
## TrmpProp                   2.9708  1   0.084782 .
## ClintProp                  3.5246  1   0.060464 .
## COVID_COUNT.y              3.0213  1   0.082179 .
## ClintVote.y                2.9708  1   0.084778 .
## ClintVote.x                3.1275  1   0.076981 .
## all_doses_administered.x   2.8329  1   0.092351 .
## fully_vaccinated.y         8.8887  1   0.002869 **
## RARELY:olderprop           3.2997  1   0.069294 .
## RARELY:TrmpProp            9.0028  1   0.002696 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod24, test = 'Chi')

# drop alldoses.x
mod25 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + RARELY + prop_cases + olderprop + TrmpProp + ClintProp + COVID_COUNT.y +
    ClintVote.y + ClintVote.x + fully_vaccinated.y + RARELY:olderprop + RARELY:TrmpProp,
    family = poisson, data = big_data3)
summary(mod25)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + RARELY + prop_cases + olderprop + TrmpProp +
##     ClintProp + COVID_COUNT.y + ClintVote.y + ClintVote.x + fully_vaccinated.y +
##     RARELY:olderprop + RARELY:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    824.6    862.5   -397.3    794.6       77
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.86066 -0.41680  0.02216  0.29931  1.48370
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.0325   0.1803
```

```
##  2013 code               (Intercept) 0.0000   0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                       Estimate Std. Error z value Pr(>|z|)
## (Intercept)        -2.540e+01  5.983e+00  -4.246 2.17e-05 ***
## pop2021.y           3.266e+00  1.288e+00   2.536  0.01120 *
## RARELY              8.170e+00  6.940e+00   1.177  0.23908
## prop_cases          2.259e+01  1.291e+01   1.750  0.08016 .
## olderprop           4.276e+00  3.215e+00   1.330  0.18356
## TrmpProp            1.014e+01  4.184e+00   2.424  0.01534 *
## ClintProp           9.269e+00  4.144e+00   2.237  0.02532 *
## COVID_COUNT.y      -2.019e+00  1.332e+00  -1.515  0.12970
## ClintVote.y        -6.191e-01  3.003e-01  -2.062  0.03923 *
## ClintVote.x         7.026e-07  1.434e-06   0.490  0.62420
## fully_vaccinated.y  4.978e-01  1.890e-01   2.635  0.00842 **
## RARELY:olderprop    4.930e+01  3.351e+01   1.471  0.14123
## RARELY:TrmpProp    -2.485e+01  9.224e+00  -2.694  0.00707 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod25)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                       Chisq Df Pr(>Chisq)
## pop2021.y           6.4327  1   0.011204 *
## RARELY              0.1967  1   0.657380
## prop_cases          3.0616  1   0.080162 .
## olderprop          22.4917  1  2.111e-06 ***
## TrmpProp            3.6204  1   0.057076 .
## ClintProp           5.0022  1   0.025316 *
## COVID_COUNT.y       2.2961  1   0.129699
## ClintVote.y         4.2511  1   0.039226 *
## ClintVote.x         0.2400  1   0.624202
## fully_vaccinated.y  6.9409  1   0.008425 **
## RARELY:olderprop    2.1645  1   0.141228
## RARELY:TrmpProp     7.2560  1   0.007067 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod25, test = 'Chi')

# drop clintvote.x
mod26 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + RARELY + prop_cases + olderprop + TrmpProp + ClintProp + COVID_COUNT.y +
    ClintVote.y + fully_vaccinated.y + RARELY:olderprop + RARELY:TrmpProp, family = poisson,
    data = big_data3)
summary(mod26)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + RARELY + prop_cases + olderprop + TrmpProp +
##     ClintProp + COVID_COUNT.y + ClintVote.y + fully_vaccinated.y +
##     RARELY:olderprop + RARELY:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    822.9    858.2   -397.4    794.9       78
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.85788 -0.42485  0.00982  0.28377  1.47357
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 3.286e-02 1.813e-01
##  2013 code               (Intercept) 7.848e-09 8.859e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                     Estimate Std. Error z value Pr(>|z|)
## (Intercept)        -25.6124     6.0202  -4.254  2.1e-05 ***
## pop2021.y            3.1845     1.2900   2.469  0.01357 *
## RARELY               7.1751     6.6610   1.077  0.28139
## prop_cases          21.5323    12.8564   1.675  0.09397 .
## olderprop            4.0613     3.1946   1.271  0.20362
## TrmpProp            10.6130     4.0967   2.591  0.00958 **
## ClintProp            9.8879     3.9619   2.496  0.01257 *
## COVID_COUNT.y       -1.9142     1.3284  -1.441  0.14960
## ClintVote.y         -0.6111     0.3014  -2.028  0.04258 *
## fully_vaccinated.y   0.4765     0.1852   2.573  0.01010 *
## RARELY:olderprop    51.5858    33.2060   1.554  0.12030
## RARELY:TrmpProp    -23.9832     9.1039  -2.634  0.00843 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) p2021. RARELY prp_cs oldrpr TrmpPr ClntPr COVID_ ClntV.
## pop2021.y   -0.778
## RARELY      -0.154  0.054
## prop_cases  -0.785  0.977  0.041
## olderprop    0.095 -0.003  0.452 -0.061
## TrmpProp    -0.679  0.087  0.127  0.131 -0.331
## ClintProp   -0.654  0.060  0.105  0.082 -0.200  0.963
## COVID_COUNT  0.794 -0.983 -0.039 -0.992  0.055 -0.138 -0.086
## ClintVote.y -0.038 -0.040 -0.191  0.104 -0.368  0.189 -0.006 -0.102
## flly_vccnt. -0.270  0.219  0.187  0.184  0.253  0.071  0.190 -0.210 -0.621
## RARELY:ldrp -0.070  0.080 -0.524  0.067 -0.837  0.164  0.053 -0.073  0.102
## RARELY:TrmP  0.212 -0.133 -0.549 -0.107  0.328 -0.268 -0.134  0.108  0.106
##             flly_. RARELY:l
```

```
## pop2021.y
## RARELY
## prop_cases
## olderprop
## TrmpProp
## ClintProp
## COVID_COUNT
## ClintVote.y
## flly_vccnt.
## RARELY:ldrp -0.140
## RARELY:TrmP -0.046 -0.419
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod26)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                       Chisq Df Pr(>Chisq)
## pop2021.y            6.0936  1   0.013567 *
## RARELY               0.2047  1   0.650970
## prop_cases           2.8050  1   0.093969 .
## olderprop           22.1064  1   2.58e-06 ***
## TrmpProp             3.8274  1   0.050421 .
## ClintProp            6.2288  1   0.012569 *
## COVID_COUNT.y        2.0763  1   0.149598
## ClintVote.y          4.1118  1   0.042584 *
## fully_vaccinated.y   6.6180  1   0.010095 *
## RARELY:olderprop     2.4134  1   0.120302
## RARELY:TrmpProp      6.9400  1   0.008429 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod26, test = 'Chi')

# drop covidcount.y
mod27 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + RARELY + prop_cases + olderprop + TrmpProp + ClintProp + ClintVote.y +
    fully_vaccinated.y + RARELY:olderprop + RARELY:TrmpProp, family = poisson, data = big_data3)
summary(mod27)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + RARELY + prop_cases + olderprop + TrmpProp +
##     ClintProp + ClintVote.y + fully_vaccinated.y + RARELY:olderprop +
##     RARELY:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
```

```
##    823.0    855.8   -398.5    797.0       79
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.84691 -0.42001  0.03322  0.31215  1.42745
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  '2013 code':LOCATION_ID (Intercept) 0.03405  0.1845
##  2013 code               (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  '2013 code':LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                     Estimate Std. Error z value Pr(>|z|)
## (Intercept)        -18.7542     3.7058  -5.061 4.17e-07 ***
## pop2021.y            1.3563     0.2368   5.728 1.02e-08 ***
## RARELY               6.8346     6.7303   1.015   0.3099
## prop_cases           3.1633     1.6381   1.931   0.0535 .
## olderprop            4.3190     3.2253   1.339   0.1805
## TrmpProp             9.8250     4.1086   2.391   0.0168 *
## ClintProp            9.4171     3.9963   2.356   0.0184 *
## ClintVote.y         -0.6554     0.3038  -2.157   0.0310 *
## fully_vaccinated.y   0.4210     0.1832   2.298   0.0216 *
## RARELY:olderprop    48.0500    33.4071   1.438   0.1503
## RARELY:TrmpProp    -22.5917     9.1611  -2.466   0.0137 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) p2021. RARELY prp_cs oldrpr TrmpPr ClntPr ClntV. flly_.
## pop2021.y    0.022
## RARELY      -0.202  0.086
## prop_cases   0.036  0.058  0.016
## olderprop    0.084  0.284  0.453 -0.054
## TrmpProp    -0.946 -0.267  0.123 -0.042 -0.328
## ClintProp   -0.966 -0.138  0.102 -0.027 -0.197  0.963
## ClintVote.y  0.070 -0.780 -0.196  0.025 -0.365  0.178 -0.014
## flly_vccnt. -0.172  0.071  0.182 -0.192  0.271  0.041  0.174 -0.660
## RARELY:ldrp -0.021  0.047 -0.527 -0.040 -0.836  0.156  0.047  0.095 -0.159
## RARELY:TrmP  0.208 -0.149 -0.551  0.006  0.324 -0.256 -0.125  0.118 -0.024
##             RARELY:l
## pop2021.y
## RARELY
## prop_cases
## olderprop
## TrmpProp
## ClintProp
## ClintVote.y
## flly_vccnt.
## RARELY:ldrp
## RARELY:TrmP -0.414
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod27)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                       Chisq Df Pr(>Chisq)
## pop2021.y           32.8097  1  1.016e-08 ***
## RARELY               0.1565  1    0.69244
## prop_cases           3.7290  1    0.05347 .
## olderprop           21.4075  1  3.713e-06 ***
## TrmpProp             3.3121  1    0.06877 .
## ClintProp            5.5529  1    0.01845 *
## ClintVote.y          4.6525  1    0.03101 *
## fully_vaccinated.y   5.2809  1    0.02156 *
## RARELY:olderprop     2.0688  1    0.15034
## RARELY:TrmpProp      6.0814  1    0.01366 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod27, test = 'Chi')

# drop rarely:olderprop
mod28 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + RARELY + prop_cases + olderprop + TrmpProp + ClintProp + ClintVote.y +
    fully_vaccinated.y + RARELY:TrmpProp, family = poisson, data = big_data3)
summary(mod28)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + RARELY + prop_cases + olderprop + TrmpProp +
##     ClintProp + ClintVote.y + fully_vaccinated.y + RARELY:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    823.0    853.3   -399.5    799.0       80
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.80036 -0.39685  0.04045  0.27855  1.72757
##
## Random effects:
##  Groups                  Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 3.483e-02 1.866e-01
##  2013 code               (Intercept) 1.033e-09 3.214e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                    Estimate Std. Error z value Pr(>|z|)
## (Intercept)        -18.6640     3.7343  -4.998 5.79e-07 ***
## pop2021.y            1.3408     0.2386   5.619 1.92e-08 ***
```

```
## RARELY              11.9605     5.7778   2.070   0.0384 *
## prop_cases           3.2610     1.6500   1.976   0.0481 *
## olderprop            8.1971     1.7845   4.593 4.36e-06 ***
## TrmpProp             8.9187     4.0903   2.180   0.0292 *
## ClintProp            9.1612     4.0228   2.277   0.0228 *
## ClintVote.y         -0.6979     0.3051  -2.288   0.0221 *
## fully_vaccinated.y   0.4641     0.1821   2.548   0.0108 *
## RARELY:TrmpProp    -17.1710     8.4224  -2.039   0.0415 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) p2021. RARELY prp_cs oldrpr TrmpPr ClntPr ClntV. flly_.
## pop2021.y    0.022
## RARELY      -0.251  0.130
## prop_cases   0.036  0.061 -0.006
## olderprop    0.122  0.589  0.027 -0.157
## TrmpProp    -0.954 -0.277  0.244 -0.037 -0.364
## ClintProp   -0.967 -0.140  0.149 -0.026 -0.288  0.969
## ClintVote.y  0.072 -0.790 -0.172  0.028 -0.523  0.167 -0.018
## flly_vccnt. -0.176  0.080  0.116 -0.200  0.254  0.066  0.182 -0.656
## RARELY:TrmP  0.219 -0.144 -0.994 -0.011 -0.045 -0.213 -0.116  0.174 -0.100
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod28)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                      Chisq Df Pr(>Chisq)
## pop2021.y          31.5761  1  1.918e-08 ***
## RARELY              0.1568  1    0.69213
## prop_cases          3.9059  1    0.04812 *
## olderprop          21.0995  1  4.361e-06 ***
## TrmpProp            3.1929  1    0.07396 .
## ClintProp           5.1861  1    0.02277 *
## ClintVote.y         5.2341  1    0.02215 *
## fully_vaccinated.y  6.4926  1    0.01083 *
## RARELY:TrmpProp     4.1564  1    0.04148 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod28, test = 'Chi')

# drop prop_cases
mod29 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + RARELY + olderprop + TrmpProp + ClintProp + ClintVote.y + fully_vaccinated.y +
    RARELY:TrmpProp, family = poisson, data = big_data3)
summary(mod29)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
```

```
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + RARELY + olderprop + TrmpProp + ClintProp + ClintVote.y +
##     fully_vaccinated.y + RARELY:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    824.8    852.6   -401.4    802.8       81
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.84197 -0.40797 -0.02275  0.33064  1.53064
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.03704  0.1924
##  2013 code               (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                    Estimate Std. Error z value Pr(>|z|)
## (Intercept)        -18.9297     3.8185  -4.957 7.14e-07 ***
## pop2021.y            1.3132     0.2437   5.388 7.11e-08 ***
## RARELY              12.0987     5.9304   2.040  0.04134 *
## olderprop            8.7571     1.8021   4.860 1.18e-06 ***
## TrmpProp             9.2049     4.1813   2.201  0.02770 *
## ClintProp            9.3480     4.1136   2.272  0.02306 *
## ClintVote.y         -0.7148     0.3116  -2.294  0.02180 *
## fully_vaccinated.y   0.5360     0.1817   2.949  0.00319 **
## RARELY:TrmpProp    -17.0679     8.6423  -1.975  0.04828 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) p2021. RARELY oldrpr TrmpPr ClntPr ClntV. flly_.
## pop2021.y    0.018
## RARELY      -0.250  0.131
## olderprop    0.127  0.609  0.027
## TrmpProp    -0.954 -0.274  0.243 -0.373
## ClintProp   -0.967 -0.137  0.147 -0.294  0.969
## ClintVote.y  0.070 -0.795 -0.171 -0.527  0.169 -0.016
## flly_vccnt. -0.169  0.096  0.116  0.230  0.058  0.178 -0.663
## RARELY:TrmP  0.219 -0.143 -0.994 -0.047 -0.213 -0.115  0.173 -0.103
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod29)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                      Chisq Df Pr(>Chisq)
## pop2021.y          29.0352  1  7.107e-08 ***
```

```
## RARELY              0.4991  1   0.479883
## olderprop          23.6150  1  1.177e-06 ***
## TrmpProp            3.3196  1   0.068457 .
## ClintProp           5.1639  1   0.023061 *
## ClintVote.y         5.2614  1   0.021803 *
## fully_vaccinated.y  8.6966  1   0.003188 **
## RARELY:TrmpProp     3.9003  1   0.048277 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod28, test = 'Chi')

# drop prop_cases
mod30 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + olderprop + ClintProp + ClintVote.y + fully_vaccinated.y, family = poisson,
    data = big_data3)
summary(mod30)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + olderprop + ClintProp + ClintVote.y + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    825.8    846.0   -404.9    809.8       84
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.74817 -0.30821  0.00873  0.28296  1.37591
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 4.168e-02 2.041e-01
##  2013 code               (Intercept) 4.291e-10 2.072e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                    Estimate Std. Error z value Pr(>|z|)
## (Intercept)        -10.8303     1.1868  -9.126  < 2e-16 ***
## pop2021.y            1.3861     0.2399   5.778 7.54e-09 ***
## olderprop            9.9224     1.7254   5.751 8.89e-09 ***
## ClintProp            1.1662     0.9840   1.185  0.23595
## ClintVote.y         -0.7303     0.3128  -2.335  0.01955 *
## fully_vaccinated.y   0.4872     0.1867   2.609  0.00907 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) p2021. oldrpr ClntPr ClntV.
## pop2021.y   -0.863
## olderprop   -0.839  0.559
```

```
## ClintProp   -0.635  0.694  0.391
## ClintVote.y  0.794 -0.783 -0.500 -0.909
## flly_vccnt. -0.371  0.099  0.269  0.568 -0.679
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod30)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                      Chisq Df Pr(>Chisq)
## pop2021.y          33.3907  1  7.538e-09 ***
## olderprop          33.0699  1  8.891e-09 ***
## ClintProp           1.4046  1   0.235949
## ClintVote.y         5.4514  1   0.019553 *
## fully_vaccinated.y  6.8086  1   0.009072 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod30, test = 'Chi')

# drop clinprop
mod31 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
    pop2021.y + olderprop + ClintVote.y + fully_vaccinated.y, family = poisson, data = big_data3)
summary(mod31)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + olderprop + ClintVote.y + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    825.2    842.9   -405.6    811.2       85
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.69522 -0.31738 -0.00151  0.31845  1.39057
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 4.271e-02 2.067e-01
##  2013 code               (Intercept) 1.538e-09 3.922e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                    Estimate Std. Error z value Pr(>|z|)
## (Intercept)         -9.9385     0.9259 -10.734  < 2e-16 ***
## pop2021.y            1.1881     0.1745   6.806  1.0e-11 ***
## olderprop            9.1184     1.6037   5.686  1.3e-08 ***
```

```
## ClintVote.y         -0.3941     0.1315  -2.996  0.00274 **
## fully_vaccinated.y   0.3633     0.1552   2.341  0.01922 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) p2021. oldrpr ClntV.
## pop2021.y   -0.759
## olderprop   -0.831  0.435
## ClintVote.y  0.675 -0.506 -0.376
## flly_vccnt. -0.015 -0.498  0.062 -0.474
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod31)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                      Chisq Df Pr(>Chisq)
## pop2021.y          46.3284  1  1.000e-11 ***
## olderprop          32.3288  1  1.302e-08 ***
## ClintVote.y         8.9758  1   0.002736 **
## fully_vaccinated.y  5.4815  1   0.019219 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
drop1(mod31, test = "Chi")
```

```
## Single term deletions
##
## Model:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) +
##     pop2021.y + olderprop + ClintVote.y + fully_vaccinated.y
##                     npar    AIC    LRT   Pr(Chi)
## <none>                   825.21
## pop2021.y              1 857.69 34.477 4.314e-09 ***
## olderprop              1 849.87 26.657 2.430e-07 ***
## ClintVote.y            1 830.79  7.580  0.005901 **
## fully_vaccinated.y     1 828.56  5.349  0.020733 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# confint(mod31, method = 'boot')

# drop 2013 code as RE
mod32 <- glmer(formula = COVID_DEATHS.x ~ 1 + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
    olderprop + ClintVote.y + fully_vaccinated.y, family = poisson, data = big_data3)
summary(mod32)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
```

```
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ 1 + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     olderprop + ClintVote.y + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    823.2    838.3   -405.6    811.2       86
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.69580 -0.31735 -0.00089  0.31816  1.39121
##
## Random effects:
##  Groups                  Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.04271  0.2067
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92
##
## Fixed effects:
##                    Estimate Std. Error z value Pr(>|z|)
## (Intercept)         -9.9441     0.9259 -10.740  < 2e-16 ***
## pop2021.y            1.1896     0.1745   6.815 9.41e-12 ***
## olderprop            9.1271     1.6038   5.691 1.26e-08 ***
## ClintVote.y         -0.3939     0.1315  -2.995  0.00275 **
## fully_vaccinated.y   0.3619     0.1552   2.332  0.01970 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) p2021. oldrpr ClntV.
## pop2021.y   -0.759
## olderprop   -0.831  0.435
## ClintVote.y  0.675 -0.506 -0.376
## flly_vccnt. -0.015 -0.498  0.062 -0.474
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## Model is nearly unidentifiable: large eigenvalue ratio
##  - Rescale variables?
```

```
Anova(mod32)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                     Chisq Df Pr(>Chisq)
## pop2021.y         46.4477  1  9.410e-12 ***
## olderprop         32.3876  1  1.263e-08 ***
## ClintVote.y        8.9684  1   0.002747 **
## fully_vaccinated.y 5.4380  1   0.019703 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
drop1(mod32, test = "Chi")
```

```
## Single term deletions
```

```
##
## Model:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     olderprop + ClintVote.y + fully_vaccinated.y
##                     npar    AIC    LRT   Pr(Chi)
## <none>                   823.21
## pop2021.y              1 857.93 36.719 1.364e-09 ***
## olderprop              1 848.41 27.201 1.834e-07 ***
## ClintVote.y            1 829.81  8.596  0.003369 **
## fully_vaccinated.y     1 826.56  5.349  0.020731 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
add1(mod32, scope = ~pop2021.x + pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY +
    ALWAYS + prop_cases + `Older (65 plus).x` + olderprop + TrmpProp + ClintProp +
    COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y + `Older (65 plus).y` +
    ClintVote.y + TrmpVote.y + TotalVote.y + ClintVote.x + TrmpVote.x + TotalVote.x +
    COVID_COUNT.x + COVID_TEST.x + all_doses_administered.x + fully_vaccinated.x +
    fully_vaccinated.y + RARELY * olderprop * TrmpProp, test = "Chisq")
```

```
## Single term additions
##
## Model:
## COVID_DEATHS.x ~ 1 + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     olderprop + ClintVote.y + fully_vaccinated.y
##                           Df    AIC    LRT Pr(>Chi)
## <none>                       823.21
## pop2021.x                  1 825.03 0.1860  0.66623
## NEVER                      1 825.04 0.1761  0.67474
## RARELY                     1 825.20 0.0078  0.92973
## SOMETIMES                  1 825.10 0.1084  0.74199
## FREQUENTLY                 1 824.27 0.9397  0.33236
## ALWAYS                     1 824.03 1.1818  0.27699
## prop_cases                 1 821.84 3.3717  0.06633 .
## `Older (65 plus).x`        1 824.86 0.3486  0.55491
## TrmpProp                   1 824.63 0.5786  0.44687
## ClintProp                  1 823.81 1.4013  0.23650
## COVID_COUNT.y              1 822.38 2.8316  0.09243 .
## COVID_TEST.y               1 824.60 0.6084  0.43539
## all_doses_administered.y   1 821.44 3.7722  0.05211 .
## `Older (65 plus).y`        1 824.41 0.8006  0.37092
## TrmpVote.y                 1 823.84 1.3747  0.24101
## TotalVote.y                1 823.25 1.9631  0.16119
## ClintVote.x                1 824.86 0.3465  0.55608
## TrmpVote.x                 1 825.18 0.0322  0.85751
## TotalVote.x                1 825.12 0.0950  0.75791
## COVID_COUNT.x              1 824.83 0.3814  0.53685
## COVID_TEST.x               1 825.05 0.1649  0.68464
## all_doses_administered.x   1 825.21 0.0018  0.96617
## fully_vaccinated.x         1 825.20 0.0093  0.92320
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
# no additional predictors significant at 0.05 level. AIC can be lowered
# slightly, but we will not add anything if it's not significant.  FINAL Poisson
# FE model - mod32 AIC = 823.2


### OFFSET by pop - remove covidtest.x
mod7.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
    prop_cases + `Older (65 plus).x` + olderprop + TrmpProp + ClintProp + COVID_COUNT.y +
    COVID_TEST.y + all_doses_administered.y + `Older (65 plus).y` + ClintVote.y +
    TrmpVote.y + TotalVote.y + ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x +
    all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y, family = poisson,
    data = big_data3)
summary(mod7.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES +
##     FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
##     olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y +
##     all_doses_administered.y + `Older (65 plus).y` + ClintVote.y +
##     TrmpVote.y + TotalVote.y + ClintVote.x + TrmpVote.x + TotalVote.x +
##     COVID_COUNT.x + all_doses_administered.x + fully_vaccinated.x +
##     fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    846.7    914.8   -396.4    792.7       65
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.91587 -0.42820  0.01702  0.36368  1.62582
##
## Random effects:
##  Groups                  Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 3.026e-02 1.740e-01
##  2013 code               (Intercept) 1.984e-10 1.409e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                            Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -6.306e+01  3.763e+01  -1.676   0.0938 .
## NEVER                     5.178e+01  3.711e+01   1.395   0.1629
## RARELY                    5.181e+01  3.729e+01   1.389   0.1647
## SOMETIMES                 5.130e+01  3.719e+01   1.380   0.1677
## FREQUENTLY                5.212e+01  3.724e+01   1.400   0.1616
## ALWAYS                    5.168e+01  3.724e+01   1.388   0.1652
## prop_cases                1.469e+01  1.505e+01   0.976   0.3289
## `Older (65 plus).x`      -6.856e-06  3.349e-05  -0.205   0.8378
## olderprop                -1.050e+00  8.244e+00  -0.127   0.8987
## TrmpProp                 -9.767e-01  9.793e+00  -0.100   0.9206
```

```
## ClintProp                 1.126e+01  8.452e+00   1.332   0.1827
## COVID_COUNT.y            -1.330e+00  1.684e+00  -0.790   0.4296
## COVID_TEST.y              1.757e-01  2.866e-01   0.613   0.5399
## all_doses_administered.y -3.861e-01  1.214e+00  -0.318   0.7506
## `Older (65 plus).y`       1.634e+00  1.538e+00   1.063   0.2879
## ClintVote.y              -1.553e+00  1.764e+00  -0.880   0.3787
## TrmpVote.y                4.929e+00  4.773e+00   1.033   0.3018
## TotalVote.y              -4.386e+00  3.437e+00  -1.276   0.2018
## ClintVote.x              -4.073e-05  1.785e-04  -0.228   0.8195
## TrmpVote.x               -4.807e-05  1.803e-04  -0.267   0.7898
## TotalVote.x               5.512e-05  1.666e-04   0.331   0.7407
## COVID_COUNT.x            -5.958e-06  2.682e-05  -0.222   0.8242
## all_doses_administered.x -9.890e-06  1.911e-05  -0.517   0.6048
## fully_vaccinated.x        8.669e-06  3.983e-05   0.218   0.8277
## fully_vaccinated.y        1.057e+00  1.145e+00   0.923   0.3560
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod7.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                           Chisq Df Pr(>Chisq)
## NEVER                    1.9467  1     0.1629
## RARELY                   1.9307  1     0.1647
## SOMETIMES                1.9034  1     0.1677
## FREQUENTLY               1.9592  1     0.1616
## ALWAYS                   1.9262  1     0.1652
## prop_cases               0.9532  1     0.3289
## `Older (65 plus).x`      0.0419  1     0.8378
## olderprop                0.0162  1     0.8987
## TrmpProp                 0.0099  1     0.9206
## ClintProp                1.7752  1     0.1827
## COVID_COUNT.y            0.6238  1     0.4296
## COVID_TEST.y             0.3758  1     0.5399
## all_doses_administered.y 0.1011  1     0.7506
## `Older (65 plus).y`      1.1296  1     0.2879
## ClintVote.y              0.7748  1     0.3787
## TrmpVote.y               1.0663  1     0.3018
## TotalVote.y              1.6290  1     0.2018
## ClintVote.x              0.0521  1     0.8195
## TrmpVote.x               0.0711  1     0.7898
## TotalVote.x              0.1095  1     0.7407
## COVID_COUNT.x            0.0494  1     0.8242
## all_doses_administered.x 0.2678  1     0.6048
## fully_vaccinated.x       0.0474  1     0.8277
## fully_vaccinated.y       0.8521  1     0.3560
```

```r
# drop1(mod7.off, test = 'Chi')


# drop TrmpProp
mod8.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
    prop_cases + `Older (65 plus).x` + olderprop + ClintProp + COVID_COUNT.y + COVID_TEST.y +
    all_doses_administered.y + `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y +
    ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x + all_doses_administered.x +
    fully_vaccinated.x + fully_vaccinated.y, family = poisson, data = big_data3)
summary(mod8.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES +
##     FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
##     olderprop + ClintProp + COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y +
##     `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y +
##     ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x +
##     all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    844.8    910.3   -396.4    792.8       66
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.91853 -0.42394  0.01366  0.36224  1.62766
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 3.026e-02 1.739e-01
##  2013 code                (Intercept) 1.859e-10 1.363e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -6.343e+01  3.744e+01  -1.694   0.0902 .
## NEVER                     5.152e+01  3.702e+01   1.392   0.1640
## RARELY                    5.158e+01  3.721e+01   1.386   0.1657
## SOMETIMES                 5.105e+01  3.710e+01   1.376   0.1688
## FREQUENTLY                5.187e+01  3.715e+01   1.396   0.1627
## ALWAYS                    5.144e+01  3.716e+01   1.384   0.1663
## prop_cases                1.467e+01  1.505e+01   0.975   0.3295
## `Older (65 plus).x`      -5.204e-06  2.935e-05  -0.177   0.8592
## olderprop                -1.052e+00  8.243e+00  -0.128   0.8985
## ClintProp                 1.123e+01  8.441e+00   1.330   0.1835
## COVID_COUNT.y            -1.323e+00  1.683e+00  -0.786   0.4318
## COVID_TEST.y              1.749e-01  2.865e-01   0.611   0.5415
## all_doses_administered.y -3.707e-01  1.206e+00  -0.307   0.7585
## `Older (65 plus).y`       1.617e+00  1.528e+00   1.058   0.2899
```

```
## ClintVote.y              -1.423e+00  1.161e+00  -1.225   0.2206
## TrmpVote.y                4.580e+00  3.234e+00   1.416   0.1567
## TotalVote.y              -4.158e+00  2.548e+00  -1.632   0.1027
## ClintVote.x              -5.023e-05  1.512e-04  -0.332   0.7398
## TrmpVote.x               -5.766e-05  1.532e-04  -0.376   0.7066
## TotalVote.x               6.366e-05  1.431e-04   0.445   0.6563
## COVID_COUNT.x            -6.631e-06  2.611e-05  -0.254   0.7995
## all_doses_administered.x -1.016e-05  1.894e-05  -0.536   0.5917
## fully_vaccinated.x        9.431e-06  3.925e-05   0.240   0.8101
## fully_vaccinated.y        1.040e+00  1.132e+00   0.919   0.3583
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod8.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                            Chisq Df Pr(>Chisq)
## NEVER                     1.9365  1     0.1640
## RARELY                    1.9211  1     0.1657
## SOMETIMES                 1.8932  1     0.1688
## FREQUENTLY                1.9492  1     0.1627
## ALWAYS                    1.9163  1     0.1663
## prop_cases                0.9508  1     0.3295
## `Older (65 plus).x`       0.0314  1     0.8592
## olderprop                 0.0163  1     0.8985
## ClintProp                 1.7691  1     0.1835
## COVID_COUNT.y             0.6181  1     0.4318
## COVID_TEST.y              0.3727  1     0.5415
## all_doses_administered.y  0.0945  1     0.7585
## `Older (65 plus).y`       1.1202  1     0.2899
## ClintVote.y               1.5004  1     0.2206
## TrmpVote.y                2.0054  1     0.1567
## TotalVote.y               2.6625  1     0.1027
## ClintVote.x               0.1103  1     0.7398
## TrmpVote.x                0.1417  1     0.7066
## TotalVote.x               0.1980  1     0.6563
## COVID_COUNT.x             0.0645  1     0.7995
## all_doses_administered.x  0.2877  1     0.5917
## fully_vaccinated.x        0.0577  1     0.8101
## fully_vaccinated.y        0.8439  1     0.3583
```

```
# drop1(mod8.off, test = 'Chi')

# drop olderprop
mod9.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
    prop_cases + `Older (65 plus).x` + ClintProp + COVID_COUNT.y + COVID_TEST.y +
```

```
    all_doses_administered.y + `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y +
    ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x + all_doses_administered.x +
    fully_vaccinated.x + fully_vaccinated.y, family = poisson, data = big_data3)
summary(mod9.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES +
##     FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
##     ClintProp + COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y +
##     `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y +
##     ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x +
##     all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    842.8    905.8   -396.4    792.8       67
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.9165 -0.4286  0.0139  0.3520  1.6212
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.03031  0.1741
##  2013 code                (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -6.421e+01  3.695e+01  -1.738  0.08225 .
## NEVER                     5.241e+01  3.638e+01   1.441  0.14970
## RARELY                    5.248e+01  3.655e+01   1.436  0.15099
## SOMETIMES                 5.195e+01  3.643e+01   1.426  0.15389
## FREQUENTLY                5.277e+01  3.648e+01   1.446  0.14808
## ALWAYS                    5.233e+01  3.650e+01   1.434  0.15158
## prop_cases                1.280e+01  3.166e+00   4.043 5.27e-05 ***
## `Older (65 plus).x`      -4.975e-06  2.936e-05  -0.169  0.86545
## ClintProp                 1.114e+01  8.423e+00   1.323  0.18579
## COVID_COUNT.y            -1.118e+00  4.284e-01  -2.609  0.00908 **
## COVID_TEST.y              1.624e-01  2.691e-01   0.603  0.54624
## all_doses_administered.y -3.563e-01  1.202e+00  -0.296  0.76693
## `Older (65 plus).y`       1.432e+00  4.521e-01   3.167  0.00154 **
## ClintVote.y              -1.425e+00  1.162e+00  -1.226  0.22004
## TrmpVote.y                4.519e+00  3.201e+00   1.412  0.15800
## TotalVote.y              -4.097e+00  2.505e+00  -1.636  0.10190
## ClintVote.x              -4.612e-05  1.479e-04  -0.312  0.75513
## TrmpVote.x               -5.347e-05  1.497e-04  -0.357  0.72098
## TotalVote.x               5.964e-05  1.398e-04   0.427  0.66966
## COVID_COUNT.x            -6.962e-06  2.597e-05  -0.268  0.78864
## all_doses_administered.x -1.086e-05  1.805e-05  -0.602  0.54738
```

```
## fully_vaccinated.x        1.108e-05  3.699e-05   0.300  0.76440
## fully_vaccinated.y        1.021e+00  1.122e+00   0.910  0.36299
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod9.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                            Chisq Df Pr(>Chisq)
## NEVER                     2.0753  1   0.149700
## RARELY                    2.0622  1   0.150989
## SOMETIMES                 2.0332  1   0.153894
## FREQUENTLY                2.0920  1   0.148075
## ALWAYS                    2.0563  1   0.151583
## prop_cases               16.3491  1  5.268e-05 ***
## `Older (65 plus).x`       0.0287  1   0.865451
## ClintProp                 1.7507  1   0.185791
## COVID_COUNT.y             6.8069  1   0.009081 **
## COVID_TEST.y              0.3641  1   0.546238
## all_doses_administered.y  0.0878  1   0.766933
## `Older (65 plus).y`      10.0329  1   0.001538 **
## ClintVote.y               1.5041  1   0.220044
## TrmpVote.y                1.9933  1   0.157999
## TotalVote.y               2.6755  1   0.101901
## ClintVote.x               0.0973  1   0.755132
## TrmpVote.x                0.1276  1   0.720983
## TotalVote.x               0.1820  1   0.669660
## COVID_COUNT.x             0.0719  1   0.788643
## all_doses_administered.x  0.3620  1   0.547383
## fully_vaccinated.x        0.0898  1   0.764399
## fully_vaccinated.y        0.8275  1   0.362986
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod9.off, test = 'Chi')

# drop older.x
mod10.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
    prop_cases + ClintProp + COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y +
    `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y + ClintVote.x +
    TrmpVote.x + TotalVote.x + COVID_COUNT.x + all_doses_administered.x + fully_vaccinated.x +
    fully_vaccinated.y, family = poisson, data = big_data3)
summary(mod10.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
```

```
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES +
##     FREQUENTLY + ALWAYS + prop_cases + ClintProp + COVID_COUNT.y +
##     COVID_TEST.y + all_doses_administered.y + `Older (65 plus).y` +
##     ClintVote.y + TrmpVote.y + TotalVote.y + ClintVote.x + TrmpVote.x +
##     TotalVote.x + COVID_COUNT.x + all_doses_administered.x +
##     fully_vaccinated.x + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    840.8    901.3   -396.4    792.8       68
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.91406 -0.42528  0.02253  0.35175  1.62202
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 3.030e-02 1.741e-01
##  2013 code                (Intercept) 1.252e-10 1.119e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -6.517e+01  3.653e+01  -1.784  0.07446 .
## NEVER                     5.345e+01  3.589e+01   1.489  0.13646
## RARELY                    5.353e+01  3.604e+01   1.485  0.13746
## SOMETIMES                 5.299e+01  3.594e+01   1.474  0.14039
## FREQUENTLY                5.382e+01  3.598e+01   1.496  0.13476
## ALWAYS                    5.338e+01  3.599e+01   1.483  0.13803
## prop_cases                1.273e+01  3.139e+00   4.055 5.01e-05 ***
## ClintProp                 1.120e+01  8.415e+00   1.331  0.18317
## COVID_COUNT.y            -1.098e+00  4.142e-01  -2.652  0.00801 **
## COVID_TEST.y              1.654e-01  2.685e-01   0.616  0.53806
## all_doses_administered.y -3.591e-01  1.202e+00  -0.299  0.76511
## `Older (65 plus).y`       1.381e+00  3.461e-01   3.989 6.63e-05 ***
## ClintVote.y              -1.414e+00  1.161e+00  -1.218  0.22311
## TrmpVote.y                4.608e+00  3.160e+00   1.458  0.14481
## TotalVote.y              -4.165e+00  2.475e+00  -1.683  0.09237 .
## ClintVote.x              -5.880e-05  1.285e-04  -0.457  0.64736
## TrmpVote.x               -6.684e-05  1.283e-04  -0.521  0.60227
## TotalVote.x               7.057e-05  1.250e-04   0.564  0.57248
## COVID_COUNT.x            -9.952e-06  1.941e-05  -0.513  0.60824
## all_doses_administered.x -1.112e-05  1.801e-05  -0.617  0.53696
## fully_vaccinated.x        1.244e-05  3.615e-05   0.344  0.73075
## fully_vaccinated.y        1.013e+00  1.121e+00   0.904  0.36597
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod10.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                             Chisq Df Pr(>Chisq)
## NEVER                      2.2174  1   0.136463
## RARELY                     2.2061  1   0.137464
## SOMETIMES                  2.1736  1   0.140393
## FREQUENTLY                 2.2368  1   0.134760
## ALWAYS                     2.1998  1   0.138027
## prop_cases                16.4456  1  5.007e-05 ***
## ClintProp                  1.7717  1   0.183171
## COVID_COUNT.y              7.0316  1   0.008008 **
## COVID_TEST.y               0.3791  1   0.538060
## all_doses_administered.y   0.0893  1   0.765114
## `Older (65 plus).y`       15.9124  1  6.634e-05 ***
## ClintVote.y                1.4843  1   0.223108
## TrmpVote.y                 2.1261  1   0.144805
## TotalVote.y                2.8326  1   0.092368 .
## ClintVote.x                0.2092  1   0.647363
## TrmpVote.x                 0.2716  1   0.602275
## TotalVote.x                0.3186  1   0.572477
## COVID_COUNT.x              0.2627  1   0.608239
## all_doses_administered.x   0.3812  1   0.536956
## fully_vaccinated.x         0.1184  1   0.730753
## fully_vaccinated.y         0.8173  1   0.365971
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod10.off, test = 'Chi')

# drop alldoses.y
mod11.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
    prop_cases + ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` +
    ClintVote.y + TrmpVote.y + TotalVote.y + ClintVote.x + TrmpVote.x + TotalVote.x +
    COVID_COUNT.x + all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y,
    family = poisson, data = big_data3)
summary(mod11.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES +
##     FREQUENTLY + ALWAYS + prop_cases + ClintProp + COVID_COUNT.y +
##     COVID_TEST.y + `Older (65 plus).y` + ClintVote.y + TrmpVote.y +
##     TotalVote.y + ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x +
##     all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
```

```
##    838.9    896.9   -396.4    792.9       69
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.92521 -0.41256  0.01534  0.35651  1.62980
##
## Random effects:
##  Groups                  Name        Variance Std.Dev.
##  '2013 code':LOCATION_ID (Intercept) 3.05e-02 0.1746327
##  2013 code               (Intercept) 2.40e-08 0.0001549
## Number of obs: 92, groups:  '2013 code':LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)               -6.774e+01  3.560e+01  -1.903  0.05704 .
## NEVER                      5.558e+01  3.526e+01   1.577  0.11489
## RARELY                     5.566e+01  3.542e+01   1.571  0.11609
## SOMETIMES                  5.514e+01  3.530e+01   1.562  0.11830
## FREQUENTLY                 5.594e+01  3.536e+01   1.582  0.11368
## ALWAYS                     5.551e+01  3.537e+01   1.569  0.11660
## prop_cases                 1.258e+01  3.111e+00   4.042 5.30e-05 ***
## ClintProp                  1.202e+01  7.975e+00   1.508  0.13160
## COVID_COUNT.y             -1.071e+00  4.072e-01  -2.631  0.00851 **
## COVID_TEST.y               1.503e-01  2.639e-01   0.569  0.56906
## 'Older (65 plus).y'        1.368e+00  3.438e-01   3.979 6.91e-05 ***
## ClintVote.y               -1.532e+00  1.097e+00  -1.396  0.16260
## TrmpVote.y                 4.866e+00  3.046e+00   1.597  0.11022
## TotalVote.y               -4.341e+00  2.410e+00  -1.801  0.07167 .
## ClintVote.x               -5.739e-05  1.288e-04  -0.446  0.65583
## TrmpVote.x                -6.539e-05  1.285e-04  -0.509  0.61083
## TotalVote.x                6.982e-05  1.253e-04   0.557  0.57747
## COVID_COUNT.x             -1.080e-05  1.931e-05  -0.559  0.57599
## all_doses_administered.x -1.436e-05  1.434e-05  -1.002  0.31650
## fully_vaccinated.x         1.918e-05  2.826e-05   0.679  0.49736
## fully_vaccinated.y         6.843e-01  2.260e-01   3.028  0.00246 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## unable to evaluate scaled gradient
## Model failed to converge: degenerate  Hessian with 1 negative eigenvalues
```

```
Anova(mod11.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                            Chisq Df Pr(>Chisq)
## NEVER                     2.4856  1   0.114892
## RARELY                    2.4693  1   0.116086
## SOMETIMES                 2.4397  1   0.118303
## FREQUENTLY                2.5023  1   0.113677
## ALWAYS                    2.4625  1   0.116596
```

```
## prop_cases               16.3386  1  5.297e-05 ***
## ClintProp                 2.2735  1   0.131602
## COVID_COUNT.y             6.9236  1   0.008506 **
## COVID_TEST.y              0.3243  1   0.569062
## `Older (65 plus).y`      15.8364  1  6.906e-05 ***
## ClintVote.y               1.9499  1   0.162598
## TrmpVote.y                2.5510  1   0.110225
## TotalVote.y               3.2443  1   0.071671 .
## ClintVote.x               0.1986  1   0.655832
## TrmpVote.x                0.2590  1   0.610827
## TotalVote.x               0.3103  1   0.577466
## COVID_COUNT.x             0.3128  1   0.575988
## all_doses_administered.x  1.0034  1   0.316497
## fully_vaccinated.x        0.4606  1   0.497361
## fully_vaccinated.y        9.1702  1   0.002460 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod11.off, test = 'Chi')

# drop clintvote.x
mod12.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
    prop_cases + ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` +
    ClintVote.y + TrmpVote.y + TotalVote.y + TrmpVote.x + TotalVote.x + COVID_COUNT.x +
    all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y, family = poisson,
    data = big_data3)
summary(mod12.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES +
##     FREQUENTLY + ALWAYS + prop_cases + ClintProp + COVID_COUNT.y +
##     COVID_TEST.y + `Older (65 plus).y` + ClintVote.y + TrmpVote.y +
##     TotalVote.y + TrmpVote.x + TotalVote.x + COVID_COUNT.x +
##     all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    837.1    892.6   -396.5    793.1       70
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.92840 -0.43374  0.02119  0.35580  1.61158
##
## Random effects:
##  Groups                  Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.03061  0.1749
##  2013 code               (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
```

```
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -7.128e+01  3.472e+01  -2.053  0.04009 *
## NEVER                       5.969e+01  3.405e+01   1.753  0.07962 .
## RARELY                      5.983e+01  3.418e+01   1.751  0.08002 .
## SOMETIMES                   5.925e+01  3.409e+01   1.738  0.08223 .
## FREQUENTLY                  6.006e+01  3.416e+01   1.758  0.07872 .
## ALWAYS                      5.964e+01  3.416e+01   1.746  0.08078 .
## prop_cases                  1.231e+01  3.054e+00   4.032 5.53e-05 ***
## ClintProp                   1.027e+01  6.937e+00   1.481  0.13872
## COVID_COUNT.y              -1.050e+00  4.044e-01  -2.596  0.00943 **
## COVID_TEST.y                1.572e-01  2.637e-01   0.596  0.55107
## `Older (65 plus).y`         1.343e+00  3.400e-01   3.952 7.76e-05 ***
## ClintVote.y                -1.280e+00  9.416e-01  -1.359  0.17416
## TrmpVote.y                  4.334e+00  2.802e+00   1.547  0.12190
## TotalVote.y                -4.030e+00  2.309e+00  -1.745  0.08091 .
## TrmpVote.x                 -8.376e-06  1.098e-05  -0.763  0.44569
## TotalVote.x                 1.400e-05  6.779e-06   2.066  0.03886 *
## COVID_COUNT.x              -1.352e-05  1.827e-05  -0.740  0.45930
## all_doses_administered.x -1.346e-05  1.423e-05  -0.946  0.34423
## fully_vaccinated.x          2.045e-05  2.815e-05   0.726  0.46754
## fully_vaccinated.y          6.536e-01  2.161e-01   3.025  0.00249 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod12.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                              Chisq Df Pr(>Chisq)
## NEVER                       3.0726  1   0.079620 .
## RARELY                      3.0644  1   0.080025 .
## SOMETIMES                   3.0203  1   0.082228 .
## FREQUENTLY                  3.0911  1   0.078720 .
## ALWAYS                      3.0492  1   0.080778 .
## prop_cases                 16.2573  1   5.53e-05 ***
## ClintProp                   2.1921  1   0.138720
## COVID_COUNT.y               6.7403  1   0.009426 **
## COVID_TEST.y                0.3554  1   0.551071
## `Older (65 plus).y`        15.6160  1   7.76e-05 ***
## ClintVote.y                 1.8468  1   0.174160
## TrmpVote.y                  2.3927  1   0.121899
## TotalVote.y                 3.0465  1   0.080910 .
## TrmpVote.x                  0.5816  1   0.445687
## TotalVote.x                 4.2671  1   0.038856 *
## COVID_COUNT.x               0.5476  1   0.459304
## all_doses_administered.x    0.8946  1   0.344230
## fully_vaccinated.x          0.5278  1   0.467538
## fully_vaccinated.y          9.1501  1   0.002487 **
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod12.off, test = 'Chi')

# drop covidtest.y
mod13.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
    prop_cases + ClintProp + COVID_COUNT.y + `Older (65 plus).y` + ClintVote.y +
    TrmpVote.y + TotalVote.y + TrmpVote.x + TotalVote.x + COVID_COUNT.x + all_doses_administered.x +
    fully_vaccinated.x + fully_vaccinated.y, family = poisson, data = big_data3)
summary(mod13.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES +
##     FREQUENTLY + ALWAYS + prop_cases + ClintProp + COVID_COUNT.y +
##     `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y +
##     TrmpVote.x + TotalVote.x + COVID_COUNT.x + all_doses_administered.x +
##     fully_vaccinated.x + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    835.4    888.4   -396.7    793.4       71
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.88350 -0.42946  0.02871  0.31641  1.61081
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 3.095e-02 1.759e-01
##  2013 code               (Intercept) 8.778e-10 2.963e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                            Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -6.998e+01  3.480e+01  -2.011  0.04432 *
## NEVER                     5.879e+01  3.416e+01   1.721  0.08528 .
## RARELY                    5.886e+01  3.428e+01   1.717  0.08601 .
## SOMETIMES                 5.832e+01  3.420e+01   1.705  0.08815 .
## FREQUENTLY                5.911e+01  3.426e+01   1.725  0.08450 .
## ALWAYS                    5.868e+01  3.426e+01   1.713  0.08676 .
## prop_cases                1.203e+01  3.020e+00   3.982 6.82e-05 ***
## ClintProp                 9.537e+00  6.848e+00   1.393  0.16370
## COVID_COUNT.y            -9.084e-01  3.270e-01  -2.778  0.00546 **
## `Older (65 plus).y`       1.348e+00  3.413e-01   3.949 7.86e-05 ***
## ClintVote.y              -1.238e+00  9.425e-01  -1.314  0.18884
## TrmpVote.y                3.902e+00  2.714e+00   1.438  0.15054
## TotalVote.y              -3.633e+00  2.218e+00  -1.638  0.10150
## TrmpVote.x               -7.392e-06  1.090e-05  -0.678  0.49784
## TotalVote.x               1.333e-05  6.709e-06   1.987  0.04690 *
## COVID_COUNT.x            -1.400e-05  1.834e-05  -0.763  0.44541
```

```
## all_doses_administered.x -1.387e-05  1.428e-05  -0.971  0.33133
## fully_vaccinated.x        2.188e-05  2.817e-05   0.777  0.43740
## fully_vaccinated.y        6.556e-01  2.168e-01   3.025  0.00249 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod13.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                              Chisq Df Pr(>Chisq)
## NEVER                       2.9613  1   0.085277 .
## RARELY                      2.9475  1   0.086013 .
## SOMETIMES                   2.9079  1   0.088148 .
## FREQUENTLY                  2.9762  1   0.084499 .
## ALWAYS                      2.9336  1   0.086756 .
## prop_cases                 15.8596  1  6.822e-05 ***
## ClintProp                   1.9397  1   0.163701
## COVID_COUNT.y               7.7194  1   0.005463 **
## `Older (65 plus).y`        15.5919  1  7.859e-05 ***
## ClintVote.y                 1.7267  1   0.188837
## TrmpVote.y                  2.0667  1   0.150543
## TotalVote.y                 2.6819  1   0.101495
## TrmpVote.x                  0.4595  1   0.497837
## TotalVote.x                 3.9489  1   0.046902 *
## COVID_COUNT.x               0.5823  1   0.445407
## all_doses_administered.x    0.9437  1   0.331328
## fully_vaccinated.x          0.6031  1   0.437405
## fully_vaccinated.y          9.1478  1   0.002490 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod13.off, test = 'Chi')

# drop trumpvote.x
mod14.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
    prop_cases + ClintProp + COVID_COUNT.y + `Older (65 plus).y` + ClintVote.y +
    TrmpVote.y + TotalVote.y + TotalVote.x + COVID_COUNT.x + all_doses_administered.x +
    fully_vaccinated.x + fully_vaccinated.y, family = poisson, data = big_data3)
summary(mod14.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES +
##     FREQUENTLY + ALWAYS + prop_cases + ClintProp + COVID_COUNT.y +
```

```
##     `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y +
##     TotalVote.x + COVID_COUNT.x + all_doses_administered.x +
##     fully_vaccinated.x + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    833.9    884.3   -397.0    793.9       72
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.8799 -0.4237  0.0239  0.3022  1.5673
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 3.108e-02 1.763e-01
##  2013 code               (Intercept) 1.364e-09 3.693e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -6.273e+01  3.311e+01  -1.894  0.05816 .
## NEVER                     5.193e+01  3.263e+01   1.591  0.11151
## RARELY                    5.175e+01  3.264e+01   1.585  0.11286
## SOMETIMES                 5.144e+01  3.266e+01   1.575  0.11528
## FREQUENTLY                5.214e+01  3.268e+01   1.595  0.11067
## ALWAYS                    5.167e+01  3.267e+01   1.582  0.11367
## prop_cases                1.236e+01  2.985e+00   4.140 3.48e-05 ***
## ClintProp                 8.420e+00  6.649e+00   1.266  0.20541
## COVID_COUNT.y            -9.381e-01  3.244e-01  -2.892  0.00383 **
## `Older (65 plus).y`       1.368e+00  3.406e-01   4.015 5.93e-05 ***
## ClintVote.y              -1.290e+00  9.406e-01  -1.371  0.17023
## TrmpVote.y                2.977e+00  2.342e+00   1.271  0.20369
## TotalVote.y              -2.719e+00  1.754e+00  -1.550  0.12119
## TotalVote.x               1.169e-05  6.265e-06   1.866  0.06211 .
## COVID_COUNT.x            -1.025e-05  1.749e-05  -0.586  0.55764
## all_doses_administered.x -1.765e-05  1.316e-05  -1.341  0.17979
## fully_vaccinated.x        2.739e-05  2.701e-05   1.014  0.31052
## fully_vaccinated.y        6.768e-01  2.144e-01   3.157  0.00160 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod14.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                            Chisq Df Pr(>Chisq)
## NEVER                     2.5327  1   0.111508
## RARELY                    2.5137  1   0.112864
## SOMETIMES                 2.4803  1   0.115281
```

```
## FREQUENTLY                2.5446  1   0.110670
## ALWAYS                    2.5025  1   0.113666
## prop_cases               17.1369  1  3.478e-05 ***
## ClintProp                 1.6035  1   0.205409
## COVID_COUNT.y             8.3646  1   0.003826 **
## `Older (65 plus).y`      16.1240  1  5.933e-05 ***
## ClintVote.y               1.8809  1   0.170227
## TrmpVote.y                1.6157  1   0.203692
## TotalVote.y               2.4019  1   0.121192
## TotalVote.x               3.4803  1   0.062105 .
## COVID_COUNT.x             0.3438  1   0.557635
## all_doses_administered.x  1.7994  1   0.179789
## fully_vaccinated.x        1.0284  1   0.310524
## fully_vaccinated.y        9.9638  1   0.001596 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod14.off, test = 'Chi')

# drop covidcount.x
mod15.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
    prop_cases + ClintProp + COVID_COUNT.y + `Older (65 plus).y` + ClintVote.y +
    TrmpVote.y + TotalVote.y + TotalVote.x + all_doses_administered.x + fully_vaccinated.x +
    fully_vaccinated.y, family = poisson, data = big_data3)
summary(mod15.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES +
##     FREQUENTLY + ALWAYS + prop_cases + ClintProp + COVID_COUNT.y +
##     `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y +
##     TotalVote.x + all_doses_administered.x + fully_vaccinated.x +
##     fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    832.3    880.2   -397.1    794.3       73
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.87373 -0.42598  0.01089  0.31624  1.54125
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.03113  0.1764
##  2013 code                (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -5.982e+01  3.276e+01  -1.826  0.06786 .
```

```
## NEVER                     4.917e+01  3.231e+01   1.522  0.12807
## RARELY                    4.891e+01  3.230e+01   1.514  0.12999
## SOMETIMES                 4.869e+01  3.234e+01   1.505  0.13225
## FREQUENTLY                4.930e+01  3.235e+01   1.524  0.12745
## ALWAYS                    4.886e+01  3.233e+01   1.511  0.13074
## prop_cases                1.239e+01  2.987e+00   4.147 3.37e-05 ***
## ClintProp                 7.548e+00  6.485e+00   1.164  0.24446
## COVID_COUNT.y            -1.017e+00  2.959e-01  -3.436  0.00059 ***
## `Older (65 plus).y`       1.330e+00  3.343e-01   3.978 6.95e-05 ***
## ClintVote.y              -1.179e+00  9.221e-01  -1.279  0.20098
## TrmpVote.y                2.681e+00  2.288e+00   1.171  0.24144
## TotalVote.y              -2.421e+00  1.681e+00  -1.441  0.14965
## TotalVote.x               9.476e-06  4.998e-06   1.896  0.05798 .
## all_doses_administered.x -1.772e-05  1.316e-05  -1.346  0.17819
## fully_vaccinated.x        2.685e-05  2.700e-05   0.994  0.32001
## fully_vaccinated.y        6.831e-01  2.141e-01   3.191  0.00142 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod15.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                            Chisq Df Pr(>Chisq)
## NEVER                     2.3157  1  0.1280710
## RARELY                    2.2926  1  0.1299943
## SOMETIMES                 2.2659  1  0.1322532
## FREQUENTLY                2.3233  1  0.1274467
## ALWAYS                    2.2837  1  0.1307424
## prop_cases               17.1951  1  3.373e-05 ***
## ClintProp                 1.3547  1  0.2444641
## COVID_COUNT.y            11.8067  1  0.0005902 ***
## `Older (65 plus).y`      15.8257  1  6.945e-05 ***
## ClintVote.y               1.6353  1  0.2009784
## TrmpVote.y                1.3722  1  0.2414405
## TotalVote.y               2.0758  1  0.1496534
## TotalVote.x               3.5944  1  0.0579758 .
## all_doses_administered.x  1.8127  1  0.1781890
## fully_vaccinated.x        0.9889  1  0.3200110
## fully_vaccinated.y       10.1832  1  0.0014173 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod15.off, test = 'Chi')

# drop fullyvaccinated.x
mod16.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
```

```
    prop_cases + ClintProp + COVID_COUNT.y + `Older (65 plus).y` + ClintVote.y +
    TrmpVote.y + TotalVote.y + TotalVote.x + all_doses_administered.x + fully_vaccinated.y,
    family = poisson, data = big_data3)
summary(mod16.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES +
##     FREQUENTLY + ALWAYS + prop_cases + ClintProp + COVID_COUNT.y +
##     `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y +
##     TotalVote.x + all_doses_administered.x + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    831.2    876.6   -397.6    795.2       74
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.88125 -0.34985  0.00674  0.33444  1.50423
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 3.179e-02 1.783e-01
##  2013 code                (Intercept) 8.729e-09 9.343e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -5.801e+01  3.297e+01  -1.760 0.078452 .
## NEVER                     4.712e+01  3.250e+01   1.450 0.147146
## RARELY                    4.681e+01  3.249e+01   1.441 0.149628
## SOMETIMES                 4.675e+01  3.254e+01   1.437 0.150824
## FREQUENTLY                4.727e+01  3.254e+01   1.453 0.146263
## ALWAYS                    4.680e+01  3.252e+01   1.439 0.150161
## prop_cases                1.281e+01  2.980e+00   4.299 1.71e-05 ***
## ClintProp                 8.792e+00  6.417e+00   1.370 0.170629
## COVID_COUNT.y            -1.077e+00  2.916e-01  -3.695 0.000220 ***
## `Older (65 plus).y`       1.363e+00  3.352e-01   4.065 4.79e-05 ***
## ClintVote.y              -1.230e+00  9.280e-01  -1.325 0.185057
## TrmpVote.y                3.376e+00  2.197e+00   1.537 0.124348
## TotalVote.y              -3.065e+00  1.563e+00  -1.961 0.049838 *
## TotalVote.x               8.513e-06  4.948e-06   1.721 0.085306 .
## all_doses_administered.x -5.012e-06  3.182e-06  -1.575 0.115243
## fully_vaccinated.y        7.122e-01  2.132e-01   3.341 0.000836 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod16.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                             Chisq Df Pr(>Chisq)
## NEVER                      2.1016  1  0.1471459
## RARELY                     2.0760  1  0.1496281
## SOMETIMES                  2.0639  1  0.1508239
## FREQUENTLY                 2.1108  1  0.1462634
## ALWAYS                     2.0706  1  0.1501607
## prop_cases                18.4825  1  1.715e-05 ***
## ClintProp                  1.8774  1  0.1706295
## COVID_COUNT.y             13.6521  1  0.0002200 ***
## `Older (65 plus).y`       16.5281  1  4.793e-05 ***
## ClintVote.y                1.7565  1  0.1850566
## TrmpVote.y                 2.3617  1  0.1243478
## TotalVote.y                3.8469  1  0.0498381 *
## TotalVote.x                2.9608  1  0.0853060 .
## all_doses_administered.x   2.4808  1  0.1152427
## fully_vaccinated.y        11.1600  1  0.0008358 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod16.off, test = 'Chi')

# drop clintvote.y
mod17.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
    prop_cases + ClintProp + COVID_COUNT.y + `Older (65 plus).y` + TrmpVote.y + TotalVote.y +
    TotalVote.x + all_doses_administered.x + fully_vaccinated.y, family = poisson,
    data = big_data3)
summary(mod17.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES +
##     FREQUENTLY + ALWAYS + prop_cases + ClintProp + COVID_COUNT.y +
##     `Older (65 plus).y` + TrmpVote.y + TotalVote.y + TotalVote.x +
##     all_doses_administered.x + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    831.0    873.9   -398.5    797.0       75
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.82690 -0.34919  0.05884  0.28666  1.55827
##
## Random effects:
##  Groups                  Name        Variance  Std.Dev.
```

```
##  `2013 code`:LOCATION_ID (Intercept) 3.246e-02 1.802e-01
##  2013 code               (Intercept) 3.966e-09 6.297e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -4.790e+01  3.232e+01  -1.482 0.138309
## NEVER                       4.001e+01  3.230e+01   1.239 0.215446
## RARELY                      3.938e+01  3.224e+01   1.221 0.221930
## SOMETIMES                   3.961e+01  3.234e+01   1.225 0.220608
## FREQUENTLY                  4.009e+01  3.233e+01   1.240 0.214974
## ALWAYS                      3.968e+01  3.232e+01   1.228 0.219572
## prop_cases                  1.280e+01  3.001e+00   4.266 1.99e-05 ***
## ClintProp                   9.539e-01  2.522e+00   0.378 0.705284
## COVID_COUNT.y              -1.081e+00  2.935e-01  -3.684 0.000229 ***
## `Older (65 plus).y`         1.412e+00  3.357e-01   4.207 2.59e-05 ***
## TrmpVote.y                  1.102e+00  1.387e+00   0.795 0.426619
## TotalVote.y                -2.049e+00  1.372e+00  -1.493 0.135411
## TotalVote.x                 1.043e-05  4.771e-06   2.186 0.028828 *
## all_doses_administered.x -6.061e-06  3.108e-06  -1.950 0.051175 .
## fully_vaccinated.y          6.884e-01  2.138e-01   3.220 0.001281 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod17.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                              Chisq Df Pr(>Chisq)
## NEVER                       1.5345  1  0.2154456
## RARELY                      1.4918  1  0.2219299
## SOMETIMES                   1.5004  1  0.2206085
## FREQUENTLY                  1.5376  1  0.2149735
## ALWAYS                      1.5072  1  0.2195717
## prop_cases                 18.1981  1  1.991e-05 ***
## ClintProp                   0.1430  1  0.7052844
## COVID_COUNT.y              13.5732  1  0.0002294 ***
## `Older (65 plus).y`        17.6954  1  2.593e-05 ***
## TrmpVote.y                  0.6320  1  0.4266194
## TotalVote.y                 2.2294  1  0.1354108
## TotalVote.x                 4.7778  1  0.0288284 *
## all_doses_administered.x  3.8025  1  0.0511754 .
## fully_vaccinated.y         10.3703  1  0.0012806 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod17.off, test = 'Chi')
```

```r
# drop clintprop
mod18.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
    prop_cases + COVID_COUNT.y + `Older (65 plus).y` + TrmpVote.y + TotalVote.y +
    TotalVote.x + all_doses_administered.x + fully_vaccinated.y, family = poisson,
    data = big_data3)
summary(mod18.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID) + NEVER + RARELY + SOMETIMES +
##     FREQUENTLY + ALWAYS + prop_cases + COVID_COUNT.y + `Older (65 plus).y` +
##     TrmpVote.y + TotalVote.y + TotalVote.x + all_doses_administered.x +
##     fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    829.1    869.5   -398.6    797.1       76
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.81428 -0.35480  0.04585  0.28583  1.55578
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.03258  0.1805
##  2013 code               (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -4.696e+01  3.227e+01  -1.455 0.145605
## NEVER                     3.900e+01  3.224e+01   1.210 0.226327
## RARELY                    3.839e+01  3.218e+01   1.193 0.232934
## SOMETIMES                 3.859e+01  3.227e+01   1.196 0.231763
## FREQUENTLY                3.910e+01  3.227e+01   1.212 0.225607
## ALWAYS                    3.867e+01  3.226e+01   1.199 0.230574
## prop_cases                1.318e+01  2.839e+00   4.645 3.41e-06 ***
## COVID_COUNT.y            -1.117e+00  2.786e-01  -4.010 6.08e-05 ***
## `Older (65 plus).y`       1.462e+00  3.047e-01   4.799 1.60e-06 ***
## TrmpVote.y                5.847e-01  2.351e-01   2.487 0.012867 *
## TotalVote.y              -1.553e+00  4.492e-01  -3.458 0.000544 ***
## TotalVote.x               1.013e-05  4.708e-06   2.150 0.031528 *
## all_doses_administered.x -5.904e-06  3.083e-06  -1.915 0.055538 .
## fully_vaccinated.y        7.036e-01  2.100e-01   3.350 0.000807 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod18.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                            Chisq Df Pr(>Chisq)
## NEVER                     1.4638  1  0.2263273
## RARELY                    1.4229  1  0.2329343
## SOMETIMES                 1.4300  1  0.2317630
## FREQUENTLY                1.4683  1  0.2256066
## ALWAYS                    1.4373  1  0.2305740
## prop_cases               21.5720  1  3.408e-06 ***
## COVID_COUNT.y            16.0782  1  6.078e-05 ***
## `Older (65 plus).y`      23.0275  1  1.597e-06 ***
## TrmpVote.y                6.1874  1  0.0128666 *
## TotalVote.y              11.9570  1  0.0005444 ***
## TotalVote.x               4.6240  1  0.0315279 *
## all_doses_administered.x  3.6659  1  0.0555382 .
## fully_vaccinated.y       11.2248  1  0.0008071 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod18.off, test = 'Chi')

# drop RARELY
mod19.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID) + NEVER + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases +
    COVID_COUNT.y + `Older (65 plus).y` + TrmpVote.y + TotalVote.y + TotalVote.x +
    all_doses_administered.x + fully_vaccinated.y, family = poisson, data = big_data3)
summary(mod19.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID) + NEVER + SOMETIMES + FREQUENTLY +
##     ALWAYS + prop_cases + COVID_COUNT.y + `Older (65 plus).y` +
##     TrmpVote.y + TotalVote.y + TotalVote.x + all_doses_administered.x +
##     fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    828.5    866.4   -399.3    798.5       77
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.73459 -0.32727  0.05813  0.28168  1.58262
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 3.369e-02 1.835e-01
##  2013 code               (Intercept) 7.553e-09 8.691e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
```

```
##
## Fixed effects:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -8.486e+00  1.036e+00  -8.188 2.66e-16 ***
## NEVER                       5.602e-01  9.249e-01   0.606  0.54474
## SOMETIMES                   1.047e-01  9.642e-01   0.109  0.91356
## FREQUENTLY                  6.169e-01  7.017e-01   0.879  0.37933
## ALWAYS                      1.963e-01  6.554e-01   0.299  0.76458
## prop_cases                  1.345e+01  2.864e+00   4.698 2.63e-06 ***
## COVID_COUNT.y              -1.127e+00  2.818e-01  -4.000 6.32e-05 ***
## `Older (65 plus).y`         1.462e+00  3.085e-01   4.740 2.14e-06 ***
## TrmpVote.y                  5.551e-01  2.371e-01   2.341  0.01921 *
## TotalVote.y                -1.477e+00  4.499e-01  -3.283  0.00103 **
## TotalVote.x                 9.578e-06  4.756e-06   2.014  0.04404 *
## all_doses_administered.x -5.527e-06  3.113e-06  -1.775  0.07584 .
## fully_vaccinated.y          6.597e-01  2.092e-01   3.153  0.00162 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod19.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                              Chisq Df Pr(>Chisq)
## NEVER                       0.3668  1   0.544745
## SOMETIMES                   0.0118  1   0.913564
## FREQUENTLY                  0.7729  1   0.379326
## ALWAYS                      0.0897  1   0.764584
## prop_cases                 22.0669  1  2.633e-06 ***
## COVID_COUNT.y              16.0034  1  6.323e-05 ***
## `Older (65 plus).y`        22.4664  1  2.139e-06 ***
## TrmpVote.y                  5.4824  1   0.019209 *
## TotalVote.y                10.7755  1   0.001029 **
## TotalVote.x                 4.0552  1   0.044036 *
## all_doses_administered.x    3.1520  1   0.075836 .
## fully_vaccinated.y          9.9404  1   0.001617 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod19.off, test = 'Chi')

# drop SOMETIMES
mod20.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID) + NEVER + FREQUENTLY + ALWAYS + prop_cases + COVID_COUNT.y +
    `Older (65 plus).y` + TrmpVote.y + TotalVote.y + TotalVote.x + all_doses_administered.x +
    fully_vaccinated.y, family = poisson, data = big_data3)
summary(mod20.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
```

```
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID) + NEVER + FREQUENTLY + ALWAYS +
##     prop_cases + COVID_COUNT.y + `Older (65 plus).y` + TrmpVote.y +
##     TotalVote.y + TotalVote.x + all_doses_administered.x + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    826.6    861.9   -399.3    798.6       78
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.72754 -0.32733  0.05536  0.27859  1.56655
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 3.375e-02 0.1837175
##  2013 code               (Intercept) 6.047e-08 0.0002459
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -8.423e+00  8.521e-01  -9.885  < 2e-16 ***
## NEVER                     4.860e-01  6.324e-01   0.768 0.442221
## FREQUENTLY                5.653e-01  5.114e-01   1.105 0.268954
## ALWAYS                    1.386e-01  3.754e-01   0.369 0.711906
## prop_cases                1.344e+01  2.863e+00   4.696 2.66e-06 ***
## COVID_COUNT.y            -1.126e+00  2.818e-01  -3.995 6.46e-05 ***
## `Older (65 plus).y`       1.460e+00  3.085e-01   4.735 2.20e-06 ***
## TrmpVote.y                5.545e-01  2.372e-01   2.338 0.019380 *
## TotalVote.y              -1.479e+00  4.458e-01  -3.318 0.000906 ***
## TotalVote.x               9.577e-06  4.759e-06   2.013 0.044158 *
## all_doses_administered.x -5.529e-06  3.115e-06  -1.775 0.075858 .
## fully_vaccinated.y        6.630e-01  2.064e-01   3.212 0.001317 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) NEVER  FREQUE ALWAYS prp_cs COVID_ `O(65p TrmpV. TtlVt.y
## NEVER       -0.263
## FREQUENTLY  -0.244  0.190
## ALWAYS      -0.143  0.428  0.470
## prop_cases  -0.736  0.117  0.092 -0.005
## COVID_COUNT  0.751  0.011 -0.061  0.110 -0.818
## `O(65pls).` -0.419 -0.065  0.207  0.007  0.456 -0.621
## TrmpVote.y  -0.065 -0.126  0.064  0.090 -0.002 -0.136  0.204
## TotalVote.y -0.344  0.144 -0.193 -0.178  0.259 -0.143 -0.386 -0.668
## TotalVote.x  0.264  0.071  0.069  0.181 -0.267  0.266 -0.346  0.055 -0.242
## all_dss_dm. -0.211 -0.082 -0.065 -0.188  0.286 -0.288  0.373  0.020  0.168
## flly_vccnt.  0.236 -0.079  0.126  0.090 -0.073 -0.068  0.069  0.246 -0.623
##             TtlVt.x all__.
## NEVER
## FREQUENTLY
```

```
## ALWAYS
## prop_cases
## COVID_COUNT
## `O(65pls).`
## TrmpVote.y
## TotalVote.y
## TotalVote.x
## all_dss_dm. -0.984
## flly_vccnt.  0.555  -0.514
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## unable to evaluate scaled gradient
## Model failed to converge: degenerate  Hessian with 1 negative eigenvalues
```

```
Anova(mod20.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                             Chisq Df Pr(>Chisq)
## NEVER                      0.5905  1  0.4422211
## FREQUENTLY                 1.2221  1  0.2689545
## ALWAYS                     0.1364  1  0.7119061
## prop_cases                22.0490  1  2.658e-06 ***
## COVID_COUNT.y             15.9639  1  6.456e-05 ***
## `Older (65 plus).y`       22.4163  1  2.195e-06 ***
## TrmpVote.y                 5.4669  1  0.0193804 *
## TotalVote.y               11.0098  1  0.0009063 ***
## TotalVote.x                4.0505  1  0.0441580 *
## all_doses_administered.x   3.1515  1  0.0758578 .
## fully_vaccinated.y        10.3186  1  0.0013170 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod20.off, test = 'Chi')


# drop ALWAYS
mod21.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID) + NEVER + FREQUENTLY + prop_cases + COVID_COUNT.y +
    `Older (65 plus).y` + TrmpVote.y + TotalVote.y + TotalVote.x + all_doses_administered.x +
    fully_vaccinated.y, family = poisson, data = big_data3)
summary(mod21.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID) + NEVER + FREQUENTLY + prop_cases +
##     COVID_COUNT.y + `Older (65 plus).y` + TrmpVote.y + TotalVote.y +
##     TotalVote.x + all_doses_administered.x + fully_vaccinated.y
##    Data: big_data3
```

```
##
##      AIC      BIC   logLik deviance df.resid
##    824.7    857.5   -399.3    798.7       79
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.73526 -0.33000  0.05146  0.27157  1.49073
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.0339   0.1841
##  2013 code               (Intercept) 0.0000   0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -8.379e+00  8.447e-01  -9.920  < 2e-16 ***
## NEVER                       3.865e-01  5.725e-01   0.675 0.499683
## FREQUENTLY                  4.766e-01  4.520e-01   1.054 0.291685
## prop_cases                  1.347e+01  2.867e+00   4.696 2.65e-06 ***
## COVID_COUNT.y              -1.140e+00  2.806e-01  -4.064 4.81e-05 ***
## `Older (65 plus).y`         1.460e+00  3.090e-01   4.726 2.29e-06 ***
## TrmpVote.y                  5.505e-01  2.366e-01   2.327 0.019991 *
## TotalVote.y                -1.457e+00  4.394e-01  -3.315 0.000916 ***
## TotalVote.x                 9.318e-06  4.689e-06   1.987 0.046894 *
## all_doses_administered.x -5.345e-06  3.065e-06  -1.744 0.081157 .
## fully_vaccinated.y          6.612e-01  2.058e-01   3.213 0.001315 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) NEVER  FREQUE prp_cs COVID_ `O(65p TrmpV. TtlVt.y TtlVt.x
## NEVER       -0.226
## FREQUENTLY  -0.202 -0.014
## prop_cases  -0.744  0.131  0.107
## COVID_COUNT  0.780 -0.041 -0.128 -0.822
## `O(65pls).` -0.423 -0.075  0.231  0.456 -0.625
## TrmpVote.y  -0.053 -0.182  0.024 -0.002 -0.147  0.205
## TotalVote.y -0.379  0.247 -0.126  0.263 -0.126 -0.391 -0.665
## TotalVote.x  0.298 -0.007 -0.018 -0.271  0.252 -0.353  0.039 -0.217
## all_dss_dm. -0.244 -0.002  0.027  0.291 -0.274  0.381  0.038  0.139  -0.984
## flly_vccnt.  0.252 -0.131  0.095 -0.073 -0.078  0.069  0.240 -0.619   0.550
##             all__.
## NEVER
## FREQUENTLY
## prop_cases
## COVID_COUNT
## `O(65pls).`
## TrmpVote.y
## TotalVote.y
## TotalVote.x
## all_dss_dm.
## flly_vccnt. -0.508
## fit warnings:
```

```
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod21.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                             Chisq Df Pr(>Chisq)
## NEVER                      0.4556  1  0.4996829
## FREQUENTLY                 1.1118  1  0.2916854
## prop_cases                22.0537  1  2.651e-06 ***
## COVID_COUNT.y             16.5198  1  4.815e-05 ***
## `Older (65 plus).y`       22.3355  1  2.289e-06 ***
## TrmpVote.y                 5.4127  1  0.0199913 *
## TotalVote.y               10.9898  1  0.0009161 ***
## TotalVote.x                3.9492  1  0.0468936 *
## all_doses_administered.x   3.0416  1  0.0811571 .
## fully_vaccinated.y        10.3214  1  0.0013150 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod21.off, test = 'Chi')

# drop NEVER
mod22.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID) + FREQUENTLY + prop_cases + COVID_COUNT.y + `Older (65 plus).y` +
    TrmpVote.y + TotalVote.y + TotalVote.x + all_doses_administered.x + fully_vaccinated.y,
    family = poisson, data = big_data3)
summary(mod22.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID) + FREQUENTLY + prop_cases +
##     COVID_COUNT.y + `Older (65 plus).y` + TrmpVote.y + TotalVote.y +
##     TotalVote.x + all_doses_administered.x + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    823.1    853.4   -399.6    799.1       80
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.72672 -0.33711  0.05078  0.27395  1.52717
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 3.399e-02 1.844e-01
##  2013 code                (Intercept) 4.991e-09 7.065e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
```

```
##
## Fixed effects:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -8.236e+00  8.232e-01 -10.005  < 2e-16 ***
## FREQUENTLY                  4.811e-01  4.523e-01   1.064 0.287506
## prop_cases                  1.316e+01  2.844e+00   4.627 3.72e-06 ***
## COVID_COUNT.y              -1.126e+00  2.804e-01  -4.014 5.98e-05 ***
## `Older (65 plus).y`         1.475e+00  3.084e-01   4.784 1.72e-06 ***
## TrmpVote.y                  5.758e-01  2.328e-01   2.473 0.013406 *
## TotalVote.y                -1.530e+00  4.260e-01  -3.591 0.000330 ***
## TotalVote.x                 9.333e-06  4.693e-06   1.989 0.046741 *
## all_doses_administered.x -5.340e-06  3.068e-06  -1.741 0.081735 .
## fully_vaccinated.y          6.763e-01  2.041e-01   3.313 0.000922 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) FREQUE prp_cs COVID_ `O(65p TrmpV. TtlVt.y TtlVt.x all__.
## FREQUENTLY  -0.211
## prop_cases  -0.740  0.110
## COVID_COUNT  0.792 -0.129 -0.824
## `O(65pls).` -0.453  0.230  0.471 -0.631
## TrmpVote.y  -0.098  0.022  0.023 -0.157  0.195
## TotalVote.y -0.342 -0.126  0.239 -0.120 -0.386 -0.651
## TotalVote.x  0.304 -0.018 -0.272  0.252 -0.354  0.038 -0.222
## all_dss_dm. -0.251  0.026  0.294 -0.274  0.382  0.039  0.144  -0.984
## flly_vccnt.  0.231  0.094 -0.057 -0.084  0.060  0.222 -0.611   0.553  -0.512
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod22.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                              Chisq Df Pr(>Chisq)
## FREQUENTLY                  1.1313  1  0.2875057
## prop_cases                 21.4064  1  3.715e-06 ***
## COVID_COUNT.y              16.1090  1  5.980e-05 ***
## `Older (65 plus).y`        22.8829  1  1.722e-06 ***
## TrmpVote.y                  6.1147  1  0.0134065 *
## TotalVote.y                12.8931  1  0.0003298 ***
## TotalVote.x                 3.9547  1  0.0467407 *
## all_doses_administered.x  3.0301  1  0.0817353 .
## fully_vaccinated.y         10.9787  1  0.0009216 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod22.off, test = 'Chi')

# drop FREQUENTLY
```

```
mod23.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID) + prop_cases + COVID_COUNT.y + `Older (65 plus).y` +
    TrmpVote.y + TotalVote.y + TotalVote.x + all_doses_administered.x + fully_vaccinated.y,
    family = poisson, data = big_data3)
summary(mod23.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID) + prop_cases + COVID_COUNT.y +
##     `Older (65 plus).y` + TrmpVote.y + TotalVote.y + TotalVote.x +
##     all_doses_administered.x + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    822.3    850.0   -400.1    800.3       81
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.76120 -0.37505  0.00815  0.26664  1.54446
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.03429  0.1852
##  2013 code                (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -8.065e+00  8.070e-01  -9.993  < 2e-16 ***
## prop_cases                  1.285e+01  2.835e+00   4.534 5.79e-06 ***
## COVID_COUNT.y              -1.091e+00  2.789e-01  -3.911 9.18e-05 ***
## `Older (65 plus).y`         1.402e+00  3.010e-01   4.658 3.19e-06 ***
## TrmpVote.y                  5.738e-01  2.336e-01   2.456 0.014037 *
## TotalVote.y                -1.474e+00  4.240e-01  -3.477 0.000507 ***
## TotalVote.x                 9.420e-06  4.711e-06   2.000 0.045534 *
## all_doses_administered.x -5.422e-06  3.079e-06  -1.761 0.078191 .
## fully_vaccinated.y          6.564e-01  2.039e-01   3.220 0.001282 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) prp_cs COVID_ `O(65p TrmpV. TtlVt.y TtlVt.x all__.
## prop_cases  -0.738
## COVID_COUNT  0.789 -0.822
## `O(65pls).` -0.425  0.461 -0.623
## TrmpVote.y  -0.095  0.021 -0.156  0.195
## TotalVote.y -0.381  0.257 -0.139 -0.369 -0.654
## TotalVote.x  0.307 -0.272  0.252 -0.360  0.039 -0.226
## all_dss_dm. -0.252  0.293 -0.274  0.386  0.038  0.148  -0.984
## flly_vccnt.  0.258 -0.069 -0.073  0.039  0.221 -0.606   0.558  -0.517
## fit warnings:
```

```
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod23.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                            Chisq Df Pr(>Chisq)
## prop_cases               20.5549  1  5.795e-06 ***
## COVID_COUNT.y            15.2986  1  9.179e-05 ***
## `Older (65 plus).y`      21.6967  1  3.193e-06 ***
## TrmpVote.y                6.0335  1  0.0140369 *
## TotalVote.y              12.0913  1  0.0005066 ***
## TotalVote.x               3.9987  1  0.0455343 *
## all_doses_administered.x  3.1021  1  0.0781914 .
## fully_vaccinated.y       10.3682  1  0.0012820 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod23.off, test = 'Chi')


# drop alldoses.x
mod24.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID) + prop_cases + COVID_COUNT.y + `Older (65 plus).y` +
    TrmpVote.y + TotalVote.y + TotalVote.x + fully_vaccinated.y, family = poisson,
    data = big_data3)
summary(mod24.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID) + prop_cases + COVID_COUNT.y +
##     `Older (65 plus).y` + TrmpVote.y + TotalVote.y + TotalVote.x +
##     fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    823.3    848.5   -401.6    803.3       82
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.78348 -0.30656  0.03163  0.27969  1.49636
##
## Random effects:
##  Groups                  Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.0368   0.1918
##  2013 code               (Intercept) 0.0000   0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
```

```
## Fixed effects:
##                       Estimate Std. Error z value Pr(>|z|)
## (Intercept)         -8.448e+00  8.014e-01 -10.541  < 2e-16 ***
## prop_cases           1.437e+01  2.781e+00   5.167 2.38e-07 ***
## COVID_COUNT.y       -1.229e+00  2.750e-01  -4.469 7.87e-06 ***
## `Older (65 plus).y`  1.609e+00  2.852e-01   5.641 1.69e-08 ***
## TrmpVote.y           5.888e-01  2.402e-01   2.452  0.01422 *
## TotalVote.y         -1.359e+00  4.305e-01  -3.157  0.00159 **
## TotalVote.x          1.241e-06  8.696e-07   1.427  0.15345
## fully_vaccinated.y   4.706e-01  1.787e-01   2.634  0.00845 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) prp_cs COVID_ `O(65p TrmpV. TtlVt.y TtlVt.x
## prop_cases  -0.718
## COVID_COUNT  0.773 -0.807
## `O(65pls).` -0.366  0.395 -0.582
## TrmpVote.y  -0.086  0.009 -0.150  0.194
## TotalVote.y -0.360  0.226 -0.103 -0.468 -0.668
## TotalVote.x  0.343  0.094 -0.099  0.123  0.427 -0.452
## flly_vccnt.  0.155  0.100 -0.260  0.300  0.281 -0.624   0.316
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod24.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                       Chisq Df Pr(>Chisq)
## prop_cases          26.6977  1  2.379e-07 ***
## COVID_COUNT.y       19.9704  1  7.865e-06 ***
## `Older (65 plus).y` 31.8248  1  1.687e-08 ***
## TrmpVote.y           6.0103  1   0.014222 *
## TotalVote.y          9.9695  1   0.001592 **
## TotalVote.x          2.0377  1   0.153446
## fully_vaccinated.y   6.9353  1   0.008451 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod24.off, test = 'Chi')

# drop totalvote.x
mod25.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
    (1 | `2013 code`:LOCATION_ID) + prop_cases + COVID_COUNT.y + `Older (65 plus).y` +
    TrmpVote.y + TotalVote.y + fully_vaccinated.y, family = poisson, data = big_data3)
summary(mod25.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
```

```
##  Family: poisson  ( log )
## Formula: COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`) +
##     (1 | `2013 code`:LOCATION_ID) + prop_cases + COVID_COUNT.y +
##     `Older (65 plus).y` + TrmpVote.y + TotalVote.y + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    823.3    846.0   -402.6    805.3       83
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.70671 -0.32015 -0.01299  0.28572  1.53908
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.03888  0.1972
##  2013 code               (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                     Estimate Std. Error z value Pr(>|z|)
## (Intercept)          -8.8423     0.7686 -11.504  < 2e-16 ***
## prop_cases           13.9974     2.8273   4.951 7.39e-07 ***
## COVID_COUNT.y        -1.1882     0.2793  -4.254 2.10e-05 ***
## `Older (65 plus).y`   1.5588     0.2892   5.390 7.07e-08 ***
## TrmpVote.y            0.4450     0.2221   2.004  0.04508 *
## TotalVote.y          -1.0865     0.3924  -2.769  0.00562 **
## fully_vaccinated.y    0.3907     0.1732   2.257  0.02404 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) prp_cs COVID_ `O(65p TrmpV. TtlVt.
## prop_cases  -0.802
## COVID_COUNT  0.863 -0.805
## `O(65pls).` -0.438  0.389 -0.577
## TrmpVote.y  -0.274 -0.033 -0.120  0.157
## TotalVote.y -0.244  0.300 -0.165 -0.466 -0.590
## flly_vccnt.  0.052  0.075 -0.243  0.277  0.172 -0.569
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(mod25.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                       Chisq Df Pr(>Chisq)
## prop_cases          24.5102  1  7.392e-07 ***
## COVID_COUNT.y       18.0979  1  2.098e-05 ***
## `Older (65 plus).y` 29.0467  1  7.065e-08 ***
## TrmpVote.y           4.0157  1   0.045077 *
## TotalVote.y          7.6670  1   0.005624 **
## fully_vaccinated.y   5.0920  1   0.024036 *
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod25.off, test = 'Chi')


# dropped RE of 2013code
mod26.off <- glmer(formula = COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`:LOCATION_ID) +
    prop_cases + COVID_COUNT.y + `Older (65 plus).y` + TrmpVote.y + TotalVote.y +
    fully_vaccinated.y, family = poisson, data = big_data3)
summary(mod26.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`:LOCATION_ID) +
##     prop_cases + COVID_COUNT.y + `Older (65 plus).y` + TrmpVote.y +
##     TotalVote.y + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    821.3    841.4   -402.6    805.3       84
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.70649 -0.32010 -0.01209  0.28626  1.53799
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.03887  0.1972
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92
##
## Fixed effects:
##                     Estimate Std. Error z value Pr(>|z|)
## (Intercept)          -8.8337     0.7685 -11.495  < 2e-16 ***
## prop_cases           13.9832     2.8271   4.946 7.57e-07 ***
## COVID_COUNT.y        -1.1864     0.2793  -4.248 2.16e-05 ***
## `Older (65 plus).y`   1.5559     0.2892   5.380 7.44e-08 ***
## TrmpVote.y            0.4408     0.2220   1.986  0.04708 *
## TotalVote.y          -1.0827     0.3923  -2.760  0.00579 **
## fully_vaccinated.y    0.3913     0.1731   2.260  0.02383 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) prp_cs COVID_ `O(65p TrmpV. TtlVt.
## prop_cases  -0.802
## COVID_COUNT  0.863 -0.805
## `O(65pls).` -0.438  0.389 -0.577
## TrmpVote.y  -0.274 -0.033 -0.120  0.157
## TotalVote.y -0.244  0.300 -0.165 -0.466 -0.590
## flly_vccnt.  0.052  0.075 -0.243  0.277  0.172 -0.569
## optimizer (Nelder_Mead) convergence code: 0 (OK)
```

```
## Model failed to converge with max|grad| = 0.0194022 (tol = 0.002, component 1)
## Model is nearly unidentifiable: very large eigenvalue
##  - Rescale variables?
## Model is nearly unidentifiable: large eigenvalue ratio
##  - Rescale variables?
```

```
Anova(mod26.off)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                        Chisq Df Pr(>Chisq)
## prop_cases           24.4635  1  7.573e-07 ***
## COVID_COUNT.y        18.0442  1  2.158e-05 ***
## `Older (65 plus).y`  28.9458  1  7.443e-08 ***
## TrmpVote.y            3.9424  1   0.047083 *
## TotalVote.y           7.6157  1   0.005786 **
## fully_vaccinated.y    5.1068  1   0.023832 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(mod26.off, test = 'Chi')
add1(mod26.off, scope = ~pop2021.x + pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY +
    ALWAYS + prop_cases + `Older (65 plus).x` + olderprop + TrmpProp + ClintProp +
    COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y + `Older (65 plus).y` +
    ClintVote.y + TrmpVote.y + TotalVote.y + ClintVote.x + TrmpVote.x + TotalVote.x +
    COVID_COUNT.x + COVID_TEST.x + all_doses_administered.x + fully_vaccinated.x +
    fully_vaccinated.y + RARELY * olderprop * TrmpProp, test = "Chisq")
```

```
## Single term additions
##
## Model:
## COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`:LOCATION_ID) +
##     prop_cases + COVID_COUNT.y + `Older (65 plus).y` + TrmpVote.y +
##     TotalVote.y + fully_vaccinated.y
##                           Df    AIC     LRT Pr(>Chi)
## <none>                       821.27
## pop2021.x                  1 821.28 1.98796  0.15855
## pop2021.y                  1 823.22 0.04468  0.83259
## NEVER                      1 822.71 0.55355  0.45687
## RARELY                     1 823.13 0.13678  0.71151
## SOMETIMES                  1 823.14 0.12890  0.71957
## FREQUENTLY                 1 822.21 1.05556  0.30423
## ALWAYS                     1 822.81 0.45336  0.50074
## `Older (65 plus).x`        1 821.11 2.15802  0.14183
## olderprop                  1 823.25 0.01474  0.90335
## TrmpProp                   1 821.70 1.56727  0.21060
## ClintProp                  1 823.25 0.01863  0.89143
## COVID_TEST.y               1 823.22 0.04463  0.83268
## all_doses_administered.y   1 820.35 2.91327  0.08785 .
## ClintVote.y                1 822.55 0.71585  0.39751
## ClintVote.x                1 820.59 2.67781  0.10176
## TrmpVote.x                 1 822.42 0.85002  0.35655
```

```
## TotalVote.x                1 821.28 1.98295  0.15908
## COVID_COUNT.x              1 821.53 1.73602  0.18764
## COVID_TEST.x               1 821.57 1.69846  0.19249
## all_doses_administered.x   1 822.11 1.15956  0.28156
## fully_vaccinated.x         1 822.05 1.21430  0.27048
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
#### Mod26.off is our Final Mixed effects model with offset Poisson.  AIC = 821.3
```

Binomial Mixed Effects

```
modbm <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.x + pop2021.y + NEVER +
    RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
    olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y +
    `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y + ClintVote.x +
    TrmpVote.x + TotalVote.x + COVID_COUNT.x + COVID_TEST.x + all_doses_administered.x +
    fully_vaccinated.x + fully_vaccinated.y + RARELY * olderprop * TrmpProp, family = binomial,
    data = big_data3)
summary(modbm)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.x +
##     pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
##     prop_cases + `Older (65 plus).x` + olderprop + TrmpProp +
##     ClintProp + COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y +
##     `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y +
##     ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x +
##     COVID_TEST.x + all_doses_administered.x + fully_vaccinated.x +
##     fully_vaccinated.y + RARELY * olderprop * TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    846.2    931.9   -389.1    778.2       58
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.87643 -0.51293  0.04593  0.43324  1.59762
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.397e-02 1.548e-01
##  2013 code               (Intercept) 4.403e-09 6.636e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
```

```
## (Intercept)               -8.682e+01  3.932e+01  -2.208  0.02725 *
## pop2021.x                  1.698e-06  6.232e-06   0.273  0.78520
## pop2021.y                  8.577e+00  3.287e+00   2.609  0.00907 **
## NEVER                      4.763e+01  3.503e+01   1.360  0.17391
## RARELY                    -2.684e+01  1.116e+02  -0.240  0.81004
## SOMETIMES                  4.648e+01  3.510e+01   1.324  0.18543
## FREQUENTLY                 4.733e+01  3.514e+01   1.347  0.17806
## ALWAYS                     4.706e+01  3.514e+01   1.339  0.18046
## prop_cases                 3.314e+01  1.703e+01   1.946  0.05163 .
## `Older (65 plus).x`        5.168e-05  4.473e-05   1.155  0.24789
## olderprop                  1.767e+01  4.940e+01   0.358  0.72059
## TrmpProp                   1.900e+00  2.778e+01   0.068  0.94547
## ClintProp                  1.838e+01  1.179e+01   1.558  0.11923
## COVID_COUNT.y             -3.263e+00  1.868e+00  -1.747  0.08065 .
## COVID_TEST.y               6.175e-01  3.897e-01   1.585  0.11307
## all_doses_administered.y  -3.234e-01  1.221e+00  -0.265  0.79114
## `Older (65 plus).y`       -6.176e+00  3.427e+00  -1.802  0.07151 .
## ClintVote.y               -2.067e+00  2.560e+00  -0.807  0.41946
## TrmpVote.y                 6.081e+00  1.031e+01   0.590  0.55547
## TotalVote.y               -4.197e+00  7.971e+00  -0.527  0.59847
## ClintVote.x               -1.386e-04  2.261e-04  -0.613  0.53980
## TrmpVote.x                -1.530e-04  2.321e-04  -0.659  0.50987
## TotalVote.x                1.335e-04  2.173e-04   0.614  0.53915
## COVID_COUNT.x             -2.532e-05  6.068e-05  -0.417  0.67651
## COVID_TEST.x              -1.354e-06  1.301e-05  -0.104  0.91710
## all_doses_administered.x  -2.234e-05  2.359e-05  -0.947  0.34365
## fully_vaccinated.x         3.612e-05  5.058e-05   0.714  0.47518
## fully_vaccinated.y         8.567e-01  1.148e+00   0.746  0.45548
## RARELY:olderprop           5.086e+02  5.960e+02   0.853  0.39353
## RARELY:TrmpProp            8.543e+01  1.548e+02   0.552  0.58106
## olderprop:TrmpProp         1.859e+01  7.577e+01   0.245  0.80623
## RARELY:olderprop:TrmpProp -6.148e+02  8.621e+02  -0.713  0.47574
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                            Chisq Df Pr(>Chisq)
## pop2021.x                 0.0743  1    0.78520
## pop2021.y                 6.8090  1    0.00907 **
## NEVER                     1.8489  1    0.17391
## RARELY                    2.0217  1    0.15506
## SOMETIMES                 1.7536  1    0.18543
## FREQUENTLY                1.8138  1    0.17806
## ALWAYS                    1.7939  1    0.18046
## prop_cases                3.7876  1    0.05163 .
## `Older (65 plus).x`       1.3352  1    0.24789
```

```
## olderprop                 4.0452  1    0.04430 *
## TrmpProp                  0.1193  1    0.72979
## ClintProp                 2.4274  1    0.11923
## COVID_COUNT.y             3.0517  1    0.08065 .
## COVID_TEST.y              2.5107  1    0.11307
## all_doses_administered.y  0.0701  1    0.79114
## `Older (65 plus).y`       3.2480  1    0.07151 .
## ClintVote.y               0.6518  1    0.41946
## TrmpVote.y                0.3476  1    0.55547
## TotalVote.y               0.2773  1    0.59847
## ClintVote.x               0.3759  1    0.53980
## TrmpVote.x                0.4343  1    0.50987
## TotalVote.x               0.3771  1    0.53915
## COVID_COUNT.x             0.1741  1    0.67651
## COVID_TEST.x              0.0108  1    0.91710
## all_doses_administered.x  0.8968  1    0.34365
## fully_vaccinated.x        0.5099  1    0.47518
## fully_vaccinated.y        0.5570  1    0.45548
## RARELY:olderprop          4.9227  1    0.02651 *
## RARELY:TrmpProp           2.8003  1    0.09425 .
## olderprop:TrmpProp        2.0949  1    0.14779
## RARELY:olderprop:TrmpProp 0.5086  1    0.47574
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop covidtests.x
modbm2 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.x + pop2021.y + NEVER +
    RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
    olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y +
    `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y + ClintVote.x +
    TrmpVote.x + TotalVote.x + COVID_COUNT.x + all_doses_administered.x + fully_vaccinated.x +
    fully_vaccinated.y + RARELY * olderprop * TrmpProp, family = binomial, data = big_data3)
summary(modbm2)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.x +
##     pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
##     prop_cases + `Older (65 plus).x` + olderprop + TrmpProp +
##     ClintProp + COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y +
##     `Older (65 plus).y` + ClintVote.y + TrmpVote.y + TotalVote.y +
##     ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x +
##     all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y +
##     RARELY * olderprop * TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    844.2    927.4   -389.1    778.2       59
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
```

```
## -1.87064 -0.51172  0.04357  0.43353  1.58972
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.400e-02 1.549e-01
##  2013 code                (Intercept) 5.373e-10 2.318e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                               Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -8.754e+01  3.875e+01  -2.259  0.02389 *
## pop2021.x                   1.537e-06  6.044e-06   0.254  0.79929
## pop2021.y                   8.554e+00  3.280e+00   2.607  0.00912 **
## NEVER                       4.809e+01  3.477e+01   1.383  0.16670
## RARELY                     -2.175e+01  1.011e+02  -0.215  0.82968
## SOMETIMES                   4.694e+01  3.485e+01   1.347  0.17801
## FREQUENTLY                  4.780e+01  3.488e+01   1.370  0.17065
## ALWAYS                      4.753e+01  3.488e+01   1.363  0.17295
## prop_cases                  3.315e+01  1.703e+01   1.946  0.05162 .
## `Older (65 plus).x`         5.286e-05  4.352e-05   1.215  0.22451
## olderprop                   1.922e+01  4.711e+01   0.408  0.68332
## TrmpProp                    2.557e+00  2.710e+01   0.094  0.92485
## ClintProp                   1.801e+01  1.129e+01   1.596  0.11060
## COVID_COUNT.y              -3.242e+00  1.858e+00  -1.745  0.08099 .
## COVID_TEST.y                5.924e-01  3.150e-01   1.881  0.06002 .
## all_doses_administered.y   -3.040e-01  1.208e+00  -0.252  0.80132
## `Older (65 plus).y`        -6.156e+00  3.423e+00  -1.798  0.07214 .
## ClintVote.y                -2.010e+00  2.505e+00  -0.803  0.42223
## TrmpVote.y                  5.862e+00  1.011e+01   0.580  0.56213
## TotalVote.y                -4.032e+00  7.823e+00  -0.515  0.60627
## ClintVote.x                -1.281e-04  2.038e-04  -0.629  0.52953
## TrmpVote.x                 -1.418e-04  2.070e-04  -0.685  0.49350
## TotalVote.x                 1.229e-04  1.938e-04   0.634  0.52588
## COVID_COUNT.x              -3.035e-05  3.803e-05  -0.798  0.42478
## all_doses_administered.x   -2.275e-05  2.328e-05  -0.977  0.32836
## fully_vaccinated.x          3.689e-05  5.016e-05   0.735  0.46205
## fully_vaccinated.y          8.401e-01  1.139e+00   0.738  0.46060
## RARELY:olderprop            4.844e+02  5.513e+02   0.879  0.37966
## RARELY:TrmpProp             7.874e+01  1.419e+02   0.555  0.57905
## olderprop:TrmpProp          1.605e+01  7.189e+01   0.223  0.82333
## RARELY:olderprop:TrmpProp -5.797e+02  7.980e+02  -0.726  0.46754
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 4 (failure to converge in 10000 evaluations)
## boundary (singular) fit: see ?isSingular
## failure to converge in 10000 evaluations
```

```
Anova(modbm2)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
```

```
##                              Chisq Df Pr(>Chisq)
## pop2021.x                   0.0647  1   0.799288
## pop2021.y                   6.7989  1   0.009122 **
## NEVER                       1.9124  1   0.166696
## RARELY                      2.1514  1   0.142440
## SOMETIMES                   1.8142  1   0.178008
## FREQUENTLY                  1.8773  1   0.170647
## ALWAYS                      1.8572  1   0.172947
## prop_cases                  3.7879  1   0.051625 .
## `Older (65 plus).x`         1.4753  1   0.224514
## olderprop                   3.9146  1   0.047869 *
## TrmpProp                    0.1296  1   0.718828
## ClintProp                   2.5457  1   0.110595
## COVID_COUNT.y               3.0449  1   0.080991 .
## COVID_TEST.y                3.5369  1   0.060016 .
## all_doses_administered.y    0.0633  1   0.801323
## `Older (65 plus).y`         3.2336  1   0.072140 .
## ClintVote.y                 0.6441  1   0.422233
## TrmpVote.y                  0.3360  1   0.562131
## TotalVote.y                 0.2656  1   0.606268
## ClintVote.x                 0.3953  1   0.529531
## TrmpVote.x                  0.4689  1   0.493498
## TotalVote.x                 0.4023  1   0.525882
## COVID_COUNT.x               0.6371  1   0.424778
## all_doses_administered.x    0.9554  1   0.328355
## fully_vaccinated.x          0.5409  1   0.462049
## fully_vaccinated.y          0.5444  1   0.460599
## RARELY:olderprop            4.9786  1   0.025663 *
## RARELY:TrmpProp             2.8470  1   0.091544 .
## olderprop:TrmpProp          2.2288  1   0.135457
## RARELY:olderprop:TrmpProp   0.5278  1   0.467544
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop doses.y
modbm3 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.x + pop2021.y + NEVER +
    RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
    olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` +
    ClintVote.y + TrmpVote.y + TotalVote.y + ClintVote.x + TrmpVote.x + TotalVote.x +
    COVID_COUNT.x + all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y +
    RARELY * olderprop * TrmpProp, family = binomial, data = big_data3)
summary(modbm3)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.x +
##     pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS +
##     prop_cases + `Older (65 plus).x` + olderprop + TrmpProp +
##     ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` +
##     ClintVote.y + TrmpVote.y + TotalVote.y + ClintVote.x + TrmpVote.x +
##     TotalVote.x + COVID_COUNT.x + all_doses_administered.x +
```

```
##     fully_vaccinated.x + fully_vaccinated.y + RARELY * olderprop *
##     TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    842.2    922.9   -389.1    778.2       60
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.88450 -0.53166  0.04594  0.43344  1.58740
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.02408  0.1552
##  2013 code               (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -9.009e+01  3.743e+01  -2.407  0.01608 *
## pop2021.x                   1.094e-06  5.795e-06   0.189  0.85021
## pop2021.y                   8.743e+00  3.196e+00   2.736  0.00622 **
## NEVER                       4.962e+01  3.427e+01   1.448  0.14766
## RARELY                     -2.029e+01  1.011e+02  -0.201  0.84094
## SOMETIMES                   4.847e+01  3.435e+01   1.411  0.15819
## FREQUENTLY                  4.931e+01  3.440e+01   1.433  0.15174
## ALWAYS                      4.904e+01  3.439e+01   1.426  0.15390
## prop_cases                  3.278e+01  1.699e+01   1.929  0.05376 .
## `Older (65 plus).x`         5.449e-05  4.305e-05   1.266  0.20555
## olderprop                   1.976e+01  4.713e+01   0.419  0.67507
## TrmpProp                    2.893e+00  2.710e+01   0.107  0.91500
## ClintProp                   1.857e+01  1.108e+01   1.677  0.09356 .
## COVID_COUNT.y              -3.193e+00  1.850e+00  -1.726  0.08438 .
## COVID_TEST.y                5.794e-01  3.109e-01   1.863  0.06239 .
## `Older (65 plus).y`        -6.379e+00  3.311e+00  -1.926  0.05405 .
## ClintVote.y                -2.029e+00  2.507e+00  -0.809  0.41823
## TrmpVote.y                  5.869e+00  1.013e+01   0.580  0.56217
## TotalVote.y                -4.053e+00  7.833e+00  -0.517  0.60487
## ClintVote.x                -1.331e-04  2.030e-04  -0.655  0.51221
## TrmpVote.x                 -1.470e-04  2.061e-04  -0.713  0.47573
## TotalVote.x                 1.287e-04  1.926e-04   0.668  0.50404
## COVID_COUNT.x              -3.015e-05  3.808e-05  -0.792  0.42851
## all_doses_administered.x   -2.648e-05  1.799e-05  -1.472  0.14104
## fully_vaccinated.x          4.464e-05  3.972e-05   1.124  0.26107
## fully_vaccinated.y          5.603e-01  2.435e-01   2.301  0.02137 *
## RARELY:olderprop            4.857e+02  5.520e+02   0.880  0.37889
## RARELY:TrmpProp             7.929e+01  1.421e+02   0.558  0.57685
## olderprop:TrmpProp          1.709e+01  7.184e+01   0.238  0.81199
## RARELY:olderprop:TrmpProp -5.842e+02  7.988e+02  -0.731  0.46459
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
```

```
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm3)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                              Chisq Df Pr(>Chisq)
## pop2021.x                   0.0357  1   0.850212
## pop2021.y                   7.4845  1   0.006223 **
## NEVER                       2.0963  1   0.147656
## RARELY                      2.2613  1   0.132642
## SOMETIMES                   1.9914  1   0.158193
## FREQUENTLY                  2.0547  1   0.151741
## ALWAYS                      2.0332  1   0.153898
## prop_cases                  3.7203  1   0.053756 .
## `Older (65 plus).x`         1.6025  1   0.205552
## olderprop                   3.9351  1   0.047290 *
## TrmpProp                    0.1006  1   0.751122
## ClintProp                   2.8120  1   0.093559 .
## COVID_COUNT.y               2.9784  1   0.084382 .
## COVID_TEST.y                3.4726  1   0.062393 .
## `Older (65 plus).y`         3.7112  1   0.054049 .
## ClintVote.y                 0.6553  1   0.418234
## TrmpVote.y                  0.3360  1   0.562171
## TotalVote.y                 0.2677  1   0.604866
## ClintVote.x                 0.4295  1   0.512211
## TrmpVote.x                  0.5086  1   0.475726
## TotalVote.x                 0.4464  1   0.504038
## COVID_COUNT.x               0.6269  1   0.428511
## all_doses_administered.x    2.1665  1   0.141043
## fully_vaccinated.x          1.2631  1   0.261065
## fully_vaccinated.y          5.2961  1   0.021374 *
## RARELY:olderprop            4.8661  1   0.027390 *
## RARELY:TrmpProp             2.9214  1   0.087410 .
## olderprop:TrmpProp          2.1671  1   0.140995
## RARELY:olderprop:TrmpProp 0.5348  1   0.464590
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop pop2021.x
modbm4 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y + NEVER + RARELY +
    SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` + olderprop +
    TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` + ClintVote.y +
    TrmpVote.y + TotalVote.y + ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x +
    all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y + RARELY *
    olderprop * TrmpProp, family = binomial, data = big_data3)
summary(modbm4)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
```

```
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases +
##     `Older (65 plus).x` + olderprop + TrmpProp + ClintProp +
##     COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` + ClintVote.y +
##     TrmpVote.y + TotalVote.y + ClintVote.x + TrmpVote.x + TotalVote.x +
##     COVID_COUNT.x + all_doses_administered.x + fully_vaccinated.x +
##     fully_vaccinated.y + RARELY * olderprop * TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    840.3    918.5   -389.1    778.3       61
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.89391 -0.53718  0.04101  0.43247  1.58616
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.406e-02 1.551e-01
##  2013 code                (Intercept) 4.218e-10 2.054e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                               Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -9.078e+01  3.724e+01  -2.438  0.01479 *
## pop2021.y                   8.815e+00  3.172e+00   2.779  0.00545 **
## NEVER                       4.947e+01  3.425e+01   1.444  0.14866
## RARELY                     -1.762e+01  1.000e+02  -0.176  0.86024
## SOMETIMES                   4.831e+01  3.433e+01   1.407  0.15931
## FREQUENTLY                  4.915e+01  3.438e+01   1.430  0.15280
## ALWAYS                      4.888e+01  3.437e+01   1.422  0.15494
## prop_cases                  3.206e+01  1.657e+01   1.935  0.05303 .
## `Older (65 plus).x`         5.521e-05  4.285e-05   1.288  0.19762
## olderprop                   2.077e+01  4.684e+01   0.443  0.65742
## TrmpProp                    4.230e+00  2.617e+01   0.162  0.87158
## ClintProp                   1.780e+01  1.032e+01   1.726  0.08442 .
## COVID_COUNT.y              -3.135e+00  1.824e+00  -1.719  0.08564 .
## COVID_TEST.y                5.768e-01  3.104e-01   1.858  0.06316 .
## `Older (65 plus).y`        -6.478e+00  3.268e+00  -1.982  0.04747 *
## ClintVote.y                -1.824e+00  2.265e+00  -0.806  0.42053
## TrmpVote.y                  5.115e+00  9.310e+00   0.549  0.58277
## TotalVote.y                -3.533e+00  7.334e+00  -0.482  0.62999
## ClintVote.x                -1.430e-04  1.961e-04  -0.729  0.46595
## TrmpVote.x                 -1.576e-04  1.984e-04  -0.794  0.42713
## TotalVote.x                 1.397e-04  1.835e-04   0.761  0.44667
## COVID_COUNT.x              -2.543e-05  2.906e-05  -0.875  0.38149
## all_doses_administered.x   -2.795e-05  1.605e-05  -1.742  0.08157 .
## fully_vaccinated.x          4.796e-05  3.528e-05   1.359  0.17404
## fully_vaccinated.y          5.601e-01  2.434e-01   2.302  0.02136 *
## RARELY:olderprop            4.741e+02  5.483e+02   0.865  0.38729
## RARELY:TrmpProp             7.569e+01  1.408e+02   0.538  0.59077
## olderprop:TrmpProp          1.664e+01  7.179e+01   0.232  0.81671
## RARELY:olderprop:TrmpProp -5.697e+02  7.948e+02  -0.717  0.47350
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm4)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                              Chisq Df Pr(>Chisq)
## pop2021.y                   7.7245  1   0.005448 **
## NEVER                       2.0859  1   0.148662
## RARELY                      2.2863  1   0.130523
## SOMETIMES                   1.9808  1   0.159310
## FREQUENTLY                  2.0441  1   0.152801
## ALWAYS                      2.0229  1   0.154944
## prop_cases                  3.7428  1   0.053034 .
## `Older (65 plus).x`         1.6598  1   0.197624
## olderprop                   3.3786  1   0.066048 .
## TrmpProp                    0.0025  1   0.960441
## ClintProp                   2.9777  1   0.084419 .
## COVID_COUNT.y               2.9546  1   0.085636 .
## COVID_TEST.y                3.4525  1   0.063156 .
## `Older (65 plus).y`         3.9288  1   0.047467 *
## ClintVote.y                 0.6488  1   0.420526
## TrmpVote.y                  0.3018  1   0.582772
## TotalVote.y                 0.2321  1   0.629994
## ClintVote.x                 0.5316  1   0.465954
## TrmpVote.x                  0.6306  1   0.427134
## TotalVote.x                 0.5791  1   0.446667
## COVID_COUNT.x               0.7659  1   0.381495
## all_doses_administered.x    3.0333  1   0.081572 .
## fully_vaccinated.x          1.8478  1   0.174041
## fully_vaccinated.y          5.2975  1   0.021356 *
## RARELY:olderprop            5.0472  1   0.024665 *
## RARELY:TrmpProp             3.6724  1   0.055319 .
## olderprop:TrmpProp          2.1957  1   0.138401
## RARELY:olderprop:TrmpProp   0.5138  1   0.473504
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop trumpprop
modbm5 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y + NEVER + RARELY +
    SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` + olderprop +
    TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` + ClintVote.y +
    TrmpVote.y + ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x + all_doses_administered.x +
    fully_vaccinated.x + fully_vaccinated.y + RARELY * olderprop * TrmpProp, family = binomial,
    data = big_data3)
summary(modbm5)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases +
##     `Older (65 plus).x` + olderprop + TrmpProp + ClintProp +
##     COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` + ClintVote.y +
##     TrmpVote.y + ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x +
##     all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y +
##     RARELY * olderprop * TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    838.5    914.2   -389.3    778.5       62
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.90474 -0.53258  0.03701  0.43178  1.56445
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.02412  0.1553
##  2013 code                (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -9.465e+01  3.640e+01  -2.600  0.00931 **
## pop2021.y                   8.308e+00  2.992e+00   2.776  0.00550 **
## NEVER                       4.721e+01  3.396e+01   1.390  0.16448
## RARELY                      1.544e+01  7.285e+01   0.212  0.83213
## SOMETIMES                   4.606e+01  3.404e+01   1.353  0.17603
## FREQUENTLY                  4.692e+01  3.410e+01   1.376  0.16881
## ALWAYS                      4.668e+01  3.409e+01   1.369  0.17100
## prop_cases                  3.102e+01  1.644e+01   1.887  0.05922 .
## `Older (65 plus).x`         4.690e-05  3.924e-05   1.195  0.23209
## olderprop                   3.837e+01  2.914e+01   1.317  0.18800
## TrmpProp                    1.576e+01  1.053e+01   1.496  0.13459
## ClintProp                   1.399e+01  6.598e+00   2.121  0.03396 *
## COVID_COUNT.y              -3.043e+00  1.815e+00  -1.676  0.09370 .
## COVID_TEST.y                5.950e-01  3.082e-01   1.931  0.05352 .
## `Older (65 plus).y`        -6.043e+00  3.142e+00  -1.923  0.05442 .
## ClintVote.y                -8.991e-01  1.200e+00  -0.749  0.45361
## TrmpVote.y                  6.678e-01  1.189e+00   0.562  0.57423
## ClintVote.x                -1.347e-04  1.956e-04  -0.688  0.49115
## TrmpVote.x                 -1.480e-04  1.976e-04  -0.749  0.45403
## TotalVote.x                 1.305e-04  1.827e-04   0.714  0.47508
## COVID_COUNT.x              -2.026e-05  2.702e-05  -0.750  0.45336
## all_doses_administered.x   -3.070e-05  1.508e-05  -2.036  0.04175 *
## fully_vaccinated.x          5.709e-05  2.994e-05   1.907  0.05654 .
## fully_vaccinated.y          5.228e-01  2.313e-01   2.261  0.02378 *
## RARELY:olderprop            2.831e+02  3.788e+02   0.747  0.45480
## RARELY:TrmpProp             2.495e+01  9.346e+01   0.267  0.78950
```

```
## olderprop:TrmpProp        -1.169e+01  4.090e+01  -0.286  0.77496
## RARELY:olderprop:TrmpProp -2.951e+02  5.539e+02  -0.533  0.59425
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm5)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                             Chisq Df Pr(>Chisq)
## pop2021.y                  7.7087  1   0.005496 **
## NEVER                      1.9326  1   0.164478
## RARELY                     2.1617  1   0.141490
## SOMETIMES                  1.8308  1   0.176031
## FREQUENTLY                 1.8935  1   0.168806
## ALWAYS                     1.8742  1   0.171000
## prop_cases                 3.5591  1   0.059219 .
## `Older (65 plus).x`        1.4280  1   0.232088
## olderprop                  3.0331  1   0.081581 .
## TrmpProp                   3.6999  1   0.054416 .
## ClintProp                  4.4970  1   0.033955 *
## COVID_COUNT.y              2.8097  1   0.093696 .
## COVID_TEST.y               3.7278  1   0.053515 .
## `Older (65 plus).y`        3.6997  1   0.054423 .
## ClintVote.y                0.5616  1   0.453606
## TrmpVote.y                 0.3157  1   0.574231
## ClintVote.x                0.4740  1   0.491147
## TrmpVote.x                 0.5606  1   0.454031
## TotalVote.x                0.5101  1   0.475077
## COVID_COUNT.x              0.5622  1   0.453364
## all_doses_administered.x   4.1452  1   0.041754 *
## fully_vaccinated.x         3.6362  1   0.056535 .
## fully_vaccinated.y         5.1108  1   0.023777 *
## RARELY:olderprop           5.2200  1   0.022328 *
## RARELY:TrmpProp            4.9402  1   0.026239 *
## olderprop:TrmpProp         3.6499  1   0.056072 .
## RARELY:olderprop:TrmpProp  0.2838  1   0.594246
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop 3-way
modbm6 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y + NEVER + RARELY +
    SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` + olderprop +
    TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` + ClintVote.y +
    TrmpVote.y + ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x + all_doses_administered.x +
    fully_vaccinated.x + fully_vaccinated.y + RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
    family = binomial, data = big_data3)
summary(modbm6)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases +
##     `Older (65 plus).x` + olderprop + TrmpProp + ClintProp +
##     COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` + ClintVote.y +
##     TrmpVote.y + ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x +
##     all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y +
##     RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    836.8    909.9   -389.4    778.8       63
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.96229 -0.51472  0.05759  0.39873  1.51345
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.422e-02 1.556e-01
##  2013 code                (Intercept) 7.283e-10 2.699e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)               -9.718e+01  3.614e+01  -2.689  0.00716 **
## pop2021.y                  8.069e+00  2.962e+00   2.725  0.00644 **
## NEVER                      4.760e+01  3.400e+01   1.400  0.16147
## RARELY                     4.942e+01  3.511e+01   1.408  0.15921
## SOMETIMES                  4.644e+01  3.408e+01   1.363  0.17302
## FREQUENTLY                 4.737e+01  3.414e+01   1.388  0.16526
## ALWAYS                     4.713e+01  3.413e+01   1.381  0.16738
## prop_cases                 3.366e+01  1.570e+01   2.144  0.03203 *
## `Older (65 plus).x`        3.907e-05  3.653e-05   1.070  0.28479
## olderprop                  4.899e+01  2.129e+01   2.301  0.02141 *
## TrmpProp                   1.928e+01  8.212e+00   2.348  0.01887 *
## ClintProp                  1.422e+01  6.593e+00   2.157  0.03102 *
## COVID_COUNT.y             -3.362e+00  1.715e+00  -1.960  0.04996 *
## COVID_TEST.y               6.473e-01  2.931e-01   2.209  0.02720 *
## `Older (65 plus).y`       -5.456e+00  2.945e+00  -1.853  0.06393 .
## ClintVote.y               -9.149e-01  1.201e+00  -0.762  0.44630
## TrmpVote.y                 5.976e-01  1.183e+00   0.505  0.61340
## ClintVote.x               -1.297e-04  1.957e-04  -0.663  0.50751
## TrmpVote.x                -1.437e-04  1.978e-04  -0.726  0.46757
## TotalVote.x                1.293e-04  1.831e-04   0.707  0.47981
## COVID_COUNT.x             -1.934e-05  2.701e-05  -0.716  0.47392
## all_doses_administered.x -3.158e-05  1.500e-05  -2.106  0.03525 *
## fully_vaccinated.x         5.774e-05  2.995e-05   1.928  0.05390 .
## fully_vaccinated.y         5.409e-01  2.290e-01   2.362  0.01816 *
## RARELY:olderprop           8.239e+01  3.604e+01   2.286  0.02226 *
## RARELY:TrmpProp           -2.450e+01  1.104e+01  -2.219  0.02649 *
```

```
## olderprop:TrmpProp       -3.161e+01  1.657e+01  -1.907  0.05649 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm6)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                             Chisq Df Pr(>Chisq)
## pop2021.y                  7.4231  1   0.006439 **
## NEVER                      1.9604  1   0.161472
## RARELY                     2.1531  1   0.142281
## SOMETIMES                  1.8566  1   0.173018
## FREQUENTLY                 1.9254  1   0.165260
## ALWAYS                     1.9063  1   0.167377
## prop_cases                 4.5971  1   0.032026 *
## `Older (65 plus).x`        1.1441  1   0.284791
## olderprop                  3.0340  1   0.081537 .
## TrmpProp                   3.6940  1   0.054609 .
## ClintProp                  4.6519  1   0.031019 *
## COVID_COUNT.y              3.8429  1   0.049957 *
## COVID_TEST.y               4.8779  1   0.027202 *
## `Older (65 plus).y`        3.4325  1   0.063927 .
## ClintVote.y                0.5800  1   0.446296
## TrmpVote.y                 0.2552  1   0.613404
## ClintVote.x                0.4392  1   0.507508
## TrmpVote.x                 0.5277  1   0.467569
## TotalVote.x                0.4993  1   0.479810
## COVID_COUNT.x              0.5128  1   0.473918
## all_doses_administered.x 4.4332  1   0.035247 *
## fully_vaccinated.x         3.7159  1   0.053896 .
## fully_vaccinated.y         5.5804  1   0.018163 *
## RARELY:olderprop           5.2257  1   0.022255 *
## RARELY:TrmpProp            4.9241  1   0.026485 *
## olderprop:TrmpProp         3.6376  1   0.056487 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop trumpvote.y
modbm7 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y + NEVER + RARELY +
    SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` + olderprop +
    TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` + ClintVote.y +
    ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x + all_doses_administered.x +
    fully_vaccinated.x + fully_vaccinated.y + RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
    family = binomial, data = big_data3)
summary(modbm7)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
```

```
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases +
##     `Older (65 plus).x` + olderprop + TrmpProp + ClintProp +
##     COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` + ClintVote.y +
##     ClintVote.x + TrmpVote.x + TotalVote.x + COVID_COUNT.x +
##     all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y +
##     RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    835.1    905.7   -389.5    779.1       64
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.98140 -0.51658  0.04546  0.40443  1.51079
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.420e-02 0.1555759
##  2013 code                (Intercept) 1.387e-08 0.0001178
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -9.763e+01  3.612e+01  -2.703  0.00687 **
## pop2021.y                 7.873e+00  2.936e+00   2.681  0.00733 **
## NEVER                     4.870e+01  3.393e+01   1.435  0.15119
## RARELY                    4.963e+01  3.510e+01   1.414  0.15739
## SOMETIMES                 4.755e+01  3.400e+01   1.399  0.16195
## FREQUENTLY                4.851e+01  3.406e+01   1.424  0.15431
## ALWAYS                    4.830e+01  3.405e+01   1.418  0.15606
## prop_cases                3.364e+01  1.570e+01   2.143  0.03209 *
## `Older (65 plus).x`       4.232e-05  3.599e-05   1.176  0.23965
## olderprop                 4.644e+01  2.069e+01   2.245  0.02478 *
## TrmpProp                  2.041e+01  7.894e+00   2.586  0.00972 **
## ClintProp                 1.289e+01  6.054e+00   2.130  0.03320 *
## COVID_COUNT.y            -3.367e+00  1.715e+00  -1.963  0.04966 *
## COVID_TEST.y              6.496e-01  2.929e-01   2.218  0.02657 *
## `Older (65 plus).y`      -5.229e+00  2.910e+00  -1.797  0.07236 .
## ClintVote.y              -3.521e-01  4.521e-01  -0.779  0.43603
## ClintVote.x              -1.411e-04  1.944e-04  -0.726  0.46796
## TrmpVote.x               -1.564e-04  1.962e-04  -0.797  0.42528
## TotalVote.x               1.404e-04  1.817e-04   0.773  0.43959
## COVID_COUNT.x            -2.272e-05  2.620e-05  -0.867  0.38591
## all_doses_administered.x -3.016e-05  1.472e-05  -2.049  0.04046 *
## fully_vaccinated.x        5.473e-05  2.931e-05   1.867  0.06188 .
## fully_vaccinated.y        5.482e-01  2.284e-01   2.400  0.01639 *
## RARELY:olderprop          8.138e+01  3.599e+01   2.261  0.02374 *
## RARELY:TrmpProp          -2.288e+01  1.057e+01  -2.165  0.03042 *
## olderprop:TrmpProp       -2.976e+01  1.616e+01  -1.841  0.06556 .
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## unable to evaluate scaled gradient
## Model failed to converge: degenerate  Hessian with 1 negative eigenvalues
```

```
Anova(modbm7)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                            Chisq Df Pr(>Chisq)
## pop2021.y                 7.1896  1   0.007333 **
## NEVER                     2.0602  1   0.151192
## RARELY                    2.1443  1   0.143100
## SOMETIMES                 1.9559  1   0.161955
## FREQUENTLY                2.0291  1   0.154312
## ALWAYS                    2.0120  1   0.156055
## prop_cases                4.5935  1   0.032093 *
## `Older (65 plus).x`       1.3826  1   0.239654
## olderprop                 3.0841  1   0.079061 .
## TrmpProp                  2.9688  1   0.084883 .
## ClintProp                 4.5355  1   0.033198 *
## COVID_COUNT.y             3.8530  1   0.049656 *
## COVID_TEST.y              4.9183  1   0.026574 *
## `Older (65 plus).y`       3.2288  1   0.072355 .
## ClintVote.y               0.6067  1   0.436035
## ClintVote.x               0.5268  1   0.467956
## TrmpVote.x                0.6357  1   0.425275
## TotalVote.x               0.5973  1   0.439592
## COVID_COUNT.x             0.7518  1   0.385911
## all_doses_administered.x 4.1984  1   0.040461 *
## fully_vaccinated.x        3.4863  1   0.061878 .
## fully_vaccinated.y        5.7602  1   0.016393 *
## RARELY:olderprop          5.1135  1   0.023740 *
## RARELY:TrmpProp           4.6855  1   0.030418 *
## olderprop:TrmpProp        3.3908  1   0.065562 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop clintvote.x
modbm8 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y + NEVER + RARELY +
    SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` + olderprop +
    TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` + ClintVote.y +
    TrmpVote.x + TotalVote.x + COVID_COUNT.x + all_doses_administered.x + fully_vaccinated.x +
    fully_vaccinated.y + RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp,
    family = binomial, data = big_data3)
summary(modbm8)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
```

```
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases +
##     `Older (65 plus).x` + olderprop + TrmpProp + ClintProp +
##     COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` + ClintVote.y +
##     TrmpVote.x + TotalVote.x + COVID_COUNT.x + all_doses_administered.x +
##     fully_vaccinated.x + fully_vaccinated.y + RARELY * olderprop *
##     TrmpProp - RARELY:olderprop:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    833.6    901.7   -389.8    779.6       65
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.96287 -0.52161  0.06373  0.41731  1.43958
##
## Random effects:
##  Groups                  Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.02462  0.1569
##  2013 code               (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -9.623e+01  3.628e+01  -2.652  0.00799 **
## pop2021.y                 7.380e+00  2.869e+00   2.572  0.01010 *
## NEVER                     5.173e+01  3.387e+01   1.527  0.12667
## RARELY                    5.568e+01  3.428e+01   1.624  0.10434
## SOMETIMES                 5.062e+01  3.394e+01   1.492  0.13575
## FREQUENTLY                5.156e+01  3.399e+01   1.517  0.12930
## ALWAYS                    5.137e+01  3.398e+01   1.511  0.13067
## prop_cases                3.149e+01  1.550e+01   2.032  0.04212 *
## `Older (65 plus).x`       2.537e-05  2.753e-05   0.921  0.35686
## olderprop                 4.289e+01  2.019e+01   2.125  0.03362 *
## TrmpProp                  1.668e+01  5.995e+00   2.783  0.00539 **
## ClintProp                 9.933e+00  4.472e+00   2.221  0.02634 *
## COVID_COUNT.y            -3.162e+00  1.701e+00  -1.859  0.06305 .
## COVID_TEST.y              6.205e-01  2.917e-01   2.127  0.03342 *
## `Older (65 plus).y`      -4.765e+00  2.851e+00  -1.671  0.09472 .
## ClintVote.y              -4.509e-01  4.335e-01  -1.040  0.29833
## TrmpVote.x               -1.424e-05  1.032e-05  -1.380  0.16762
## TotalVote.x               8.746e-06  8.938e-06   0.979  0.32779
## COVID_COUNT.x            -1.920e-05  2.589e-05  -0.742  0.45819
## all_doses_administered.x -2.834e-05  1.459e-05  -1.942  0.05211 .
## fully_vaccinated.x        5.373e-05  2.947e-05   1.823  0.06827 .
## fully_vaccinated.y        5.305e-01  2.285e-01   2.322  0.02024 *
## RARELY:olderprop          7.667e+01  3.559e+01   2.154  0.03122 *
## RARELY:TrmpProp          -2.598e+01  9.722e+00  -2.673  0.00753 **
## olderprop:TrmpProp       -2.627e+01  1.551e+01  -1.694  0.09033 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
```

```
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm8)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                            Chisq Df Pr(>Chisq)
## pop2021.y                 6.6175  1   0.010098 *
## NEVER                     2.3329  1   0.126666
## RARELY                    2.7431  1   0.097676 .
## SOMETIMES                 2.2255  1   0.135752
## FREQUENTLY                2.3009  1   0.129295
## ALWAYS                    2.2845  1   0.130673
## prop_cases                4.1303  1   0.042123 *
## `Older (65 plus).x`       0.8489  1   0.356856
## olderprop                 3.1426  1   0.076274 .
## TrmpProp                  1.4575  1   0.227325
## ClintProp                 4.9336  1   0.026339 *
## COVID_COUNT.y             3.4553  1   0.063051 .
## COVID_TEST.y              4.5242  1   0.033419 *
## `Older (65 plus).y`       2.7923  1   0.094718 .
## ClintVote.y               1.0816  1   0.298330
## TrmpVote.x                1.9041  1   0.167617
## TotalVote.x               0.9576  1   0.327790
## COVID_COUNT.x             0.5503  1   0.458189
## all_doses_administered.x 3.7722  1   0.052111 .
## fully_vaccinated.x        3.3242  1   0.068266 .
## fully_vaccinated.y        5.3912  1   0.020238 *
## RARELY:olderprop          4.6410  1   0.031217 *
## RARELY:TrmpProp           7.1425  1   0.007528 **
## olderprop:TrmpProp        2.8685  1   0.090332 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop covidcount.x
modbm9 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y + NEVER + RARELY +
    SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` + olderprop +
    TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` + ClintVote.y +
    TrmpVote.x + TotalVote.x + all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y +
    RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp, family = binomial,
    data = big_data3)
summary(modbm9)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases +
```

```
##     `Older (65 plus).x` + olderprop + TrmpProp + ClintProp +
##     COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` + ClintVote.y +
##     TrmpVote.x + TotalVote.x + all_doses_administered.x + fully_vaccinated.x +
##     fully_vaccinated.y + RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    832.1    897.7   -390.1    780.1       66
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.97379 -0.53412  0.06667  0.40590  1.41298
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.02472  0.1572
##  2013 code               (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -8.760e+01  3.440e+01  -2.547  0.01088 *
## pop2021.y                   6.511e+00  2.618e+00   2.487  0.01288 *
## NEVER                       4.597e+01  3.300e+01   1.393  0.16365
## RARELY                      4.875e+01  3.302e+01   1.476  0.13988
## SOMETIMES                   4.491e+01  3.309e+01   1.357  0.17470
## FREQUENTLY                  4.574e+01  3.311e+01   1.381  0.16716
## ALWAYS                      4.556e+01  3.311e+01   1.376  0.16883
## prop_cases                  3.133e+01  1.551e+01   2.020  0.04342 *
## `Older (65 plus).x`         1.014e-05  1.811e-05   0.560  0.57536
## olderprop                   3.810e+01  1.914e+01   1.990  0.04659 *
## TrmpProp                    1.595e+01  5.922e+00   2.693  0.00708 **
## ClintProp                   9.559e+00  4.451e+00   2.148  0.03174 *
## COVID_COUNT.y              -3.264e+00  1.697e+00  -1.923  0.05445 .
## COVID_TEST.y                6.023e-01  2.911e-01   2.069  0.03854 *
## `Older (65 plus).y`        -3.771e+00  2.514e+00  -1.500  0.13367
## ClintVote.y                -5.092e-01  4.266e-01  -1.194  0.23259
## TrmpVote.x                 -1.150e-05  9.647e-06  -1.192  0.23331
## TotalVote.x                 1.077e-05  8.479e-06   1.270  0.20407
## all_doses_administered.x -2.566e-05  1.416e-05  -1.812  0.07006 .
## fully_vaccinated.x          4.340e-05  2.599e-05   1.670  0.09494 .
## fully_vaccinated.y          5.971e-01  2.100e-01   2.844  0.00446 **
## RARELY:olderprop            7.997e+01  3.539e+01   2.260  0.02384 *
## RARELY:TrmpProp            -2.540e+01  9.698e+00  -2.619  0.00882 **
## olderprop:TrmpProp         -2.657e+01  1.552e+01  -1.712  0.08689 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm9)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                             Chisq Df Pr(>Chisq)
## pop2021.y                  6.1859  1   0.012877 *
## NEVER                      1.9402  1   0.163648
## RARELY                     2.3148  1   0.128145
## SOMETIMES                  1.8421  1   0.174699
## FREQUENTLY                 1.9083  1   0.167156
## ALWAYS                     1.8933  1   0.168827
## prop_cases                 4.0791  1   0.043416 *
## `Older (65 plus).x`        0.3138  1   0.575356
## olderprop                  2.0974  1   0.147551
## TrmpProp                   1.2420  1   0.265077
## ClintProp                  4.6127  1   0.031735 *
## COVID_COUNT.y              3.6987  1   0.054454 .
## COVID_TEST.y               4.2808  1   0.038544 *
## `Older (65 plus).y`        2.2494  1   0.133665
## ClintVote.y                1.4250  1   0.232588
## TrmpVote.x                 1.4206  1   0.233305
## TotalVote.x                1.6130  1   0.204071
## all_doses_administered.x 3.2816  1   0.070062 .
## fully_vaccinated.x         2.7886  1   0.094938 .
## fully_vaccinated.y         8.0877  1   0.004457 **
## RARELY:olderprop           5.1061  1   0.023842 *
## RARELY:TrmpProp            6.8587  1   0.008821 **
## olderprop:TrmpProp         2.9311  1   0.086888 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop older.x
modbm10 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y + NEVER + RARELY +
    SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + olderprop + TrmpProp + ClintProp +
    COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` + ClintVote.y + TrmpVote.x +
    TotalVote.x + all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y +
    RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp, family = binomial,
    data = big_data3)
summary(modbm10)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases +
##     olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y +
##     `Older (65 plus).y` + ClintVote.y + TrmpVote.x + TotalVote.x +
##     all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y +
##     RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    830.4    893.5   -390.2    780.4       67
```

```
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.9654 -0.5285  0.0574  0.4133  1.4555
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  '2013 code':LOCATION_ID (Intercept) 2.492e-02 1.579e-01
##  2013 code               (Intercept) 2.187e-10 1.479e-05
## Number of obs: 92, groups:  '2013 code':LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)               -8.651e+01  3.445e+01  -2.511  0.01202 *
## pop2021.y                  6.096e+00  2.514e+00   2.425  0.01532 *
## NEVER                      4.541e+01  3.309e+01   1.372  0.16998
## RARELY                     4.926e+01  3.310e+01   1.488  0.13671
## SOMETIMES                  4.437e+01  3.317e+01   1.337  0.18108
## FREQUENTLY                 4.524e+01  3.320e+01   1.363  0.17303
## ALWAYS                     4.502e+01  3.319e+01   1.356  0.17505
## prop_cases                 3.030e+01  1.544e+01   1.962  0.04974 *
## olderprop                  3.775e+01  1.919e+01   1.967  0.04915 *
## TrmpProp                   1.622e+01  5.921e+00   2.739  0.00616 **
## ClintProp                  1.025e+01  4.291e+00   2.389  0.01689 *
## COVID_COUNT.y             -3.113e+00  1.680e+00  -1.853  0.06386 .
## COVID_TEST.y               5.655e-01  2.840e-01   1.991  0.04647 *
## 'Older (65 plus).y'       -3.336e+00  2.395e+00  -1.393  0.16363
## ClintVote.y               -6.440e-01  3.517e-01  -1.831  0.06707 .
## TrmpVote.x                -1.096e-05  9.628e-06  -1.138  0.25501
## TotalVote.x                1.434e-05  5.594e-06   2.564  0.01035 *
## all_doses_administered.x -2.439e-05  1.404e-05  -1.737  0.08243 .
## fully_vaccinated.x         3.989e-05  2.535e-05   1.573  0.11561
## fully_vaccinated.y         6.146e-01  2.079e-01   2.956  0.00312 **
## RARELY:olderprop           7.307e+01  3.319e+01   2.202  0.02768 *
## RARELY:TrmpProp           -2.507e+01  9.709e+00  -2.582  0.00981 **
## olderprop:TrmpProp        -2.757e+01  1.546e+01  -1.783  0.07455 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm10)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                            Chisq Df Pr(>Chisq)
## pop2021.y                 5.8794  1   0.015319 *
## NEVER                     1.8831  1   0.169979
## RARELY                    2.2918  1   0.130062
## SOMETIMES                 1.7888  1   0.181078
## FREQUENTLY                1.8565  1   0.173033
```

```
## ALWAYS                   1.8392  1   0.175049
## prop_cases               3.8501  1   0.049744 *
## olderprop                2.2768  1   0.131321
## TrmpProp                 1.2790  1   0.258082
## ClintProp                5.7074  1   0.016894 *
## COVID_COUNT.y            3.4342  1   0.063858 .
## COVID_TEST.y             3.9644  1   0.046471 *
## `Older (65 plus).y`      1.9403  1   0.163632
## ClintVote.y              3.3532  1   0.067074 .
## TrmpVote.x               1.2956  1   0.255013
## TotalVote.x              6.5743  1   0.010346 *
## all_doses_administered.x 3.0162  1   0.082435 .
## fully_vaccinated.x       2.4758  1   0.115611
## fully_vaccinated.y       8.7366  1   0.003119 **
## RARELY:olderprop         4.8479  1   0.027679 *
## RARELY:TrmpProp          6.6682  1   0.009815 **
## olderprop:TrmpProp       3.1798  1   0.074552 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop trmpvote.x
modbm11 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y + NEVER + RARELY +
    SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + olderprop + TrmpProp + ClintProp +
    COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` + ClintVote.y + TotalVote.x +
    all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y + RARELY *
    olderprop * TrmpProp - RARELY:olderprop:TrmpProp, family = binomial, data = big_data3)
summary(modbm11)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     NEVER + RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases +
##     olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y +
##     `Older (65 plus).y` + ClintVote.y + TotalVote.x + all_doses_administered.x +
##     fully_vaccinated.x + fully_vaccinated.y + RARELY * olderprop *
##     TrmpProp - RARELY:olderprop:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    829.7    890.2   -390.9    781.7       68
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.96821 -0.48385  0.08982  0.38399  1.43414
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.02554  0.1598
##  2013 code                (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
```

```
## Fixed effects:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -7.370e+01  3.280e+01  -2.247 0.024651 *
## pop2021.y                   6.075e+00  2.535e+00   2.396 0.016560 *
## NEVER                       3.581e+01  3.225e+01   1.110 0.266847
## RARELY                      3.727e+01  3.164e+01   1.178 0.238736
## SOMETIMES                   3.473e+01  3.233e+01   1.074 0.282704
## FREQUENTLY                  3.550e+01  3.233e+01   1.098 0.272260
## ALWAYS                      3.522e+01  3.231e+01   1.090 0.275731
## prop_cases                  3.093e+01  1.555e+01   1.989 0.046650 *
## olderprop                   3.244e+01  1.877e+01   1.728 0.084005 .
## TrmpProp                    1.292e+01  5.202e+00   2.484 0.012982 *
## ClintProp                   9.499e+00  4.273e+00   2.223 0.026202 *
## COVID_COUNT.y              -3.118e+00  1.692e+00  -1.843 0.065397 .
## COVID_TEST.y                5.111e-01  2.820e-01   1.812 0.069960 .
## `Older (65 plus).y`        -3.191e+00  2.412e+00  -1.323 0.185853
## ClintVote.y                -8.470e-01  3.045e-01  -2.781 0.005411 **
## TotalVote.x                 1.492e-05  5.627e-06   2.651 0.008029 **
## all_doses_administered.x -2.958e-05  1.345e-05  -2.199 0.027874 *
## fully_vaccinated.x          4.485e-05  2.526e-05   1.775 0.075881 .
## fully_vaccinated.y          6.740e-01  2.021e-01   3.334 0.000856 ***
## RARELY:olderprop            7.207e+01  3.341e+01   2.157 0.031007 *
## RARELY:TrmpProp            -2.193e+01  9.376e+00  -2.339 0.019327 *
## olderprop:TrmpProp         -2.039e+01  1.425e+01  -1.431 0.152385
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm11)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                              Chisq Df Pr(>Chisq)
## pop2021.y                   5.7424  1  0.0165603 *
## NEVER                       1.2329  1  0.2668472
## RARELY                      1.9870  1  0.1586500
## SOMETIMES                   1.1540  1  0.2827036
## FREQUENTLY                  1.2053  1  0.2722599
## ALWAYS                      1.1880  1  0.2757312
## prop_cases                  3.9580  1  0.0466500 *
## olderprop                   2.3872  1  0.1223341
## TrmpProp                    1.7466  1  0.1863097
## ClintProp                   4.9426  1  0.0262021 *
## COVID_COUNT.y               3.3949  1  0.0653975 .
## COVID_TEST.y                3.2840  1  0.0699603 .
## `Older (65 plus).y`         1.7502  1  0.1858528
## ClintVote.y                 7.7367  1  0.0054109 **
## TotalVote.x                 7.0269  1  0.0080292 **
## all_doses_administered.x    4.8359  1  0.0278738 *
## fully_vaccinated.x          3.1510  1  0.0758807 .
```

```
## fully_vaccinated.y       11.1160  1  0.0008559 ***
## RARELY:olderprop          4.6525  1  0.0310075 *
## RARELY:TrmpProp           5.4716  1  0.0193275 *
## olderprop:TrmpProp        2.0482  1  0.1523853
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop SOMETIMES
modbm12 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y + NEVER + RARELY +
    FREQUENTLY + ALWAYS + prop_cases + olderprop + TrmpProp + ClintProp + COVID_COUNT.y +
    COVID_TEST.y + `Older (65 plus).y` + ClintVote.y + TotalVote.x + all_doses_administered.x +
    fully_vaccinated.x + fully_vaccinated.y + RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
    family = binomial, data = big_data3)
summary(modbm12)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     NEVER + RARELY + FREQUENTLY + ALWAYS + prop_cases + olderprop +
##     TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` +
##     ClintVote.y + TotalVote.x + all_doses_administered.x + fully_vaccinated.x +
##     fully_vaccinated.y + RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    828.9    886.9   -391.4    782.9       69
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.88850 -0.46183  0.04888  0.36008  1.43614
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.635e-02 0.1623367
##  2013 code                (Intercept) 9.526e-09 0.0000976
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -4.013e+01  9.948e+00  -4.034 5.48e-05 ***
## pop2021.y                 6.596e+00  2.515e+00   2.622  0.00873 **
## NEVER                     1.173e+00  6.897e-01   1.701  0.08893 .
## RARELY                    4.080e+00  6.785e+00   0.601  0.54758
## FREQUENTLY                7.751e-01  6.682e-01   1.160  0.24606
## ALWAYS                    5.125e-01  5.565e-01   0.921  0.35712
## prop_cases                3.565e+01  1.506e+01   2.367  0.01793 *
## olderprop                 3.086e+01  1.890e+01   1.632  0.10258
## TrmpProp                  1.219e+01  5.211e+00   2.338  0.01937 *
## ClintProp                 9.048e+00  4.294e+00   2.107  0.03510 *
## COVID_COUNT.y            -3.605e+00  1.646e+00  -2.190  0.02849 *
## COVID_TEST.y              5.398e-01  2.836e-01   1.903  0.05702 .
```

```
## `Older (65 plus).y`      -3.273e+00  2.437e+00  -1.343  0.17927
## ClintVote.y              -8.147e-01  3.061e-01  -2.662  0.00777 **
## TotalVote.x               1.538e-05  5.681e-06   2.708  0.00677 **
## all_doses_administered.x -2.935e-05  1.362e-05  -2.155  0.03119 *
## fully_vaccinated.x        4.365e-05  2.557e-05   1.707  0.08775 .
## fully_vaccinated.y        6.583e-01  2.033e-01   3.238  0.00121 **
## RARELY:olderprop          7.118e+01  3.376e+01   2.108  0.03499 *
## RARELY:TrmpProp          -2.383e+01  9.318e+00  -2.558  0.01053 *
## olderprop:TrmpProp       -1.714e+01  1.408e+01  -1.217  0.22363
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm12)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                            Chisq Df Pr(>Chisq)
## pop2021.y                 6.8764  1   0.008734 **
## NEVER                     2.8937  1   0.088926 .
## RARELY                    0.3198  1   0.571719
## FREQUENTLY                1.3455  1   0.246060
## ALWAYS                    0.8480  1   0.357116
## prop_cases                5.6025  1   0.017934 *
## olderprop                 2.6225  1   0.105361
## TrmpProp                  1.5313  1   0.215912
## ClintProp                 4.4403  1   0.035099 *
## COVID_COUNT.y             4.7982  1   0.028489 *
## COVID_TEST.y              3.6221  1   0.057016 .
## `Older (65 plus).y`       1.8036  1   0.179272
## ClintVote.y               7.0858  1   0.007770 **
## TotalVote.x               7.3330  1   0.006770 **
## all_doses_administered.x  4.6424  1   0.031192 *
## fully_vaccinated.x        2.9152  1   0.087750 .
## fully_vaccinated.y       10.4815  1   0.001206 **
## RARELY:olderprop          4.4456  1   0.034992 *
## RARELY:TrmpProp           6.5435  1   0.010527 *
## olderprop:TrmpProp        1.4809  1   0.223634
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop ALWAYS
modbm13 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y + NEVER + RARELY +
    FREQUENTLY + prop_cases + olderprop + TrmpProp + ClintProp + COVID_COUNT.y +
    COVID_TEST.y + `Older (65 plus).y` + ClintVote.y + TotalVote.x + all_doses_administered.x +
    fully_vaccinated.x + fully_vaccinated.y + RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
    family = binomial, data = big_data3)
summary(modbm13)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     NEVER + RARELY + FREQUENTLY + prop_cases + olderprop + TrmpProp +
##     ClintProp + COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` +
##     ClintVote.y + TotalVote.x + all_doses_administered.x + fully_vaccinated.x +
##     fully_vaccinated.y + RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    827.7    883.2   -391.9    783.7       70
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.92921 -0.47890  0.04371  0.36472  1.47232
##
## Random effects:
##  Groups                  Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.660e-02 0.1630994
##  2013 code               (Intercept) 1.531e-08 0.0001238
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -3.988e+01  9.977e+00  -3.997  6.4e-05 ***
## pop2021.y                 6.641e+00  2.524e+00   2.631  0.00850 **
## NEVER                     8.124e-01  5.679e-01   1.431  0.15254
## RARELY                    3.764e+00  6.806e+00   0.553  0.58018
## FREQUENTLY                3.200e-01  4.509e-01   0.710  0.47792
## prop_cases                3.470e+01  1.507e+01   2.303  0.02128 *
## olderprop                 3.296e+01  1.884e+01   1.750  0.08019 .
## TrmpProp                  1.232e+01  5.228e+00   2.356  0.01848 *
## ClintProp                 8.976e+00  4.307e+00   2.084  0.03716 *
## COVID_COUNT.y            -3.505e+00  1.647e+00  -2.128  0.03333 *
## COVID_TEST.y              5.166e-01  2.835e-01   1.822  0.06840 .
## `Older (65 plus).y`      -3.426e+00  2.440e+00  -1.404  0.16027
## ClintVote.y              -7.526e-01  3.000e-01  -2.509  0.01210 *
## TotalVote.x               1.449e-05  5.621e-06   2.579  0.00992 **
## all_doses_administered.x -2.673e-05  1.336e-05  -2.000  0.04547 *
## fully_vaccinated.x        3.921e-05  2.519e-05   1.557  0.11949
## fully_vaccinated.y        6.276e-01  2.015e-01   3.114  0.00185 **
## RARELY:olderprop          6.374e+01  3.282e+01   1.942  0.05214 .
## RARELY:TrmpProp          -2.233e+01  9.213e+00  -2.423  0.01538 *
## olderprop:TrmpProp       -1.813e+01  1.410e+01  -1.286  0.19851
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## unable to evaluate scaled gradient
## Model failed to converge: degenerate  Hessian with 1 negative eigenvalues
```

```
Anova(modbm13)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                            Chisq Df Pr(>Chisq)
## pop2021.y                 6.9243  1   0.008503 **
## NEVER                     2.0466  1   0.152544
## RARELY                    0.2989  1   0.584589
## FREQUENTLY                0.5036  1   0.477923
## prop_cases                5.3035  1   0.021283 *
## olderprop                 2.6758  1   0.101882
## TrmpProp                  1.5646  1   0.210993
## ClintProp                 4.3430  1   0.037161 *
## COVID_COUNT.y             4.5287  1   0.033330 *
## COVID_TEST.y              3.3209  1   0.068403 .
## `Older (65 plus).y`       1.9716  1   0.160274
## ClintVote.y               6.2960  1   0.012101 *
## TotalVote.x               6.6494  1   0.009919 **
## all_doses_administered.x 4.0010  1   0.045472 *
## fully_vaccinated.x        2.4240  1   0.119489
## fully_vaccinated.y        9.6966  1   0.001846 **
## RARELY:olderprop          3.7713  1   0.052140 .
## RARELY:TrmpProp           5.8722  1   0.015382 *
## olderprop:TrmpProp        1.6533  1   0.198513
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop FREQUENTLY
modbm14 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y + NEVER + RARELY +
    prop_cases + olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y +
    `Older (65 plus).y` + ClintVote.y + TotalVote.x + all_doses_administered.x +
    fully_vaccinated.x + fully_vaccinated.y + RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
    family = binomial, data = big_data3)
summary(modbm14)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     NEVER + RARELY + prop_cases + olderprop + TrmpProp + ClintProp +
##     COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` + ClintVote.y +
##     TotalVote.x + all_doses_administered.x + fully_vaccinated.x +
##     fully_vaccinated.y + RARELY * olderprop * TrmpProp - RARELY:olderprop:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    826.2    879.2   -392.1    784.2       71
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
```

```
## -1.96274 -0.46099  0.06384  0.35081  1.57677
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  '2013 code':LOCATION_ID (Intercept) 0.02651  0.1628
##  2013 code               (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  '2013 code':LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                              Estimate Std. Error z value Pr(>|z|)
## (Intercept)                -3.952e+01  9.951e+00  -3.971 7.15e-05 ***
## pop2021.y                   6.558e+00  2.518e+00   2.605  0.00920 **
## NEVER                       8.189e-01  5.672e-01   1.444  0.14885
## RARELY                      3.707e+00  6.797e+00   0.545  0.58547
## prop_cases                  3.507e+01  1.504e+01   2.331  0.01973 *
## olderprop                   3.160e+01  1.872e+01   1.688  0.09135 .
## TrmpProp                    1.240e+01  5.218e+00   2.376  0.01751 *
## ClintProp                   8.958e+00  4.301e+00   2.083  0.03726 *
## COVID_COUNT.y              -3.544e+00  1.644e+00  -2.156  0.03110 *
## COVID_TEST.y                5.259e-01  2.829e-01   1.859  0.06302 .
## 'Older (65 plus).y'        -3.342e+00  2.434e+00  -1.373  0.16982
## ClintVote.y                -7.090e-01  2.931e-01  -2.419  0.01557 *
## TotalVote.x                 1.473e-05  5.606e-06   2.627  0.00861 **
## all_doses_administered.x -2.697e-05  1.334e-05  -2.022  0.04318 *
## fully_vaccinated.x          3.940e-05  2.515e-05   1.567  0.11716
## fully_vaccinated.y          6.073e-01  1.992e-01   3.049  0.00229 **
## RARELY:olderprop            6.622e+01  3.257e+01   2.033  0.04206 *
## RARELY:TrmpProp            -2.310e+01  9.124e+00  -2.532  0.01134 *
## olderprop:TrmpProp         -1.759e+01  1.406e+01  -1.251  0.21088
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm14)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                            Chisq Df Pr(>Chisq)
## pop2021.y                 6.7837  1   0.009199 **
## NEVER                     2.0840  1   0.148846
## RARELY                    0.0539  1   0.816443
## prop_cases                5.4354  1   0.019732 *
## olderprop                 2.4980  1   0.113992
## TrmpProp                  1.6477  1   0.199272
## ClintProp                 4.3387  1   0.037256 *
## COVID_COUNT.y             4.6474  1   0.031101 *
## COVID_TEST.y              3.4562  1   0.063015 .
## 'Older (65 plus).y'       1.8846  1   0.169817
## ClintVote.y               5.8503  1   0.015575 *
## TotalVote.x               6.9012  1   0.008614 **
```

```
## all_doses_administered.x 4.0885  1   0.043177 *
## fully_vaccinated.x       2.4549  1   0.117160
## fully_vaccinated.y       9.2976  1   0.002295 **
## RARELY:olderprop         4.1328  1   0.042060 *
## RARELY:TrmpProp          6.4110  1   0.011342 *
## olderprop:TrmpProp       1.5654  1   0.210883
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop olderprop:trmpprop
modbm15 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y + NEVER + RARELY +
    prop_cases + olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y +
    `Older (65 plus).y` + ClintVote.y + TotalVote.x + all_doses_administered.x +
    fully_vaccinated.x + fully_vaccinated.y + RARELY:olderprop + RARELY:TrmpProp,
    family = binomial, data = big_data3)
summary(modbm15)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     NEVER + RARELY + prop_cases + olderprop + TrmpProp + ClintProp +
##     COVID_COUNT.y + COVID_TEST.y + `Older (65 plus).y` + ClintVote.y +
##     TotalVote.x + all_doses_administered.x + fully_vaccinated.x +
##     fully_vaccinated.y + RARELY:olderprop + RARELY:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    825.8    876.2   -392.9    785.8       72
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.95525 -0.45881  0.06828  0.33790  1.51338
##
## Random effects:
##  Groups                  Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.02746  0.1657
##  2013 code               (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -3.499e+01  9.379e+00  -3.731 0.000191 ***
## pop2021.y                 5.710e+00  2.458e+00   2.323 0.020177 *
## NEVER                     7.772e-01  5.726e-01   1.357 0.174664
## RARELY                    5.842e+00  6.663e+00   0.877 0.380560
## prop_cases                3.581e+01  1.520e+01   2.356 0.018489 *
## olderprop                 1.468e+01  1.308e+01   1.122 0.261845
## TrmpProp                  9.093e+00  4.541e+00   2.002 0.045248 *
## ClintProp                 8.303e+00  4.318e+00   1.923 0.054509 .
## COVID_COUNT.y            -3.588e+00  1.662e+00  -2.159 0.030866 *
## COVID_TEST.y              4.319e-01  2.757e-01   1.566 0.117318
```

```
## `Older (65 plus).y`      -2.356e+00  2.331e+00  -1.011 0.312180
## ClintVote.y               -6.827e-01  2.957e-01  -2.309 0.020948 *
## TotalVote.x                1.507e-05  5.680e-06   2.653 0.007976 **
## all_doses_administered.x -2.856e-05  1.347e-05  -2.120 0.033979 *
## fully_vaccinated.x         4.171e-05  2.545e-05   1.639 0.101173
## fully_vaccinated.y         6.103e-01  2.012e-01   3.034 0.002416 **
## RARELY:olderprop           6.596e+01  3.300e+01   1.999 0.045590 *
## RARELY:TrmpProp           -2.623e+01  8.917e+00  -2.942 0.003266 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm15)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                            Chisq Df Pr(>Chisq)
## pop2021.y                 5.3965  1   0.020177 *
## NEVER                     1.8424  1   0.174664
## RARELY                    0.0151  1   0.902261
## prop_cases                5.5492  1   0.018489 *
## olderprop                 2.4581  1   0.116917
## TrmpProp                  1.6213  1   0.202916
## ClintProp                 3.6971  1   0.054509 .
## COVID_COUNT.y             4.6604  1   0.030866 *
## COVID_TEST.y              2.4528  1   0.117318
## `Older (65 plus).y`       1.0214  1   0.312180
## ClintVote.y               5.3311  1   0.020948 *
## TotalVote.x               7.0388  1   0.007976 **
## all_doses_administered.x 4.4958  1   0.033979 *
## fully_vaccinated.x        2.6870  1   0.101173
## fully_vaccinated.y        9.2034  1   0.002416 **
## RARELY:olderprop          3.9967  1   0.045590 *
## RARELY:TrmpProp           8.6525  1   0.003266 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop older.y
modbm16 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y + NEVER + RARELY +
    prop_cases + olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y +
    ClintVote.y + TotalVote.x + all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y +
    RARELY:olderprop + RARELY:TrmpProp, family = binomial, data = big_data3)
summary(modbm16)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
```

```
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     NEVER + RARELY + prop_cases + olderprop + TrmpProp + ClintProp +
##     COVID_COUNT.y + COVID_TEST.y + ClintVote.y + TotalVote.x +
##     all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y +
##     RARELY:olderprop + RARELY:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    824.8    872.7   -393.4    786.8       73
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.96728 -0.48180  0.02763  0.31041  1.52355
##
## Random effects:
##  Groups                  Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.761e-02 0.1661699
##  2013 code               (Intercept) 1.987e-10 0.0000141
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)               -2.876e+01  7.064e+00  -4.071 4.69e-05 ***
## pop2021.y                  3.695e+00  1.445e+00   2.558  0.01054 *
## NEVER                      6.854e-01  5.662e-01   1.211  0.22605
## RARELY                     6.290e+00  6.660e+00   0.944  0.34495
## prop_cases                 3.848e+01  1.499e+01   2.567  0.01026 *
## olderprop                  1.881e+00  3.275e+00   0.574  0.56563
## TrmpProp                   8.235e+00  4.464e+00   1.845  0.06511 .
## ClintProp                  7.367e+00  4.220e+00   1.746  0.08084 .
## COVID_COUNT.y             -3.907e+00  1.635e+00  -2.390  0.01684 *
## COVID_TEST.y               4.068e-01  2.750e-01   1.479  0.13907
## ClintVote.y               -6.976e-01  2.957e-01  -2.359  0.01834 *
## TotalVote.x                1.194e-05  4.775e-06   2.501  0.01239 *
## all_doses_administered.x -2.167e-05  1.162e-05  -1.865  0.06221 .
## fully_vaccinated.x         3.155e-05  2.339e-05   1.349  0.17741
## fully_vaccinated.y         6.210e-01  2.011e-01   3.088  0.00201 **
## RARELY:olderprop           6.559e+01  3.309e+01   1.982  0.04748 *
## RARELY:TrmpProp           -2.684e+01  8.907e+00  -3.013  0.00258 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm16)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                            Chisq Df Pr(>Chisq)
## pop2021.y                 6.5409  1   0.010542 *
## NEVER                     1.4656  1   0.226047
```

```
## RARELY                    0.0023  1   0.961749
## prop_cases                6.5884  1   0.010264 *
## olderprop                18.7028  1  1.528e-05 ***
## TrmpProp                  1.0650  1   0.302073
## ClintProp                 3.0479  1   0.080843 .
## COVID_COUNT.y             5.7134  1   0.016836 *
## COVID_TEST.y              2.1882  1   0.139070
## ClintVote.y               5.5634  1   0.018340 *
## TotalVote.x               6.2543  1   0.012389 *
## all_doses_administered.x  3.4775  1   0.062208 .
## fully_vaccinated.x        1.8192  1   0.177414
## fully_vaccinated.y        9.5359  1   0.002015 **
## RARELY:olderprop          3.9285  1   0.047476 *
## RARELY:TrmpProp           9.0796  1   0.002585 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop NEVER
modbm17 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y + RARELY + prop_cases +
    olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + ClintVote.y +
    TotalVote.x + all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y +
    RARELY:olderprop + RARELY:TrmpProp, family = binomial, data = big_data3)
summary(modbm17)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     RARELY + prop_cases + olderprop + TrmpProp + ClintProp +
##     COVID_COUNT.y + COVID_TEST.y + ClintVote.y + TotalVote.x +
##     all_doses_administered.x + fully_vaccinated.x + fully_vaccinated.y +
##     RARELY:olderprop + RARELY:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    824.3    869.7   -394.1    788.3       74
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.94142 -0.49716  0.04222  0.30430  1.56611
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.02819  0.1679
##  2013 code                (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -2.715e+01  6.979e+00  -3.890  0.00010 ***
## pop2021.y                 3.164e+00  1.384e+00   2.286  0.02228 *
## RARELY                    6.656e+00  6.705e+00   0.993  0.32084
```

```
## prop_cases                3.256e+01  1.426e+01   2.284  0.02235 *
## olderprop                 2.111e+00  3.291e+00   0.642  0.52119
## TrmpProp                  8.505e+00  4.490e+00   1.894  0.05821 .
## ClintProp                 7.757e+00  4.236e+00   1.831  0.06708 .
## COVID_COUNT.y            -3.311e+00  1.568e+00  -2.112  0.03469 *
## COVID_TEST.y              3.889e-01  2.763e-01   1.407  0.15932
## ClintVote.y              -7.550e-01  2.936e-01  -2.571  0.01013 *
## TotalVote.x               1.122e-05  4.779e-06   2.348  0.01887 *
## all_doses_administered.x -2.116e-05  1.171e-05  -1.806  0.07088 .
## fully_vaccinated.x        3.139e-05  2.360e-05   1.330  0.18347
## fully_vaccinated.y        6.276e-01  2.020e-01   3.107  0.00189 **
## RARELY:olderprop          6.495e+01  3.331e+01   1.950  0.05117 .
## RARELY:TrmpProp          -2.714e+01  8.970e+00  -3.026  0.00248 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm17)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                            Chisq Df Pr(>Chisq)
## pop2021.y                 5.2238  1   0.022280 *
## RARELY                    0.0141  1   0.905317
## prop_cases                5.2181  1   0.022353 *
## olderprop                19.4477  1  1.034e-05 ***
## TrmpProp                  1.1737  1   0.278649
## ClintProp                 3.3532  1   0.067076 .
## COVID_COUNT.y             4.4605  1   0.034687 *
## COVID_TEST.y              1.9807  1   0.159318
## ClintVote.y               6.6114  1   0.010133 *
## TotalVote.x               5.5133  1   0.018872 *
## all_doses_administered.x  3.2626  1   0.070878 .
## fully_vaccinated.x        1.7693  1   0.183471
## fully_vaccinated.y        9.6523  1   0.001891 **
## RARELY:olderprop          3.8028  1   0.051166 .
## RARELY:TrmpProp           9.1542  1   0.002482 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(modbm17, test = 'Chi')

# drop fullyvaccinated.x
modbm18 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y + RARELY + prop_cases +
    olderprop + TrmpProp + ClintProp + COVID_COUNT.y + COVID_TEST.y + ClintVote.y +
    TotalVote.x + all_doses_administered.x + fully_vaccinated.y + RARELY:olderprop +
    RARELY:TrmpProp, family = binomial, data = big_data3)
summary(modbm18)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     RARELY + prop_cases + olderprop + TrmpProp + ClintProp +
##     COVID_COUNT.y + COVID_TEST.y + ClintVote.y + TotalVote.x +
##     all_doses_administered.x + fully_vaccinated.y + RARELY:olderprop +
##     RARELY:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    824.0    866.9   -395.0    790.0       75
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.92922 -0.45269  0.04145  0.32386  1.49410
##
## Random effects:
##  Groups                  Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 2.943e-02 0.1715595
##  2013 code               (Intercept) 1.524e-08 0.0001234
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -2.932e+01  6.882e+00  -4.261 2.04e-05 ***
## pop2021.y                 3.316e+00  1.399e+00   2.371  0.01776 *
## RARELY                    6.663e+00  6.813e+00   0.978  0.32810
## prop_cases                3.466e+01  1.437e+01   2.413  0.01583 *
## olderprop                 1.990e+00  3.336e+00   0.596  0.55084
## TrmpProp                  1.017e+01  4.376e+00   2.325  0.02008 *
## ClintProp                 9.058e+00  4.186e+00   2.164  0.03045 *
## COVID_COUNT.y            -3.536e+00  1.580e+00  -2.238  0.02524 *
## COVID_TEST.y              3.933e-01  2.802e-01   1.403  0.16052
## ClintVote.y              -6.996e-01  2.950e-01  -2.372  0.01771 *
## TotalVote.x               9.536e-06  4.701e-06   2.029  0.04250 *
## all_doses_administered.x -6.074e-06  3.067e-06  -1.981  0.04762 *
## fully_vaccinated.y        6.547e-01  2.034e-01   3.219  0.00129 **
## RARELY:olderprop          6.796e+01  3.369e+01   2.017  0.04367 *
## RARELY:TrmpProp          -2.789e+01  9.092e+00  -3.068  0.00216 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## unable to evaluate scaled gradient
## Model failed to converge: degenerate  Hessian with 1 negative eigenvalues
```

```
Anova(modbm18)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
```

```
##                              Chisq Df Pr(>Chisq)
## pop2021.y                   5.6193  1   0.017764 *
## RARELY                      0.0443  1   0.833367
## prop_cases                  5.8211  1   0.015835 *
## olderprop                  19.6553  1  9.275e-06 ***
## TrmpProp                    2.3864  1   0.122395
## ClintProp                   4.6835  1   0.030453 *
## COVID_COUNT.y               5.0071  1   0.025243 *
## COVID_TEST.y                1.9694  1   0.160516
## ClintVote.y                 5.6249  1   0.017708 *
## TotalVote.x                 4.1152  1   0.042499 *
## all_doses_administered.x    3.9235  1   0.047617 *
## fully_vaccinated.y         10.3614  1   0.001287 **
## RARELY:olderprop            4.0695  1   0.043665 *
## RARELY:TrmpProp             9.4111  1   0.002157 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(modbm18, test = 'Chi')

# drop covidtest.y
modbm19 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y + RARELY + prop_cases +
    olderprop + TrmpProp + ClintProp + COVID_COUNT.y + ClintVote.y + TotalVote.x +
    all_doses_administered.x + fully_vaccinated.y + RARELY:olderprop + RARELY:TrmpProp,
    family = binomial, data = big_data3)
summary(modbm19)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     RARELY + prop_cases + olderprop + TrmpProp + ClintProp +
##     COVID_COUNT.y + ClintVote.y + TotalVote.x + all_doses_administered.x +
##     fully_vaccinated.y + RARELY:olderprop + RARELY:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    824.0    864.3   -396.0    792.0       76
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.81737 -0.45833  0.02142  0.30031  1.48836
##
## Random effects:
##  Groups                  Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 3.075e-02 0.1753611
##  2013 code               (Intercept) 1.034e-07 0.0003215
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                             Estimate Std. Error z value Pr(>|z|)
## (Intercept)              -2.422e+01  5.944e+00  -4.075  4.6e-05 ***
```

```
## pop2021.y                  2.449e+00  1.274e+00   1.923  0.05450 .
## RARELY                     5.179e+00  6.854e+00   0.756  0.44985
## prop_cases                 2.493e+01  1.277e+01   1.952  0.05098 .
## olderprop                  2.293e+00  3.375e+00   0.679  0.49691
## TrmpProp                   8.411e+00  4.259e+00   1.975  0.04829 *
## ClintProp                  7.752e+00  4.149e+00   1.868  0.06171 .
## COVID_COUNT.y             -2.275e+00  1.320e+00  -1.724  0.08476 .
## ClintVote.y               -6.862e-01  2.992e-01  -2.294  0.02181 *
## TotalVote.x                8.128e-06  4.680e-06   1.737  0.08240 .
## all_doses_administered.x -5.253e-06  3.066e-06  -1.713  0.08672 .
## fully_vaccinated.y         6.386e-01  2.058e-01   3.103  0.00192 **
## RARELY:olderprop           6.400e+01  3.404e+01   1.880  0.06012 .
## RARELY:TrmpProp           -2.471e+01  8.940e+00  -2.765  0.00570 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## unable to evaluate scaled gradient
## Model failed to converge: degenerate  Hessian with 1 negative eigenvalues
```

```
Anova(modbm19)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                             Chisq Df Pr(>Chisq)
## pop2021.y                  3.6973  1   0.054500 .
## RARELY                     0.0310  1   0.860302
## prop_cases                 3.8089  1   0.050981 .
## olderprop                 18.9027  1  1.376e-05 ***
## TrmpProp                   1.9922  1   0.158110
## ClintProp                  3.4907  1   0.061715 .
## COVID_COUNT.y              2.9712  1   0.084761 .
## ClintVote.y                5.2611  1   0.021807 *
## TotalVote.x                3.0169  1   0.082399 .
## all_doses_administered.x   2.9342  1   0.086723 .
## fully_vaccinated.y         9.6268  1   0.001918 **
## RARELY:olderprop           3.5340  1   0.060121 .
## RARELY:TrmpProp            7.6431  1   0.005699 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(modbm19, test = 'Chi')

# alldoses.x
modbm20 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y + RARELY + prop_cases +
    olderprop + TrmpProp + ClintProp + COVID_COUNT.y + ClintVote.y + TotalVote.x +
    fully_vaccinated.y + RARELY:olderprop + RARELY:TrmpProp, family = binomial, data = big_data3)
summary(modbm20)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
```

```
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     RARELY + prop_cases + olderprop + TrmpProp + ClintProp +
##     COVID_COUNT.y + ClintVote.y + TotalVote.x + fully_vaccinated.y +
##     RARELY:olderprop + RARELY:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    824.8    862.7   -397.4    794.8       77
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.85992 -0.41829  0.01324  0.29002  1.47772
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.03288  0.1813
##  2013 code                (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                       Estimate Std. Error z value Pr(>|z|)
## (Intercept)        -2.551e+01  6.030e+00  -4.230 2.34e-05 ***
## pop2021.y           2.229e+00  1.295e+00   1.721  0.08519 .
## RARELY              7.662e+00  6.875e+00   1.114  0.26507
## prop_cases          2.206e+01  1.295e+01   1.703  0.08854 .
## olderprop           4.239e+00  3.246e+00   1.306  0.19151
## TrmpProp            1.036e+01  4.200e+00   2.467  0.01361 *
## ClintProp           9.612e+00  4.100e+00   2.344  0.01907 *
## COVID_COUNT.y      -1.964e+00  1.337e+00  -1.470  0.14166
## ClintVote.y        -6.245e-01  3.037e-01  -2.056  0.03975 *
## TotalVote.x         2.206e-07  8.348e-07   0.264  0.79163
## fully_vaccinated.y  4.881e-01  1.895e-01   2.576  0.00999 **
## RARELY:olderprop    5.012e+01  3.372e+01   1.486  0.13719
## RARELY:TrmpProp    -2.432e+01  9.168e+00  -2.652  0.00800 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm20)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                      Chisq Df Pr(>Chisq)
## pop2021.y           2.9629  1   0.085195 .
## RARELY              0.2057  1   0.650131
## prop_cases          2.9007  1   0.088539 .
## olderprop          22.4399  1  2.168e-06 ***
```

```
## TrmpProp            3.6208  1   0.057060 .
## ClintProp           5.4953  1   0.019068 *
## COVID_COUNT.y       2.1599  1   0.141657
## ClintVote.y         4.2286  1   0.039748 *
## TotalVote.x         0.0698  1   0.791631
## fully_vaccinated.y  6.6363  1   0.009992 **
## RARELY:olderprop    2.2092  1   0.137186
## RARELY:TrmpProp     7.0343  1   0.007996 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(modbm20, test = 'Chi')

# drop totalvote.x
modbm21 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y + RARELY + prop_cases +
    olderprop + TrmpProp + ClintProp + COVID_COUNT.y + ClintVote.y + fully_vaccinated.y +
    RARELY:olderprop + RARELY:TrmpProp, family = binomial, data = big_data3)
summary(modbm21)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     RARELY + prop_cases + olderprop + TrmpProp + ClintProp +
##     COVID_COUNT.y + ClintVote.y + fully_vaccinated.y + RARELY:olderprop +
##     RARELY:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    822.9    858.2   -397.4    794.9       78
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.85717 -0.42344  0.00969  0.28323  1.47307
##
## Random effects:
##  Groups                  Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 3.303e-02 1.817e-01
##  2013 code               (Intercept) 1.982e-10 1.408e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                    Estimate Std. Error z value Pr(>|z|)
## (Intercept)        -25.6458     6.0091  -4.268 1.97e-05 ***
## pop2021.y            2.1891     1.2878   1.700  0.08916 .
## RARELY               7.1586     6.6778   1.072  0.28372
## prop_cases          21.5859    12.8310   1.682  0.09251 .
## olderprop            4.0612     3.2185   1.262  0.20700
## TrmpProp            10.6321     4.1000   2.593  0.00951 **
## ClintProp            9.9041     3.9657   2.497  0.01251 *
## COVID_COUNT.y       -1.9191     1.3258  -1.447  0.14778
## ClintVote.y         -0.6106     0.3020  -2.022  0.04319 *
```

```
## fully_vaccinated.y   0.4765     0.1856   2.567  0.01025 *
## RARELY:olderprop    51.7104    33.5324   1.542  0.12305
## RARELY:TrmpProp    -23.9916     9.1191  -2.631  0.00852 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) p2021. RARELY prp_cs oldrpr TrmpPr ClntPr COVID_ ClntV.
## pop2021.y   -0.777
## RARELY      -0.152  0.051
## prop_cases  -0.783  0.977  0.039
## olderprop    0.096 -0.007  0.456 -0.065
## TrmpProp    -0.679  0.085  0.126  0.129 -0.330
## ClintProp   -0.654  0.057  0.105  0.080 -0.198  0.962
## COVID_COUNT  0.793 -0.983 -0.037 -0.992  0.059 -0.136 -0.084
## ClintVote.y -0.037 -0.041 -0.192  0.104 -0.368  0.189 -0.006 -0.102
## flly_vccnt. -0.269  0.217  0.187  0.182  0.254  0.070  0.190 -0.208 -0.622
## RARELY:ldrp -0.072  0.084 -0.528  0.071 -0.839  0.164  0.051 -0.077  0.103
## RARELY:TrmP  0.213 -0.136 -0.542 -0.109  0.332 -0.268 -0.133  0.111  0.104
##             flly_. RARELY:l
## pop2021.y
## RARELY
## prop_cases
## olderprop
## TrmpProp
## ClintProp
## COVID_COUNT
## ClintVote.y
## flly_vccnt.
## RARELY:ldrp -0.141
## RARELY:TrmP -0.045 -0.422
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm21)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                       Chisq Df Pr(>Chisq)
## pop2021.y            2.8894  1   0.089162 .
## RARELY               0.2057  1   0.650178
## prop_cases           2.8302  1   0.092507 .
## olderprop           22.0690  1   2.63e-06 ***
## TrmpProp             3.8449  1   0.049897 *
## ClintProp            6.2373  1   0.012509 *
## COVID_COUNT.y        2.0950  1   0.147781
## ClintVote.y          4.0880  1   0.043189 *
## fully_vaccinated.y   6.5915  1   0.010247 *
## RARELY:olderprop     2.3781  1   0.123049
## RARELY:TrmpProp      6.9216  1   0.008516 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
# drop1(modbm21, test = 'Chi')

# drop covidcount.y
modbm22 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y + RARELY + prop_cases +
    olderprop + TrmpProp + ClintProp + ClintVote.y + fully_vaccinated.y + RARELY:olderprop +
    RARELY:TrmpProp, family = binomial, data = big_data3)
summary(modbm22)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
##     RARELY + prop_cases + olderprop + TrmpProp + ClintProp +
##     ClintVote.y + fully_vaccinated.y + RARELY:olderprop + RARELY:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    823.0    855.8   -398.5    797.0       79
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.84608 -0.41979  0.03284  0.31208  1.42600
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 3.423e-02 1.850e-01
##  2013 code                (Intercept) 1.222e-09 3.495e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                     Estimate Std. Error z value Pr(>|z|)
## (Intercept)        -18.7984     3.7135  -5.062 4.14e-07 ***
## pop2021.y            0.3573     0.2373   1.506   0.1322
## RARELY               6.8429     6.7550   1.013   0.3111
## prop_cases           3.1674     1.6418   1.929   0.0537 .
## olderprop            4.3228     3.2402   1.334   0.1822
## TrmpProp             9.8650     4.1162   2.397   0.0165 *
## ClintProp            9.4595     4.0045   2.362   0.0182 *
## ClintVote.y         -0.6580     0.3045  -2.161   0.0307 *
## fully_vaccinated.y   0.4230     0.1836   2.304   0.0212 *
## RARELY:olderprop    48.2221    33.6088   1.435   0.1513
## RARELY:TrmpProp    -22.6471     9.1854  -2.466   0.0137 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) p2021. RARELY prp_cs oldrpr TrmpPr ClntPr ClntV. flly_.
## pop2021.y    0.022
## RARELY      -0.203  0.085
## prop_cases   0.036  0.058  0.016
## olderprop    0.082  0.283  0.455 -0.053
```

```
## TrmpProp    -0.946 -0.267  0.123 -0.042 -0.326
## ClintProp   -0.966 -0.138  0.102 -0.027 -0.195  0.963
## ClintVote.y  0.070 -0.780 -0.196  0.025 -0.365  0.178 -0.014
## flly_vccnt. -0.172  0.071  0.182 -0.191  0.271  0.042  0.174 -0.660
## RARELY:ldrp -0.019  0.047 -0.529 -0.040 -0.837  0.154  0.045  0.095 -0.160
## RARELY:TrmP  0.207 -0.150 -0.549  0.007  0.325 -0.256 -0.124  0.118 -0.024
##             RARELY:l
## pop2021.y
## RARELY
## prop_cases
## olderprop
## TrmpProp
## ClintProp
## ClintVote.y
## flly_vccnt.
## RARELY:ldrp
## RARELY:TrmP -0.415
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm22)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                      Chisq Df Pr(>Chisq)
## pop2021.y           2.2670  1    0.13216
## RARELY              0.1588  1    0.69023
## prop_cases          3.7219  1    0.05370 .
## olderprop          21.3984  1  3.731e-06 ***
## TrmpProp            3.3382  1    0.06769 .
## ClintProp           5.5801  1    0.01817 *
## ClintVote.y         4.6697  1    0.03070 *
## fully_vaccinated.y  5.3066  1    0.02124 *
## RARELY:olderprop    2.0587  1    0.15134
## RARELY:TrmpProp     6.0790  1    0.01368 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(modbm22, test = 'Chi')

# drop rarely:olderprop
modbm23 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y + RARELY + prop_cases +
    olderprop + TrmpProp + ClintProp + ClintVote.y + fully_vaccinated.y + RARELY:TrmpProp,
    family = binomial, data = big_data3)
summary(modbm23)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + pop2021.y +
```

```
##     RARELY + prop_cases + olderprop + TrmpProp + ClintProp +
##     ClintVote.y + fully_vaccinated.y + RARELY:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    823.0    853.3   -399.5    799.0       80
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.79846 -0.39654  0.04029  0.28088  1.72633
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 3.501e-02 1.871e-01
##  2013 code               (Intercept) 5.934e-09 7.703e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                     Estimate Std. Error z value Pr(>|z|)
## (Intercept)        -18.6691     3.7410  -4.990 6.03e-07 ***
## pop2021.y            0.3407     0.2391   1.424   0.1543
## RARELY              12.0301     5.7907   2.078   0.0378 *
## prop_cases           3.2762     1.6537   1.981   0.0476 *
## olderprop            8.1919     1.7885   4.580 4.64e-06 ***
## TrmpProp             8.9288     4.0978   2.179   0.0293 *
## ClintProp            9.1711     4.0302   2.276   0.0229 *
## ClintVote.y         -0.6996     0.3057  -2.288   0.0221 *
## fully_vaccinated.y   0.4655     0.1825   2.551   0.0107 *
## RARELY:TrmpProp    -17.2705     8.4410  -2.046   0.0408 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) p2021. RARELY prp_cs oldrpr TrmpPr ClntPr ClntV. flly_.
## pop2021.y    0.022
## RARELY      -0.250  0.130
## prop_cases   0.036  0.061 -0.006
## olderprop    0.122  0.589  0.027 -0.157
## TrmpProp    -0.954 -0.277  0.244 -0.036 -0.364
## ClintProp   -0.967 -0.140  0.148 -0.026 -0.288  0.969
## ClintVote.y  0.072 -0.790 -0.172  0.028 -0.523  0.167 -0.018
## flly_vccnt. -0.176  0.080  0.116 -0.200  0.254  0.066  0.182 -0.656
## RARELY:TrmP  0.219 -0.144 -0.994 -0.011 -0.044 -0.213 -0.115  0.174 -0.100
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm23)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                      Chisq Df Pr(>Chisq)
## pop2021.y           2.0291  1    0.15432
## RARELY              0.1583  1    0.69075
```

```
## prop_cases          3.9249  1    0.04758 *
## olderprop          20.9800  1  4.641e-06 ***
## TrmpProp            3.1829  1    0.07441 .
## ClintProp           5.1783  1    0.02287 *
## ClintVote.y         5.2372  1    0.02211 *
## fully_vaccinated.y  6.5062  1    0.01075 *
## RARELY:TrmpProp     4.1862  1    0.04075 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(modbm23, test = 'Chi')

# drop pop2021.y
modbm24 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + RARELY + prop_cases + olderprop +
    TrmpProp + ClintProp + ClintVote.y + fully_vaccinated.y + RARELY:TrmpProp, family = binomial,
    data = big_data3)
summary(modbm24)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + RARELY + prop_cases +
##     olderprop + TrmpProp + ClintProp + ClintVote.y + fully_vaccinated.y +
##     RARELY:TrmpProp
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    823.1    850.8   -400.5    801.1       81
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.73125 -0.41982  0.04796  0.28691  1.59949
##
## Random effects:
##  Groups                   Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 3.615e-02 1.901e-01
##  2013 code               (Intercept) 1.230e-10 1.109e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                    Estimate Std. Error z value Pr(>|z|)
## (Intercept)        -18.8195     3.7833  -4.974 6.55e-07 ***
## RARELY              10.9503     5.8232   1.880  0.06004 .
## prop_cases           3.1272     1.6700   1.873  0.06113 .
## olderprop            6.7101     1.4618   4.590 4.42e-06 ***
## TrmpProp            10.5692     3.9835   2.653  0.00797 **
## ClintProp            9.9924     4.0370   2.475  0.01332 *
## ClintVote.y         -0.3548     0.1893  -1.875  0.06083 .
## fully_vaccinated.y   0.4450     0.1836   2.423  0.01540 *
## RARELY:TrmpProp    -15.5283     8.4722  -1.833  0.06682 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Correlation of Fixed Effects:
##             (Intr) RARELY prp_cs oldrpr TrmpPr ClntPr ClntV. flly_.
## RARELY      -0.255
## prop_cases   0.034 -0.015
## olderprop    0.135 -0.062 -0.238
## TrmpProp    -0.987  0.293 -0.020 -0.259
## ClintProp   -0.973  0.169 -0.017 -0.257  0.978
## ClintVote.y  0.143 -0.113  0.125 -0.115 -0.086 -0.210
## flly_vccnt. -0.176  0.106 -0.206  0.256  0.091  0.195 -0.969
## RARELY:TrmP  0.224 -0.994 -0.002  0.050 -0.266 -0.137  0.099 -0.089
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm24)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                      Chisq Df Pr(>Chisq)
## RARELY              0.2831  1    0.59470
## prop_cases          3.5064  1    0.06113 .
## olderprop          21.0724  1  4.423e-06 ***
## TrmpProp            5.0498  1    0.02463 *
## ClintProp           6.1266  1    0.01332 *
## ClintVote.y         3.5145  1    0.06083 .
## fully_vaccinated.y  5.8706  1    0.01540 *
## RARELY:TrmpProp     3.3593  1    0.06682 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(modbm24, test = 'Chi')

# drop Rarely:TrmpProp
modbm25 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + RARELY + prop_cases + olderprop +
    TrmpProp + ClintProp + ClintVote.y + fully_vaccinated.y, family = binomial, data = big_data3)
summary(modbm25)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + RARELY + prop_cases +
##     olderprop + TrmpProp + ClintProp + ClintVote.y + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    824.4    849.6   -402.2    804.4       82
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.74631 -0.36598  0.04154  0.30026  1.41749
```

```
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  '2013 code':LOCATION_ID (Intercept) 0.03826  0.1956
##  2013 code               (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  '2013 code':LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                    Estimate Std. Error z value Pr(>|z|)
## (Intercept)        -17.2417     3.7692  -4.574 4.78e-06 ***
## RARELY               0.3477     0.6573   0.529   0.5969
## prop_cases           3.1332     1.7055   1.837   0.0662 .
## olderprop            6.8468     1.4903   4.594 4.34e-06 ***
## TrmpProp             8.5973     3.9269   2.189   0.0286 *
## ClintProp            8.9406     4.0885   2.187   0.0288 *
## ClintVote.y         -0.3199     0.1920  -1.666   0.0958 .
## fully_vaccinated.y   0.4150     0.1864   2.226   0.0260 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) RARELY prp_cs oldrpr TrmpPr ClntPr ClntV.
## RARELY      -0.300
## prop_cases   0.034 -0.151
## olderprop    0.128 -0.111 -0.238
## TrmpProp    -0.987  0.277 -0.020 -0.256
## ClintProp   -0.976  0.296 -0.016 -0.254  0.986
## ClintVote.y  0.123 -0.138  0.126 -0.119 -0.061 -0.197
## flly_vccnt. -0.159  0.161 -0.209  0.260  0.068  0.183 -0.968
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm25)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                      Chisq Df Pr(>Chisq)
## RARELY              0.2798  1    0.59686
## prop_cases          3.3747  1    0.06620 .
## olderprop          21.1086  1   4.34e-06 ***
## TrmpProp            4.7932  1    0.02857 *
## ClintProp           4.7820  1    0.02876 *
## ClintVote.y         2.7743  1    0.09579 .
## fully_vaccinated.y  4.9572  1    0.02598 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(modbm25, test = 'Chi')

# drop RARELY
modbm26 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + prop_cases + olderprop +
```

```
    TrmpProp + ClintProp + ClintVote.y + fully_vaccinated.y, family = binomial, data = big_data3)
summary(modbm26)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + prop_cases +
##     olderprop + TrmpProp + ClintProp + ClintVote.y + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    822.7    845.4   -402.3    804.7       83
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.73581 -0.34566  0.04559  0.29560  1.52700
##
## Random effects:
##  Groups                  Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 3.829e-02 1.957e-01
##  2013 code               (Intercept) 1.085e-09 3.295e-05
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                    Estimate Std. Error z value Pr(>|z|)
## (Intercept)        -16.6474     3.5958  -4.630 3.66e-06 ***
## prop_cases           3.2719     1.6865   1.940   0.0524 .
## olderprop            6.9304     1.4812   4.679 2.88e-06 ***
## TrmpProp             8.0271     3.7731   2.127   0.0334 *
## ClintProp            8.3029     3.9054   2.126   0.0335 *
## ClintVote.y         -0.3046     0.1903  -1.601   0.1094
## fully_vaccinated.y   0.3980     0.1840   2.163   0.0306 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) prp_cs oldrpr TrmpPr ClntPr ClntV.
## prop_cases  -0.012
## olderprop    0.100 -0.259
## TrmpProp    -0.987  0.023 -0.235
## ClintProp   -0.974  0.030 -0.233  0.984
## ClintVote.y  0.086  0.108 -0.137 -0.023 -0.165
## flly_vccnt. -0.117 -0.189  0.284  0.025  0.143 -0.968
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm26)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                      Chisq Df Pr(>Chisq)
```

```
## prop_cases          3.7637  1    0.05238 .
## olderprop          21.8920  1  2.884e-06 ***
## TrmpProp            4.5260  1    0.03338 *
## ClintProp           4.5198  1    0.03350 *
## ClintVote.y         2.5630  1    0.10939
## fully_vaccinated.y  4.6769  1    0.03057 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(modbm26, test = 'Chi')

# drop Clintvote.y
modbm27 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + prop_cases + olderprop +
    TrmpProp + ClintProp + fully_vaccinated.y, family = binomial, data = big_data3)
summary(modbm27)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + prop_cases +
##     olderprop + TrmpProp + ClintProp + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    823.2    843.4   -403.6    807.2       84
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.7308 -0.3360 -0.0218  0.3012  1.5934
##
## Random effects:
##  Groups                  Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.03997  0.1999
##  2013 code               (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                     Estimate Std. Error z value Pr(>|z|)
## (Intercept)        -16.17659    3.64017  -4.444 8.83e-06 ***
## prop_cases           3.57460    1.70294   2.099   0.0358 *
## olderprop            6.60888    1.49078   4.433 9.29e-06 ***
## TrmpProp             7.90246    3.83309   2.062   0.0392 *
## ClintProp            7.28684    3.91561   1.861   0.0627 .
## fully_vaccinated.y   0.11348    0.04693   2.418   0.0156 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) prp_cs oldrpr TrmpPr ClntPr
## prop_cases  -0.023
## olderprop    0.113 -0.247
## TrmpProp    -0.989  0.026 -0.241
```

```
## ClintProp   -0.977  0.050 -0.261  0.994
## flly_vccnt. -0.134 -0.338  0.608  0.007 -0.069
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm27)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                       Chisq Df Pr(>Chisq)
## prop_cases           4.4061  1    0.03581 *
## olderprop           19.6531  1  9.285e-06 ***
## TrmpProp             4.2504  1    0.03924 *
## ClintProp            3.4632  1    0.06275 .
## fully_vaccinated.y   5.8471  1    0.01560 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(modbm27, test = 'Chi')

# drop clintprop
modbm28 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + prop_cases + olderprop +
    TrmpProp + fully_vaccinated.y, family = binomial, data = big_data3)
summary(modbm28)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + prop_cases +
##     olderprop + TrmpProp + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    824.6    842.2   -405.3    810.6       85
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.6064 -0.3257  0.0160  0.2675  1.4754
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.04255  0.2063
##  2013 code               (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                     Estimate Std. Error z value Pr(>|z|)
## (Intercept)        -9.57260    0.79516 -12.039  < 2e-16 ***
## prop_cases          3.42767    1.74053   1.969   0.0489 *
## olderprop           7.33792    1.47199   4.985 6.19e-07 ***
```

```
## TrmpProp            0.81239    0.41414   1.962   0.0498 *
## fully_vaccinated.y  0.12039    0.04785   2.516   0.0119 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) prp_cs oldrpr TrmpPr
## prop_cases   0.123
## olderprop   -0.687 -0.242
## TrmpProp    -0.761 -0.220  0.182
## flly_vccnt. -0.942 -0.337  0.612  0.709
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm28)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                      Chisq Df Pr(>Chisq)
## prop_cases          3.8782  1    0.04892 *
## olderprop          24.8506  1  6.195e-07 ***
## TrmpProp            3.8479  1    0.04981 *
## fully_vaccinated.y  6.3296  1    0.01187 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(modbm28, test = 'Chi')

# drop prop_cases
modbm29 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + olderprop + TrmpProp + fully_vaccinated.y,
    family = binomial, data = big_data3)
summary(modbm29)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + olderprop +
##     TrmpProp + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    826.3    841.4   -407.1    814.3       86
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.66876 -0.28090  0.00115  0.31197  1.39352
##
## Random effects:
##  Groups                  Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.0443292 0.21054
```

```
##  2013 code               (Intercept) 0.0006621 0.02573
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                     Estimate Std. Error z value Pr(>|z|)
## (Intercept)        -9.76016    0.81243 -12.014  < 2e-16 ***
## olderprop           8.00927    1.45557   5.503 3.74e-08 ***
## TrmpProp            0.96390    0.42808   2.252 0.024341 *
## fully_vaccinated.y  0.15396    0.04653   3.309 0.000937 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) oldrpr TrmpPr
## olderprop   -0.680
## TrmpProp    -0.755  0.153
## flly_vccnt. -0.954  0.567  0.659
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## Model failed to converge with max|grad| = 0.00333785 (tol = 0.002, component 1)
```

```
Anova(modbm29)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                       Chisq Df Pr(>Chisq)
## olderprop          30.2775  1  3.744e-08 ***
## TrmpProp            5.0702  1  0.0243409 *
## fully_vaccinated.y 10.9474  1  0.0009374 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(modbm29, test = 'Chi')
add1(modbm29, scope = ~pop2021.x + pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY +
    ALWAYS + prop_cases + `Older (65 plus).x` + olderprop + TrmpProp + ClintProp +
    COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y + `Older (65 plus).y` +
    ClintVote.y + TrmpVote.y + TotalVote.y + ClintVote.x + TrmpVote.x + TotalVote.x +
    COVID_COUNT.x + COVID_TEST.x + all_doses_administered.x + fully_vaccinated.x +
    fully_vaccinated.y + RARELY * olderprop * TrmpProp, test = "Chisq")
```

```
## Single term additions
##
## Model:
## cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + olderprop +
##     TrmpProp + fully_vaccinated.y
##                            Df    AIC    LRT Pr(>Chi)
## <none>                        826.29
## pop2021.x                   1 828.28 0.0093  0.92300
## pop2021.y                   1 828.07 0.2115  0.64559
## NEVER                       1 827.91 0.3780  0.53867
## RARELY                      1 828.29 0.0000  0.99868
## SOMETIMES                   1 828.01 0.2706  0.60296
```

```
## FREQUENTLY                1 827.71 0.5795  0.44651
## ALWAYS                    1 826.99 1.2908  0.25590
## prop_cases                1 824.58 3.7098  0.05409 .
## `Older (65 plus).x`       1 828.25 0.0349  0.85190
## ClintProp                 1 825.36 2.9292  0.08699 .
## COVID_COUNT.y             1 827.50 0.7835  0.37606
## COVID_TEST.y              1 828.25 0.0369  0.84775
## all_doses_administered.y  1 823.96 4.3248  0.03756 *
## `Older (65 plus).y`       1 828.14 0.1499  0.69867
## ClintVote.y               1 826.32 1.9701  0.16043
## TrmpVote.y                1 825.55 2.7329  0.09830 .
## TotalVote.y               1 825.74 2.5470  0.11051
## ClintVote.x               1 828.23 0.0601  0.80628
## TrmpVote.x                1 827.96 0.3227  0.56997
## TotalVote.x               1 828.28 0.0055  0.94075
## COVID_COUNT.x             1 828.21 0.0723  0.78798
## COVID_TEST.x              1 828.28 0.0086  0.92624
## all_doses_administered.x  1 828.22 0.0678  0.79453
## fully_vaccinated.x        1 828.24 0.0412  0.83918
## olderprop:TrmpProp        1 826.78 1.5061  0.21974
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# add back in alldoses.y
modbm30 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + olderprop + TrmpProp + fully_vaccinated.y +
    all_doses_administered.y, family = binomial, data = big_data3)
summary(modbm30)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + olderprop +
##     TrmpProp + fully_vaccinated.y + all_doses_administered.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    824.0    841.6   -405.0    810.0       85
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.66529 -0.39453  0.01008  0.30800  1.34625
##
## Random effects:
##  Groups                  Name        Variance  Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.0407618 0.20190
##  2013 code               (Intercept) 0.0001939 0.01392
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                          Estimate Std. Error z value Pr(>|z|)
## (Intercept)               -8.2060     1.0652  -7.703 1.32e-14 ***
## olderprop                  7.6261     1.4190   5.374 7.68e-08 ***
```

```
## TrmpProp                   0.7668     0.4157   1.845   0.0651 .
## fully_vaccinated.y         1.8058     0.7779   2.321   0.0203 *
## all_doses_administered.y  -1.6581     0.7791  -2.128   0.0333 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) oldrpr TrmpPr flly_.
## olderprop   -0.581
## TrmpProp    -0.690  0.170
## flly_vccnt.  0.639 -0.093 -0.185
## all_dss_dm. -0.681  0.125  0.223 -0.998
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## Model failed to converge with max|grad| = 0.00762251 (tol = 0.002, component 1)
```

```
Anova(modbm30)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                            Chisq Df Pr(>Chisq)
## olderprop                28.8848  1  7.681e-08 ***
## TrmpProp                  3.4028  1    0.06509 .
## fully_vaccinated.y        5.3883  1    0.02027 *
## all_doses_administered.y  4.5291  1    0.03332 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(modbm30, test = 'Chi')

# remove trumpprop
modbm31 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + olderprop + fully_vaccinated.y +
    all_doses_administered.y, family = binomial, data = big_data3)
summary(modbm31)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + olderprop +
##     fully_vaccinated.y + all_doses_administered.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    825.3    840.4   -406.6    813.3       86
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.64129 -0.39117  0.01622  0.32780  1.22113
##
## Random effects:
##  Groups                  Name        Variance  Std.Dev.
```

```
##  `2013 code`:LOCATION_ID (Intercept) 0.0422981 0.20566
##  2013 code               (Intercept) 0.0008277 0.02877
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                           Estimate Std. Error z value Pr(>|z|)
## (Intercept)               -6.8885     0.7918  -8.699  < 2e-16 ***
## olderprop                  7.1954     1.4179   5.075 3.88e-07 ***
## fully_vaccinated.y         2.0370     0.7875   2.587  0.00969 **
## all_doses_administered.y  -1.9432     0.7827  -2.483  0.01304 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) oldrpr flly_.
## olderprop   -0.642
## flly_vccnt.  0.726 -0.061
## all_dss_dm. -0.753  0.089 -0.999
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## Model failed to converge with max|grad| = 0.0913666 (tol = 0.002, component 1)
```

```
Anova(modbm31)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                             Chisq Df Pr(>Chisq)
## olderprop                 25.7526  1  3.881e-07 ***
## fully_vaccinated.y         6.6914  1   0.009688 **
## all_doses_administered.y   6.1636  1   0.013040 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(modbm31, test = 'Chi')
add1(modbm31, scope = ~pop2021.x + pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY +
    ALWAYS + prop_cases + `Older (65 plus).x` + olderprop + TrmpProp + ClintProp +
    COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y + `Older (65 plus).y` +
    ClintVote.y + TrmpVote.y + TotalVote.y + ClintVote.x + TrmpVote.x + TotalVote.x +
    COVID_COUNT.x + COVID_TEST.x + all_doses_administered.x + fully_vaccinated.x +
    fully_vaccinated.y + RARELY * olderprop * TrmpProp, test = "Chisq")
```

```
## Single term additions
##
## Model:
## cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + olderprop +
##     fully_vaccinated.y + all_doses_administered.y
##                           Df    AIC    LRT Pr(>Chi)
## <none>                       825.30
## pop2021.x                  1 827.15 0.1514  0.69718
## pop2021.y                  1 827.20 0.1008  0.75088
## NEVER                      1 826.83 0.4677  0.49403
## RARELY                     1 827.21 0.0893  0.76508
```

```
## SOMETIMES                 1 827.26 0.0344  0.85293
## FREQUENTLY                1 826.63 0.6687  0.41349
## ALWAYS                    1 825.97 1.3250  0.24969
## prop_cases                1 821.81 5.4833  0.01920 *
## `Older (65 plus).x`       1 827.21 0.0909  0.76307
## TrmpProp                  1 823.96 3.3367  0.06775 .
## ClintProp                 1 824.38 2.9187  0.08756 .
## COVID_COUNT.y             1 823.48 3.8169  0.05074 .
## COVID_TEST.y              1 826.14 1.1541  0.28269
## `Older (65 plus).y`       1 827.14 0.1549  0.69387
## ClintVote.y               1 823.54 3.7591  0.05252 .
## TrmpVote.y                1 826.93 0.3670  0.54466
## TotalVote.y               1 826.85 0.4436  0.50541
## ClintVote.x               1 827.05 0.2445  0.62095
## TrmpVote.x                1 827.01 0.2825  0.59505
## TotalVote.x               1 827.00 0.2963  0.58624
## COVID_COUNT.x             1 827.27 0.0318  0.85839
## COVID_TEST.x              1 827.09 0.2037  0.65176
## all_doses_administered.x  1 826.67 0.6242  0.42950
## fully_vaccinated.x        1 826.68 0.6153  0.43280
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# add in prop.cases
modbm32 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`) + (1 | `2013 code`:LOCATION_ID) + olderprop + prop_cases +
    fully_vaccinated.y + all_doses_administered.y, family = binomial, data = big_data3)
summary(modbm32)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + olderprop +
##     prop_cases + fully_vaccinated.y + all_doses_administered.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    821.8    839.5   -403.9    807.8       85
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.57983 -0.35103  0.06943  0.23954  1.33917
##
## Random effects:
##  Groups                   Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.03951  0.1988
##  2013 code                (Intercept) 0.00000  0.0000
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92; 2013 code, 6
##
## Fixed effects:
##                           Estimate Std. Error z value Pr(>|z|)
## (Intercept)               -6.9273     0.7471  -9.272  < 2e-16 ***
## olderprop                  6.4875     1.4131   4.591 4.41e-06 ***
```

```
## prop_cases                 3.9874     1.6526   2.413  0.01583 *
## fully_vaccinated.y         2.0123     0.7477   2.691  0.00712 **
## all_doses_administered.y  -1.9440     0.7412  -2.623  0.00872 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) oldrpr prp_cs flly_.
## olderprop   -0.640
## prop_cases  -0.079 -0.207
## flly_vccnt.  0.714 -0.057 -0.054
## all_dss_dm. -0.741  0.088  0.043 -0.999
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
Anova(modbm32)
```

```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                            Chisq Df Pr(>Chisq)
## olderprop                21.0766  1  4.413e-06 ***
## prop_cases                5.8216  1   0.015830 *
## fully_vaccinated.y        7.2429  1   0.007118 **
## all_doses_administered.y  6.8787  1   0.008723 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# drop1(modbm32, test = 'Chi')
add1(modbm32, scope = ~pop2021.x + pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY +
    ALWAYS + prop_cases + `Older (65 plus).x` + olderprop + TrmpProp + ClintProp +
    COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y + `Older (65 plus).y` +
    ClintVote.y + TrmpVote.y + TotalVote.y + ClintVote.x + TrmpVote.x + TotalVote.x +
    COVID_COUNT.x + COVID_TEST.x + all_doses_administered.x + fully_vaccinated.x +
    fully_vaccinated.y + RARELY * olderprop * TrmpProp, test = "Chisq")
```

```
## Single term additions
##
## Model:
## cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`) + (1 | `2013 code`:LOCATION_ID) + olderprop +
##     prop_cases + fully_vaccinated.y + all_doses_administered.y
##                           Df    AIC      LRT Pr(>Chi)
## <none>                       821.81
## pop2021.x                  1 823.81 -0.00066   1.0000
## pop2021.y                  1 823.26  0.55315   0.4570
## NEVER                      1 822.84  0.97017   0.3246
## RARELY                     1 823.81  0.00082   0.9771
## SOMETIMES                  1 823.74  0.07134   0.7894
## FREQUENTLY                 1 823.26  0.55717   0.4554
## ALWAYS                     1 823.04  0.77075   0.3800
## `Older (65 plus).x`        1 823.81  0.00474   0.9451
## TrmpProp                   1 821.80  2.01492   0.1558
```

```
## ClintProp                 1 822.15  1.66717   0.1966
## COVID_COUNT.y             1 823.38  0.43747   0.5083
## COVID_TEST.y              1 823.75  0.06638   0.7967
## `Older (65 plus).y`       1 823.25  0.56559   0.4520
## ClintVote.y               1 821.66  2.15040   0.1425
## TrmpVote.y                1 823.49  0.32540   0.5684
## TotalVote.y               1 823.72  0.09839   0.7538
## ClintVote.x               1 823.81  0.00677   0.9344
## TrmpVote.x                1 823.77  0.03938   0.8427
## TotalVote.x               1 823.79  0.01918   0.8899
## COVID_COUNT.x             1 823.81  0.00039   0.9843
## COVID_TEST.x              1 823.79  0.02596   0.8720
## all_doses_administered.x  1 823.66  0.15570   0.6931
## fully_vaccinated.x        1 823.66  0.15600   0.6929
```

```
# drop '2013 code' as RE
modbm33 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | `2013 code`:LOCATION_ID) + olderprop + prop_cases + fully_vaccinated.y +
    all_doses_administered.y, family = binomial, data = big_data3)
summary(modbm33)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`:LOCATION_ID) + olderprop + prop_cases + fully_vaccinated.y +
##     all_doses_administered.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    819.8    834.9   -403.9    807.8       86
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.57992 -0.35102  0.06946  0.23945  1.33928
##
## Random effects:
##  Groups                  Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.03951  0.1988
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92
##
## Fixed effects:
##                           Estimate Std. Error z value Pr(>|z|)
## (Intercept)               -6.9281     0.7471  -9.274  < 2e-16 ***
## olderprop                  6.4868     1.4130   4.591 4.42e-06 ***
## prop_cases                 3.9873     1.6524   2.413  0.01582 *
## fully_vaccinated.y         2.0107     0.7477   2.689  0.00716 **
## all_doses_administered.y  -1.9425     0.7412  -2.621  0.00878 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) oldrpr prp_cs flly_.
## olderprop   -0.640
```

```
## prop_cases  -0.079 -0.207
## flly_vccnt.  0.714 -0.057 -0.054
## all_dss_dm. -0.741  0.088  0.043 -0.999
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## Model failed to converge with max|grad| = 0.00394599 (tol = 0.002, component 1)
## Model is nearly unidentifiable: large eigenvalue ratio
##  - Rescale variables?
```

```
add1(modbm33, scope = ~pop2021.x + pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY +
    ALWAYS + prop_cases + `Older (65 plus).x` + olderprop + TrmpProp + ClintProp +
    COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y + `Older (65 plus).y` +
    ClintVote.y + TrmpVote.y + TotalVote.y + ClintVote.x + TrmpVote.x + TotalVote.x +
    COVID_COUNT.x + COVID_TEST.x + all_doses_administered.x + fully_vaccinated.x +
    fully_vaccinated.y + RARELY * olderprop * TrmpProp, test = "Chisq")
```

```
## Single term additions
##
## Model:
## cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`:LOCATION_ID) + olderprop + prop_cases + fully_vaccinated.y +
##     all_doses_administered.y
##                           Df    AIC     LRT Pr(>Chi)
## <none>                       819.81
## pop2021.x                  1 821.81 0.00020   0.9887
## pop2021.y                  1 821.26 0.55329   0.4570
## NEVER                      1 820.84 0.97026   0.3246
## RARELY                     1 821.81 0.00099   0.9748
## SOMETIMES                  1 821.74 0.07134   0.7894
## FREQUENTLY                 1 821.26 0.55711   0.4554
## ALWAYS                     1 821.04 0.77066   0.3800
## `Older (65 plus).x`        1 821.81 0.00479   0.9448
## TrmpProp                   1 819.80 2.01497   0.1558
## ClintProp                  1 820.15 1.66714   0.1966
## COVID_COUNT.y              1 821.38 0.43750   0.5083
## COVID_TEST.y               1 821.75 0.06668   0.7962
## `Older (65 plus).y`        1 821.25 0.56561   0.4520
## ClintVote.y                1 819.66 2.15042   0.1425
## TrmpVote.y                 1 821.49 0.32499   0.5686
## TotalVote.y                1 821.72 0.09821   0.7540
## ClintVote.x                1 821.81 0.00689   0.9338
## TrmpVote.x                 1 821.77 0.03939   0.8427
## TotalVote.x                1 821.79 0.01988   0.8879
## COVID_COUNT.x              1 821.81 0.00043   0.9835
## COVID_TEST.x               1 821.79 0.02594   0.8721
## all_doses_administered.x   1 821.66 0.15557   0.6933
## fully_vaccinated.x         1 821.66 0.15599   0.6929
```

```
### Modbm33 is final Binomial Mixed Model.  AIC = 819.8

## Un-nest LOCATION_ID
modbm34 <- glmer(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 +
    (1 | LOCATION_ID) + olderprop + prop_cases + fully_vaccinated.y + all_doses_administered.y,
    family = binomial, data = big_data3)
summary(modbm34)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     LOCATION_ID) + olderprop + prop_cases + fully_vaccinated.y +
##     all_doses_administered.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    819.8    834.9   -403.9    807.8       86
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.57992 -0.35102  0.06946  0.23945  1.33928
##
## Random effects:
##  Groups      Name        Variance Std.Dev.
##  LOCATION_ID (Intercept) 0.03951  0.1988
## Number of obs: 92, groups:  LOCATION_ID, 92
##
## Fixed effects:
##                           Estimate Std. Error z value Pr(>|z|)
## (Intercept)               -6.9281     0.7471  -9.274  < 2e-16 ***
## olderprop                  6.4868     1.4131   4.591 4.42e-06 ***
## prop_cases                 3.9873     1.6525   2.413  0.01583 *
## fully_vaccinated.y         2.0107     0.7477   2.689  0.00716 **
## all_doses_administered.y  -1.9425     0.7412  -2.621  0.00878 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) oldrpr prp_cs flly_.
## olderprop   -0.640
## prop_cases  -0.079 -0.207
## flly_vccnt.  0.714 -0.057 -0.054
## all_dss_dm. -0.741  0.088  0.043 -0.999
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## Model failed to converge with max|grad| = 0.0039481 (tol = 0.002, component 1)
## Model is nearly unidentifiable: large eigenvalue ratio
##  - Rescale variables?
```

```
add1(modbm34, scope = ~pop2021.x + pop2021.y + NEVER + RARELY + SOMETIMES + FREQUENTLY +
    ALWAYS + prop_cases + `Older (65 plus).x` + olderprop + TrmpProp + ClintProp +
    COVID_COUNT.y + COVID_TEST.y + all_doses_administered.y + `Older (65 plus).y` +
    ClintVote.y + TrmpVote.y + TotalVote.y + ClintVote.x + TrmpVote.x + TotalVote.x +
    COVID_COUNT.x + COVID_TEST.x + all_doses_administered.x + fully_vaccinated.x +
    fully_vaccinated.y + RARELY * olderprop * TrmpProp, test = "Chisq")
```

```
## Single term additions
##
## Model:
```

```
## cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     LOCATION_ID) + olderprop + prop_cases + fully_vaccinated.y +
##     all_doses_administered.y
##                           Df    AIC     LRT Pr(>Chi)
## <none>                       819.81
## pop2021.x                  1 821.81 0.00020   0.9887
## pop2021.y                  1 821.26 0.55329   0.4570
## NEVER                      1 820.84 0.97026   0.3246
## RARELY                     1 821.81 0.00099   0.9748
## SOMETIMES                  1 821.74 0.07134   0.7894
## FREQUENTLY                 1 821.26 0.55711   0.4554
## ALWAYS                     1 821.04 0.77066   0.3800
## `Older (65 plus).x`        1 821.81 0.00479   0.9448
## TrmpProp                   1 819.80 2.01497   0.1558
## ClintProp                  1 820.15 1.66718   0.1966
## COVID_COUNT.y              1 821.38 0.43750   0.5083
## COVID_TEST.y               1 821.75 0.06671   0.7962
## `Older (65 plus).y`        1 821.25 0.56561   0.4520
## ClintVote.y                1 819.66 2.15042   0.1425
## TrmpVote.y                 1 821.49 0.32529   0.5684
## TotalVote.y                1 821.72 0.09821   0.7540
## ClintVote.x                1 821.81 0.00689   0.9338
## TrmpVote.x                 1 821.77 0.03939   0.8427
## TotalVote.x                1 821.79 0.01988   0.8879
## COVID_COUNT.x              1 821.81 0.00043   0.9835
## COVID_TEST.x               1 821.79 0.02594   0.8721
## all_doses_administered.x   1 821.66 0.15551   0.6933
## fully_vaccinated.x         1 821.66 0.15599   0.6929
```

Summaries of Best Models

Binomial Fixed-Effects Model

```
summary(mod1.1.3)
```

```
##
## Call:
## glm(formula = cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~
##     RARELY + SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
##         olderprop + TrmpProp + `2013 code` + COVID_COUNT.y +
##         all_doses_administered.y + ClintVote.y + TrmpVote.y +
##         TotalVote.y + olderprop:TrmpProp + olderprop:`2013 code` +
##         TrmpProp:`2013 code` + RARELY:olderprop + RARELY:TrmpProp +
##         RARELY:`2013 code` + olderprop:TrmpProp:`2013 code` +
##         RARELY:olderprop:TrmpProp + RARELY:olderprop:`2013 code` +
##         RARELY:TrmpProp:`2013 code` + RARELY:olderprop:TrmpProp:`2013 code`,
##     family = binomial, data = big_data3)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -4.1183  -0.7292   0.0000   0.5470   3.5508
##
## Coefficients: (8 not defined because of singularities)
##                                       Estimate Std. Error z value Pr(>|z|)
## (Intercept)                         -2.722e+01  6.341e+01  -0.429 0.667726
## RARELY                               9.567e+02  6.532e+02   1.465 0.143020
## SOMETIMES                           -1.067e+00  4.695e-01  -2.273 0.023027
## FREQUENTLY                          -1.663e+00  4.890e-01  -3.402 0.000670
## ALWAYS                              -1.452e+00  4.288e-01  -3.386 0.000709
## prop_cases                           1.346e+01  2.682e+00   5.020 5.17e-07
## `Older (65 plus).x`                  3.338e-05  6.797e-06   4.911 9.05e-07
## olderprop                            1.174e+02  3.573e+02   0.328 0.742540
## TrmpProp                             5.028e+01  9.711e+01   0.518 0.604658
## `2013 code`2                        -1.645e+01  6.405e+01  -0.257 0.797237
## `2013 code`3                         2.771e+01  4.685e+01   0.591 0.554186
## `2013 code`4                         5.765e+01  6.515e+01   0.885 0.376267
## `2013 code`5                        -1.281e+02  6.863e+01  -1.866 0.062040
## `2013 code`6                         4.277e+00  6.936e+00   0.617 0.537411
## COVID_COUNT.y                       -9.510e-01  2.780e-01  -3.421 0.000623
## all_doses_administered.y             5.269e-01  1.637e-01   3.219 0.001287
## ClintVote.y                          1.698e+00  7.734e-01   2.196 0.028086
## TrmpVote.y                           1.105e+01  3.294e+00   3.354 0.000798
## TotalVote.y                         -1.251e+01  2.855e+00  -4.383 1.17e-05
## olderprop:TrmpProp                  -2.544e+02  4.941e+02  -0.515 0.606664
## olderprop:`2013 code`2               1.869e+02  3.576e+02   0.523 0.601269
## olderprop:`2013 code`3              -6.148e+01  2.607e+02  -0.236 0.813570
## olderprop:`2013 code`4              -2.375e+02  3.635e+02  -0.653 0.513440
## olderprop:`2013 code`5               7.692e+02  3.839e+02   2.004 0.045103
## olderprop:`2013 code`6                      NA         NA      NA       NA
## TrmpProp:`2013 code`2                1.524e+01  9.791e+01   0.156 0.876290
## TrmpProp:`2013 code`3               -4.478e+01  7.309e+01  -0.613 0.540067
```

```
## TrmpProp:`2013 code`4                  -9.959e+01  9.957e+01  -1.000 0.317192
## TrmpProp:`2013 code`5                   1.637e+02  1.035e+02   1.581 0.113782
## TrmpProp:`2013 code`6                          NA         NA      NA       NA
## RARELY:olderprop                       -4.594e+03  3.278e+03  -1.401 0.161079
## RARELY:TrmpProp                        -1.521e+03  9.165e+02  -1.659 0.097058
## RARELY:`2013 code`2                    -4.335e+02  6.581e+02  -0.659 0.510114
## RARELY:`2013 code`3                    -2.421e+02  1.718e+02  -1.409 0.158927
## RARELY:`2013 code`4                    -1.215e+03  6.661e+02  -1.824 0.068207
## RARELY:`2013 code`5                     6.779e+02  7.222e+02   0.939 0.347925
## RARELY:`2013 code`6                            NA         NA      NA       NA
## olderprop:TrmpProp:`2013 code`2        -2.018e+02  4.952e+02  -0.407 0.683643
## olderprop:TrmpProp:`2013 code`3         1.458e+02  3.388e+02   0.430 0.666923
## olderprop:TrmpProp:`2013 code`4         4.616e+02  5.034e+02   0.917 0.359118
## olderprop:TrmpProp:`2013 code`5        -9.678e+02  5.306e+02  -1.824 0.068187
## olderprop:TrmpProp:`2013 code`6                NA         NA      NA       NA
## RARELY:olderprop:TrmpProp               7.320e+03  4.599e+03   1.592 0.111438
## RARELY:olderprop:`2013 code`2           1.513e+03  3.327e+03   0.455 0.649212
## RARELY:olderprop:`2013 code`3          -3.179e+02  1.262e+03  -0.252 0.801221
## RARELY:olderprop:`2013 code`4           6.007e+03  3.360e+03   1.788 0.073810
## RARELY:olderprop:`2013 code`5          -4.351e+03  3.711e+03  -1.172 0.241098
## RARELY:olderprop:`2013 code`6                  NA         NA      NA       NA
## RARELY:TrmpProp:`2013 code`2            7.398e+02  9.255e+02   0.799 0.424082
## RARELY:TrmpProp:`2013 code`3            4.242e+02  2.898e+02   1.464 0.143212
## RARELY:TrmpProp:`2013 code`4            1.926e+03  9.349e+02   2.060 0.039427
## RARELY:TrmpProp:`2013 code`5           -7.403e+02  1.010e+03  -0.733 0.463588
## RARELY:TrmpProp:`2013 code`6                   NA         NA      NA       NA
## RARELY:olderprop:TrmpProp:`2013 code`2 -2.703e+03  4.683e+03  -0.577 0.563845
## RARELY:olderprop:TrmpProp:`2013 code`3         NA         NA      NA       NA
## RARELY:olderprop:TrmpProp:`2013 code`4 -9.590e+03  4.712e+03  -2.035 0.041827
## RARELY:olderprop:TrmpProp:`2013 code`5  5.045e+03  5.190e+03   0.972 0.331073
## RARELY:olderprop:TrmpProp:`2013 code`6         NA         NA      NA       NA
##
## (Intercept)
## RARELY
## SOMETIMES                              *
## FREQUENTLY                             ***
## ALWAYS                                 ***
## prop_cases                             ***
## `Older (65 plus).x`                    ***
## olderprop
## TrmpProp
## `2013 code`2
## `2013 code`3
## `2013 code`4
## `2013 code`5                           .
## `2013 code`6
## COVID_COUNT.y                          ***
## all_doses_administered.y               **
## ClintVote.y                            *
## TrmpVote.y                             ***
## TotalVote.y                            ***
## olderprop:TrmpProp
## olderprop:`2013 code`2
## olderprop:`2013 code`3
```

```
## olderprop:‘2013 code‘4
## olderprop:‘2013 code‘5                *
## olderprop:‘2013 code‘6
## TrmpProp:‘2013 code‘2
## TrmpProp:‘2013 code‘3
## TrmpProp:‘2013 code‘4
## TrmpProp:‘2013 code‘5
## TrmpProp:‘2013 code‘6
## RARELY:olderprop
## RARELY:TrmpProp                       .
## RARELY:‘2013 code‘2
## RARELY:‘2013 code‘3
## RARELY:‘2013 code‘4                   .
## RARELY:‘2013 code‘5
## RARELY:‘2013 code‘6
## olderprop:TrmpProp:‘2013 code‘2
## olderprop:TrmpProp:‘2013 code‘3
## olderprop:TrmpProp:‘2013 code‘4
## olderprop:TrmpProp:‘2013 code‘5       .
## olderprop:TrmpProp:‘2013 code‘6
## RARELY:olderprop:TrmpProp
## RARELY:olderprop:‘2013 code‘2
## RARELY:olderprop:‘2013 code‘3
## RARELY:olderprop:‘2013 code‘4         .
## RARELY:olderprop:‘2013 code‘5
## RARELY:olderprop:‘2013 code‘6
## RARELY:TrmpProp:‘2013 code‘2
## RARELY:TrmpProp:‘2013 code‘3
## RARELY:TrmpProp:‘2013 code‘4          *
## RARELY:TrmpProp:‘2013 code‘5
## RARELY:TrmpProp:‘2013 code‘6
## RARELY:olderprop:TrmpProp:‘2013 code‘2
## RARELY:olderprop:TrmpProp:‘2013 code‘3
## RARELY:olderprop:TrmpProp:‘2013 code‘4 *
## RARELY:olderprop:TrmpProp:‘2013 code‘5
## RARELY:olderprop:TrmpProp:‘2013 code‘6
## ---
## Signif. codes:  0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1
##
## (Dispersion parameter for binomial family taken to be 1)
##
##     Null deviance: 795.33  on 91  degrees of freedom
## Residual deviance: 137.26  on 42  degrees of freedom
## AIC: 807.03
##
## Number of Fisher Scoring iterations: 4
```

```
Anova(mod1.1.3)
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                                      LR Chisq Df Pr(>Chisq)
## RARELY                                  0.349  1  0.5549325
```

```
## SOMETIMES                                  5.153  1  0.0231996 *
## FREQUENTLY                                11.663  1  0.0006375 ***
## ALWAYS                                    11.492  1  0.0006989 ***
## prop_cases                                24.911  1  6.005e-07 ***
## `Older (65 plus).x`                       23.843  1  1.045e-06 ***
## olderprop                                 63.645  1  1.490e-15 ***
## TrmpProp                                   8.814  1  0.0029894 **
## `2013 code`                               27.314  5  4.955e-05 ***
## COVID_COUNT.y                             11.622  1  0.0006518 ***
## all_doses_administered.y                  10.218  1  0.0013907 **
## ClintVote.y                                4.813  1  0.0282540 *
## TrmpVote.y                                11.243  1  0.0007994 ***
## TotalVote.y                               19.175  1  1.193e-05 ***
## olderprop:TrmpProp                        18.482  1  1.715e-05 ***
## olderprop:`2013 code`                     27.927  4  1.290e-05 ***
## TrmpProp:`2013 code`                      16.350  4  0.0025838 **
## RARELY:olderprop                           1.995  1  0.1577976
## RARELY:TrmpProp                            7.734  1  0.0054196 **
## RARELY:`2013 code`                        57.144  4  1.154e-11 ***
## olderprop:TrmpProp:`2013 code`            62.183  4  1.008e-12 ***
## RARELY:olderprop:TrmpProp                  0.073  1  0.7872664
## RARELY:olderprop:`2013 code`              26.554  4  2.447e-05 ***
## RARELY:TrmpProp:`2013 code`                9.777  4  0.0443489 *
## RARELY:olderprop:TrmpProp:`2013 code`     37.222  3  4.129e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

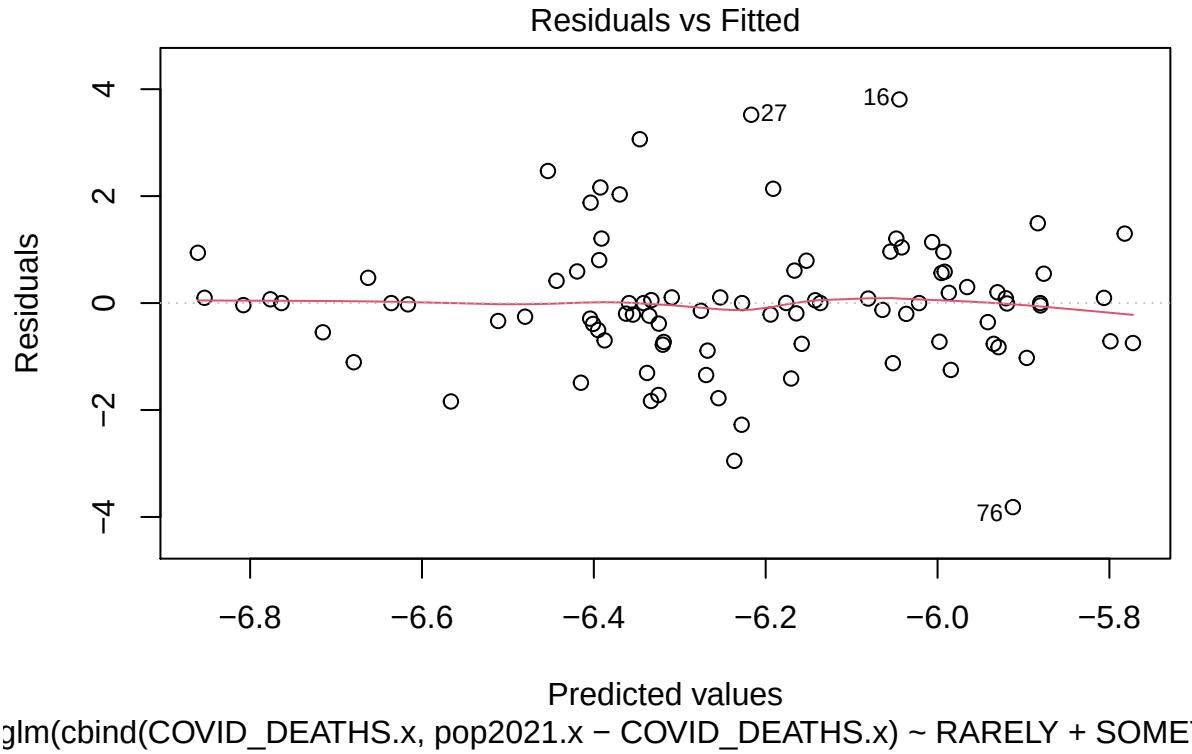
```
drop1(mod1.1.3, test = "Chi")
```

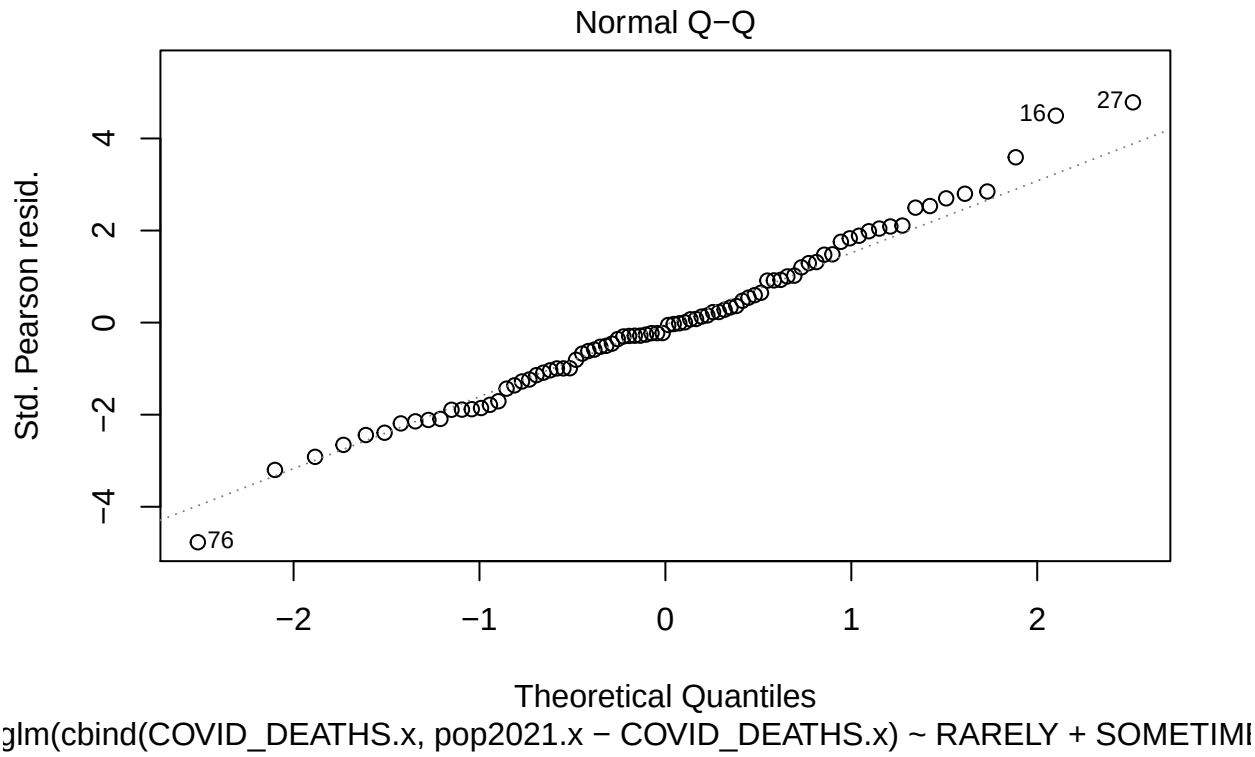
```
## Single term deletions
##
## Model:
## cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ RARELY +
##     SOMETIMES + FREQUENTLY + ALWAYS + prop_cases + `Older (65 plus).x` +
##     olderprop + TrmpProp + `2013 code` + COVID_COUNT.y + all_doses_administered.y +
##     ClintVote.y + TrmpVote.y + TotalVote.y + olderprop:TrmpProp +
##     olderprop:`2013 code` + TrmpProp:`2013 code` + RARELY:olderprop +
##     RARELY:TrmpProp + RARELY:`2013 code` + olderprop:TrmpProp:`2013 code` +
##     RARELY:olderprop:TrmpProp + RARELY:olderprop:`2013 code` +
##     RARELY:TrmpProp:`2013 code` + RARELY:olderprop:TrmpProp:`2013 code`
##                                       Df Deviance    AIC    LRT  Pr(>Chi)
## <none>                                     137.26 807.03
## SOMETIMES                              1   142.42 810.19  5.153 0.0231996 *
## FREQUENTLY                             1   148.93 816.70 11.663 0.0006375 ***
## ALWAYS                                 1   148.76 816.53 11.492 0.0006989 ***
## prop_cases                             1   162.18 829.94 24.911 6.005e-07 ***
## `Older (65 plus).x`                    1   161.11 828.88 23.843 1.045e-06 ***
## COVID_COUNT.y                          1   148.89 816.66 11.622 0.0006518 ***
## all_doses_administered.y               1   147.48 815.25 10.218 0.0013907 **
## ClintVote.y                            1   142.08 809.85  4.813 0.0282540 *
## TrmpVote.y                             1   148.51 816.28 11.243 0.0007994 ***
## TotalVote.y                            1   156.44 824.21 19.175 1.193e-05 ***
## RARELY:olderprop:TrmpProp:`2013 code`  3   174.49 838.26 37.222 4.129e-08 ***
## ---
```

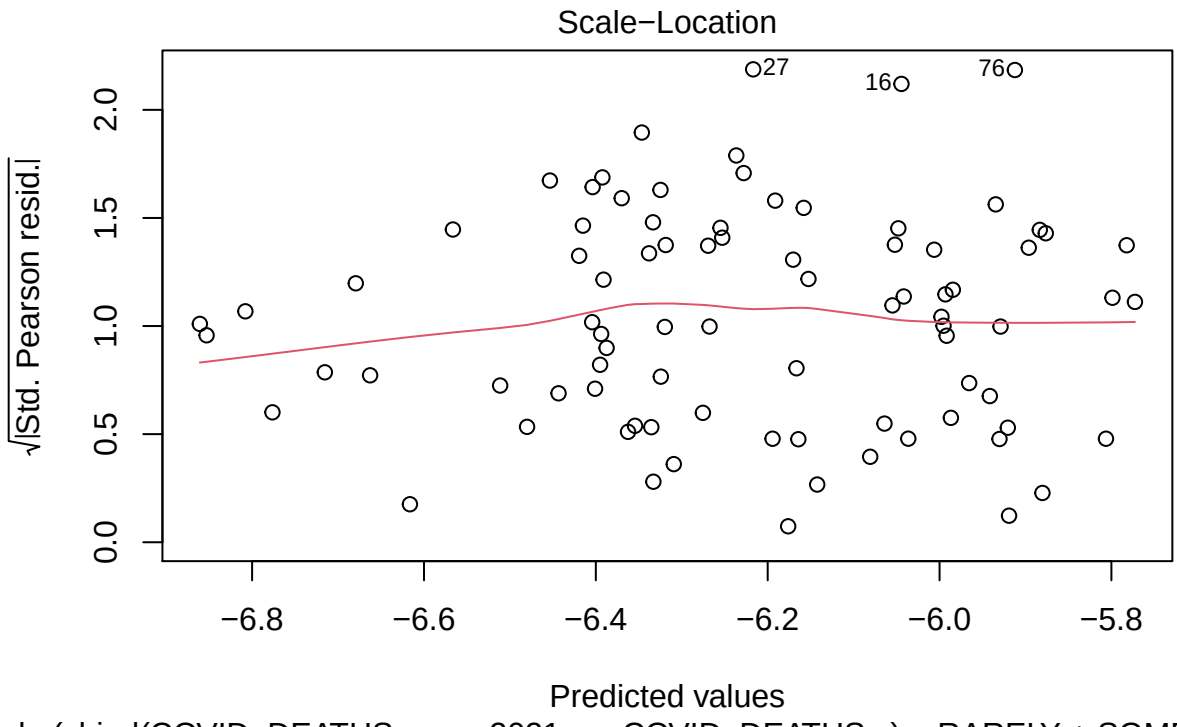
```
## Signif. codes:  0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1
```

```
plot(mod1.1.3)
```

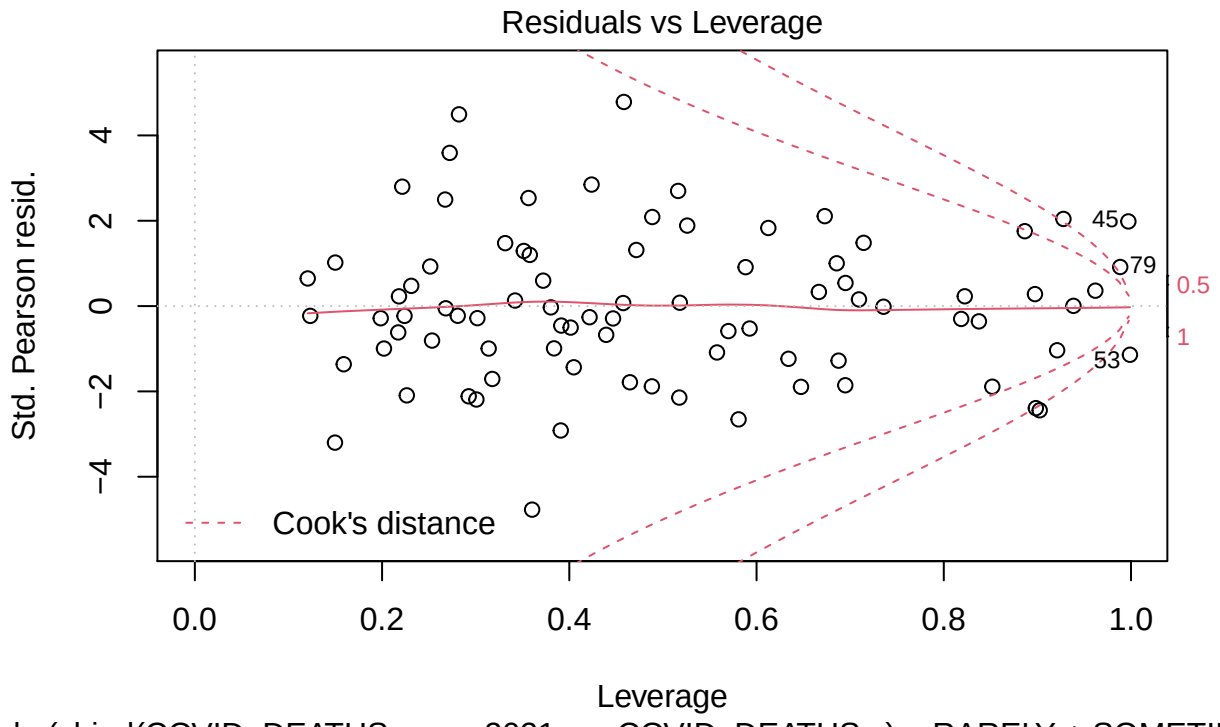
```
## Warning: not plotting observations with leverage one:
##   2, 49, 65, 71, 82, 87, 90, 92
```




Normal Q−Q
Std. Pearson resid.
Theoretical Quantiles
glm(cbind(COVID_DEATHS.x, pop2021.x − COVID_DEATHS.x) ~ RARELY + SOMETIMI
76
16
27
−4
−2
0
2
4
−2
−1
0
1
2




```
## Warning in sqrt(crit * p * (1 - hh)/hh): NaNs produced

## Warning in sqrt(crit * p * (1 - hh)/hh): NaNs produced
```



glm(cbind(COVID_DEATHS.x, pop2021.x − COVID_DEATHS.x) ~ RARELY + SOMETIMI

Poisson Fixed-Effects Model

```
summary(mod5.10)
```

```
##
## Call:
## glm(formula = COVID_DEATHS.x ~ pop2021.x + prop_cases + COVID_COUNT.x +
##     SOMETIMES + COVID_COUNT.y + COVID_TEST.y + fully_vaccinated.y +
##     `Older (65 plus).y` + TrmpVote.x + TrmpVote.y + ClintVote.y +
##     TotalVote.y + FREQUENTLY + ALWAYS + `2013 code` + olderprop *
##     TrmpProp * RARELY * `2013 code`, family = poisson, data = big_data3)
##
## Deviance Residuals:
##     Min       1Q   Median       3Q      Max
## -4.0077  -0.6866   0.0000   0.4394   3.2130
##
## Coefficients: (8 not defined because of singularities)
##                                      Estimate Std. Error z value Pr(>|z|)
## (Intercept)                        -2.015e+01  6.469e+01  -0.312 0.755384
## pop2021.x                           2.803e-05  6.523e-06   4.298 1.72e-05
## prop_cases                          4.987e+01  1.312e+01   3.802 0.000144
## COVID_COUNT.x                      -1.017e-04  3.798e-05  -2.677 0.007434
## SOMETIMES                          -1.345e+00  4.820e-01  -2.791 0.005256
```

```
## COVID_COUNT.y                                -4.855e+00  1.442e+00  -3.367 0.000761
## COVID_TEST.y                                  5.109e-01  2.285e-01   2.236 0.025351
## fully_vaccinated.y                            5.366e-01  1.689e-01   3.178 0.001484
## `Older (65 plus).y`                           3.938e+00  1.323e+00   2.976 0.002923
## TrmpVote.x                                   -5.639e-05  1.629e-05  -3.462 0.000537
## TrmpVote.y                                    1.869e+01  4.411e+00   4.238 2.26e-05
## ClintVote.y                                   2.542e+00  9.054e-01   2.808 0.004987
## TotalVote.y                                  -2.029e+01  3.912e+00  -5.186 2.14e-07
## FREQUENTLY                                   -1.480e+00  4.915e-01  -3.011 0.002604
## ALWAYS                                       -9.270e-01  4.586e-01  -2.021 0.043252
## `2013 code`2                                 -3.727e+01  6.540e+01  -0.570 0.568750
## `2013 code`3                                  2.978e+01  4.834e+01   0.616 0.537944
## `2013 code`4                                  5.274e+01  6.679e+01   0.790 0.429741
## `2013 code`5                                 -1.178e+02  7.011e+01  -1.681 0.092849
## `2013 code`6                                  1.224e+01  7.180e+00   1.705 0.088279
## olderprop                                     6.257e+01  3.645e+02   0.172 0.863687
## TrmpProp                                      3.241e+01  9.900e+01   0.327 0.743387
## RARELY                                        1.019e+03  6.713e+02   1.518 0.128973
## olderprop:TrmpProp                           -2.211e+02  5.037e+02  -0.439 0.660674
## olderprop:RARELY                             -5.047e+03  3.368e+03  -1.499 0.133934
## TrmpProp:RARELY                              -1.636e+03  9.417e+02  -1.737 0.082369
## `2013 code`2:olderprop                        3.148e+02  3.653e+02   0.862 0.388825
## `2013 code`3:olderprop                        1.798e-01  2.670e+02   0.001 0.999463
## `2013 code`4:olderprop                       -1.642e+02  3.711e+02  -0.442 0.658162
## `2013 code`5:olderprop                        7.267e+02  3.915e+02   1.856 0.063428
## `2013 code`6:olderprop                               NA         NA      NA       NA
## `2013 code`2:TrmpProp                         5.332e+01  9.982e+01   0.534 0.593261
## `2013 code`3:TrmpProp                        -5.623e+01  7.526e+01  -0.747 0.454976
## `2013 code`4:TrmpProp                        -8.989e+01  1.020e+02  -0.881 0.378317
## `2013 code`5:TrmpProp                         1.581e+02  1.055e+02   1.498 0.134180
## `2013 code`6:TrmpProp                                NA         NA      NA       NA
## `2013 code`2:RARELY                          -1.990e+02  6.769e+02  -0.294 0.768764
## `2013 code`3:RARELY                          -2.317e+02  1.788e+02  -1.296 0.195075
## `2013 code`4:RARELY                          -1.233e+03  6.896e+02  -1.788 0.073817
## `2013 code`5:RARELY                           4.274e+02  7.397e+02   0.578 0.563456
## `2013 code`6:RARELY                                  NA         NA      NA       NA
## olderprop:TrmpProp:RARELY                     8.104e+03  4.725e+03   1.715 0.086326
## `2013 code`2:olderprop:TrmpProp              -3.691e+02  5.064e+02  -0.729 0.465992
## `2013 code`3:olderprop:TrmpProp               1.665e+02  3.474e+02   0.479 0.631821
## `2013 code`4:olderprop:TrmpProp               3.996e+02  5.150e+02   0.776 0.437796
## `2013 code`5:olderprop:TrmpProp              -8.962e+02  5.409e+02  -1.657 0.097535
## `2013 code`6:olderprop:TrmpProp                      NA         NA      NA       NA
## `2013 code`2:olderprop:RARELY                 3.968e+02  3.442e+03   0.115 0.908244
## `2013 code`3:olderprop:RARELY                -1.371e+03  1.296e+03  -1.058 0.290061
## `2013 code`4:olderprop:RARELY                 5.961e+03  3.474e+03   1.716 0.086222
## `2013 code`5:olderprop:RARELY                -2.813e+03  3.798e+03  -0.741 0.458911
## `2013 code`6:olderprop:RARELY                        NA         NA      NA       NA
## `2013 code`2:TrmpProp:RARELY                  4.287e+02  9.537e+02   0.449 0.653092
## `2013 code`3:TrmpProp:RARELY                  6.795e+02  3.065e+02   2.217 0.026636
## `2013 code`4:TrmpProp:RARELY                  2.021e+03  9.726e+02   2.078 0.037709
## `2013 code`5:TrmpProp:RARELY                 -3.688e+02  1.035e+03  -0.356 0.721563
## `2013 code`6:TrmpProp:RARELY                         NA         NA      NA       NA
## `2013 code`2:olderprop:TrmpProp:RARELY       -1.230e+03  4.858e+03  -0.253 0.800141
## `2013 code`3:olderprop:TrmpProp:RARELY               NA         NA      NA       NA
```

```
## `2013 code`4:olderprop:TrmpProp:RARELY -9.861e+03  4.894e+03  -2.015 0.043917
## `2013 code`5:olderprop:TrmpProp:RARELY  2.783e+03  5.314e+03   0.524 0.600486
## `2013 code`6:olderprop:TrmpProp:RARELY         NA         NA      NA       NA
##
## (Intercept)
## pop2021.x                              ***
## prop_cases                             ***
## COVID_COUNT.x                          **
## SOMETIMES                              **
## COVID_COUNT.y                          ***
## COVID_TEST.y                           *
## fully_vaccinated.y                     **
## `Older (65 plus).y`                    **
## TrmpVote.x                             ***
## TrmpVote.y                             ***
## ClintVote.y                            **
## TotalVote.y                            ***
## FREQUENTLY                             **
## ALWAYS                                 *
## `2013 code`2
## `2013 code`3
## `2013 code`4
## `2013 code`5                           .
## `2013 code`6                           .
## olderprop
## TrmpProp
## RARELY
## olderprop:TrmpProp
## olderprop:RARELY
## TrmpProp:RARELY                        .
## `2013 code`2:olderprop
## `2013 code`3:olderprop
## `2013 code`4:olderprop
## `2013 code`5:olderprop                 .
## `2013 code`6:olderprop
## `2013 code`2:TrmpProp
## `2013 code`3:TrmpProp
## `2013 code`4:TrmpProp
## `2013 code`5:TrmpProp
## `2013 code`6:TrmpProp
## `2013 code`2:RARELY
## `2013 code`3:RARELY
## `2013 code`4:RARELY                    .
## `2013 code`5:RARELY
## `2013 code`6:RARELY
## olderprop:TrmpProp:RARELY              .
## `2013 code`2:olderprop:TrmpProp
## `2013 code`3:olderprop:TrmpProp
## `2013 code`4:olderprop:TrmpProp
## `2013 code`5:olderprop:TrmpProp        .
## `2013 code`6:olderprop:TrmpProp
## `2013 code`2:olderprop:RARELY
## `2013 code`3:olderprop:RARELY
## `2013 code`4:olderprop:RARELY          .
```

```
## `2013 code`5:olderprop:RARELY
## `2013 code`6:olderprop:RARELY
## `2013 code`2:TrmpProp:RARELY
## `2013 code`3:TrmpProp:RARELY           *
## `2013 code`4:TrmpProp:RARELY           *
## `2013 code`5:TrmpProp:RARELY
## `2013 code`6:TrmpProp:RARELY
## `2013 code`2:olderprop:TrmpProp:RARELY
## `2013 code`3:olderprop:TrmpProp:RARELY
## `2013 code`4:olderprop:TrmpProp:RARELY *
## `2013 code`5:olderprop:TrmpProp:RARELY
## `2013 code`6:olderprop:TrmpProp:RARELY
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## (Dispersion parameter for poisson family taken to be 1)
##
##     Null deviance: 16416.47  on 91  degrees of freedom
## Residual deviance:   120.28  on 38  degrees of freedom
## AIC: 798.23
##
## Number of Fisher Scoring iterations: 4
```

```
Anova(mod5.10)
```

```
## Analysis of Deviance Table (Type II tests)
##
## Response: COVID_DEATHS.x
##                                      LR Chisq Df Pr(>Chisq)
## pop2021.x                             18.612  1  1.602e-05 ***
## prop_cases                            14.270  1  0.0001584 ***
## COVID_COUNT.x                          7.129  1  0.0075847 **
## SOMETIMES                              7.770  1  0.0053115 **
## COVID_COUNT.y                         11.239  1  0.0008011 ***
## COVID_TEST.y                           5.006  1  0.0252529 *
## fully_vaccinated.y                     9.911  1  0.0016426 **
## `Older (65 plus).y`                    8.765  1  0.0030704 **
## TrmpVote.x                            11.982  1  0.0005373 ***
## TrmpVote.y                            17.930  1  2.292e-05 ***
## ClintVote.y                            7.885  1  0.0049851 **
## TotalVote.y                           26.895  1  2.149e-07 ***
## FREQUENTLY                             9.128  1  0.0025173 **
## ALWAYS                                 4.094  1  0.0430377 *
## `2013 code`                           21.009  5  0.0008067 ***
## olderprop                             10.308  1  0.0013244 **
## TrmpProp                               0.428  1  0.5130953
## RARELY                                 2.199  1  0.1381211
## olderprop:TrmpProp                     3.204  1  0.0734362 .
## olderprop:RARELY                       2.009  1  0.1564066
## TrmpProp:RARELY                       13.561  1  0.0002309 ***
## `2013 code`:olderprop                 23.649  4  9.390e-05 ***
## `2013 code`:TrmpProp                  24.756  4  5.632e-05 ***
## `2013 code`:RARELY                    56.060  4  1.948e-11 ***
## olderprop:TrmpProp:RARELY              0.641  1  0.4234411
```

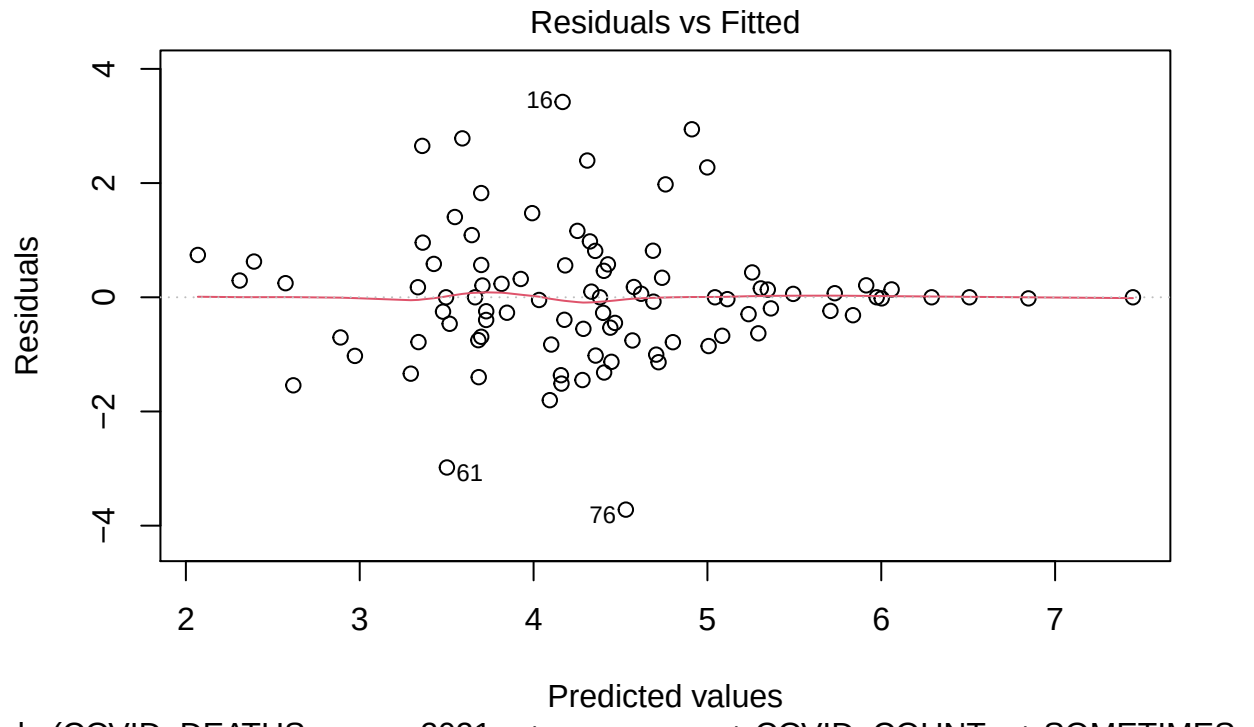
```
## `2013 code`:olderprop:TrmpProp          62.007  4  1.098e-12 ***
## `2013 code`:olderprop:RARELY            31.326  4  2.627e-06 ***
## `2013 code`:TrmpProp:RARELY             14.313  4  0.0063591 **
## `2013 code`:olderprop:TrmpProp:RARELY   32.257  3  4.621e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
drop1(mod5.10, test = "Chi")
```

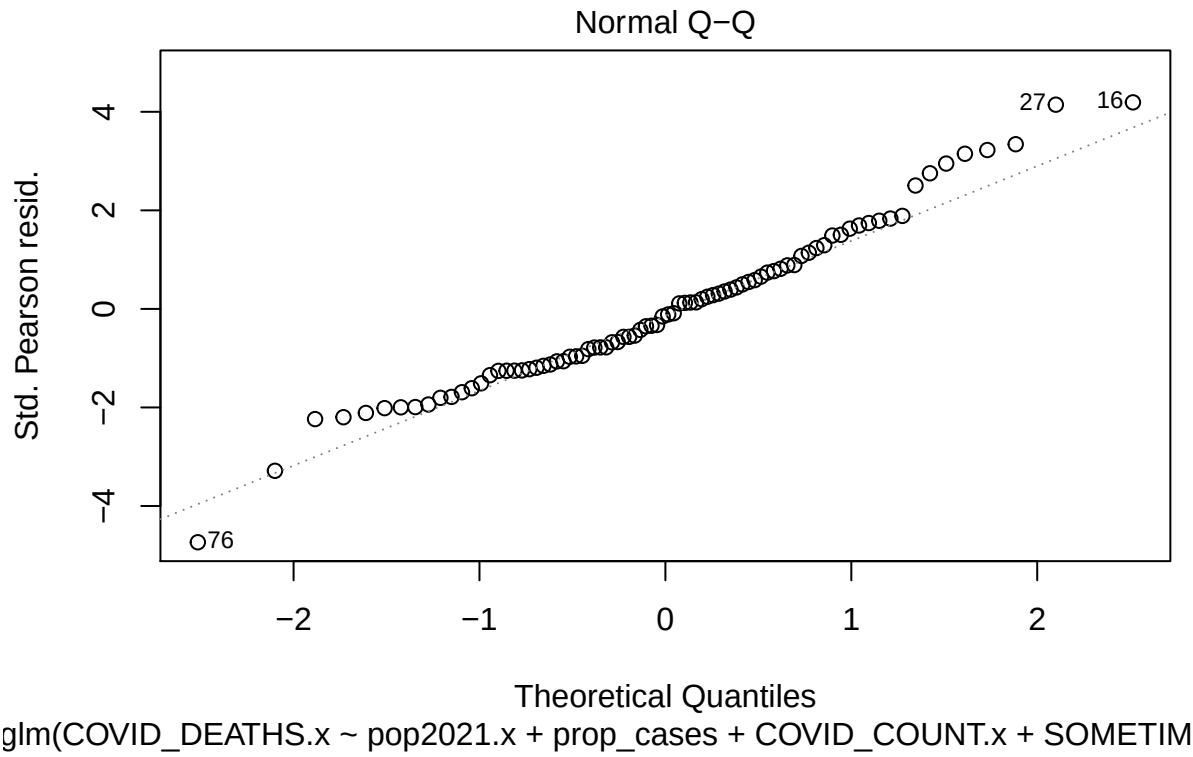
```
## Single term deletions
##
## Model:
## COVID_DEATHS.x ~ pop2021.x + prop_cases + COVID_COUNT.x + SOMETIMES +
##     COVID_COUNT.y + COVID_TEST.y + fully_vaccinated.y + `Older (65 plus).y` +
##     TrmpVote.x + TrmpVote.y + ClintVote.y + TotalVote.y + FREQUENTLY +
##     ALWAYS + `2013 code` + olderprop * TrmpProp * RARELY * `2013 code`
##                                    Df Deviance    AIC    LRT  Pr(>Chi)
## <none>                                  120.28 798.23
## pop2021.x                           1   138.89 814.84 18.612 1.602e-05 ***
## prop_cases                          1   134.54 810.50 14.270 0.0001584 ***
## COVID_COUNT.x                       1   127.41 803.36  7.129 0.0075847 **
## SOMETIMES                           1   128.05 804.00  7.770 0.0053115 **
## COVID_COUNT.y                       1   131.51 807.47 11.239 0.0008011 ***
## COVID_TEST.y                        1   125.28 801.24  5.006 0.0252529 *
## fully_vaccinated.y                  1   130.19 806.14  9.911 0.0016426 **
## `Older (65 plus).y`                 1   129.04 805.00  8.765 0.0030704 **
## TrmpVote.x                          1   132.26 808.21 11.982 0.0005373 ***
## TrmpVote.y                          1   138.21 814.16 17.930 2.292e-05 ***
## ClintVote.y                         1   128.16 804.12  7.885 0.0049851 **
## TotalVote.y                         1   147.17 823.13 26.895 2.149e-07 ***
## FREQUENTLY                          1   129.40 805.36  9.128 0.0025173 **
## ALWAYS                              1   124.37 800.33  4.094 0.0430377 *
## `2013 code`:olderprop:TrmpProp:RARELY  3   152.53 824.49 32.257 4.621e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
plot(mod5.10)
```

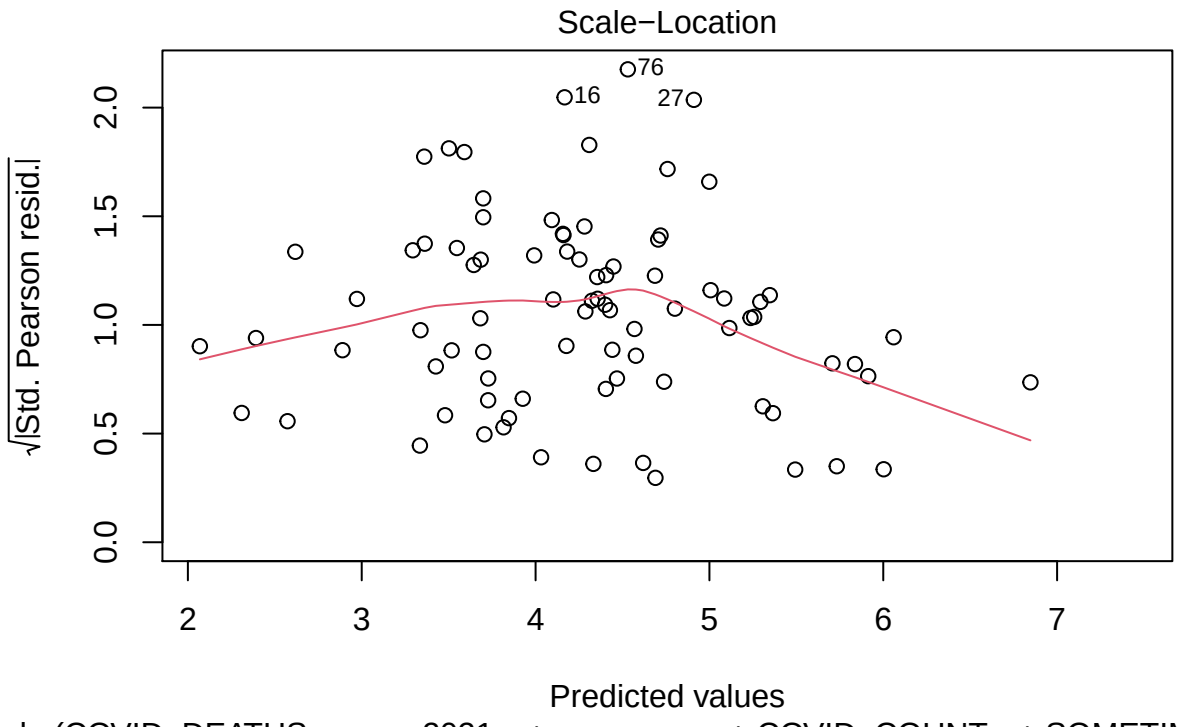
```
## Warning: not plotting observations with leverage one:
##   2, 49, 65, 71, 82, 87, 90, 92
```



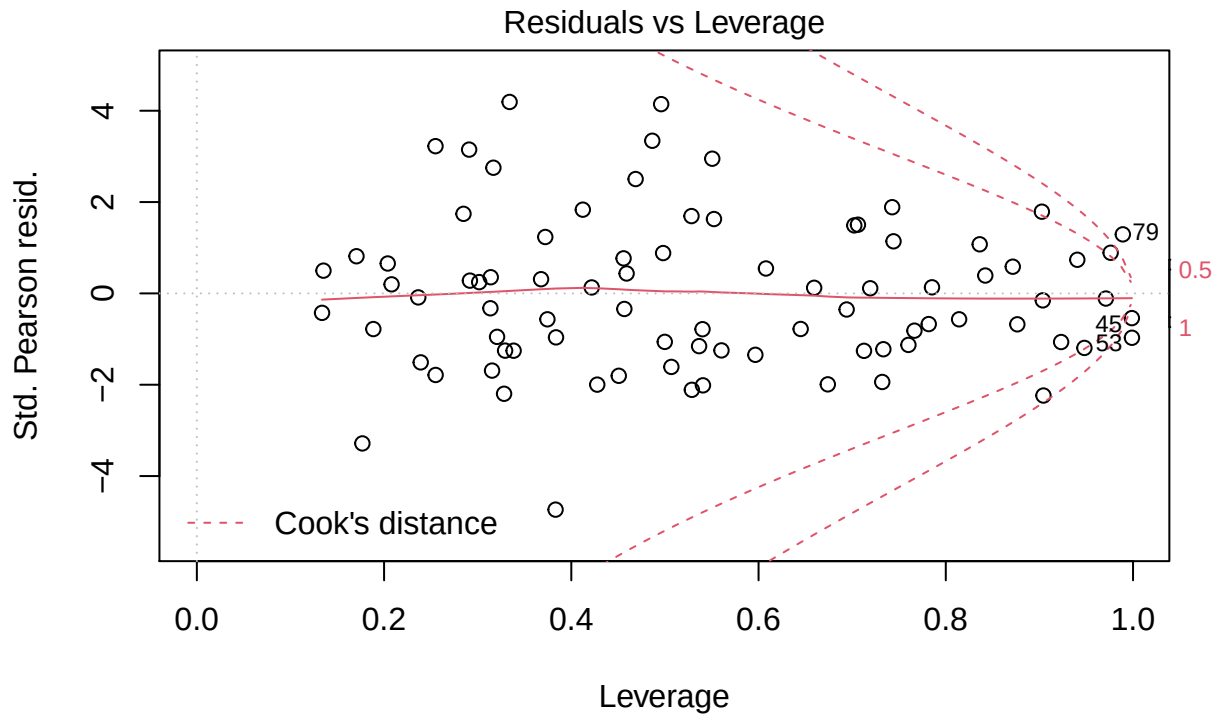
glm(COVID_DEATHS.x ~ pop2021.x + prop_cases + COVID_COUNT.x + SOMETIMES -



glm(COVID_DEATHS.x ~ pop2021.x + prop_cases + COVID_COUNT.x + SOMETIMES -




```
## Warning in sqrt(crit * p * (1 - hh)/hh): NaNs produced

## Warning in sqrt(crit * p * (1 - hh)/hh): NaNs produced
```



glm(COVID_DEATHS.x ~ pop2021.x + prop_cases + COVID_COUNT.x + SOMETIMES -

Binomail Mixed-Effects Model

```
summary(modbm33)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`:LOCATION_ID) + olderprop + prop_cases + fully_vaccinated.y +
##     all_doses_administered.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    819.8    834.9   -403.9    807.8       86
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.57992 -0.35102  0.06946  0.23945  1.33928
##
## Random effects:
##  Groups                  Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.03951  0.1988
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92
```

```
##
## Fixed effects:
##                            Estimate Std. Error z value Pr(>|z|)
## (Intercept)                 -6.9281     0.7471  -9.274  < 2e-16 ***
## olderprop                    6.4868     1.4130   4.591 4.42e-06 ***
## prop_cases                   3.9873     1.6524   2.413  0.01582 *
## fully_vaccinated.y           2.0107     0.7477   2.689  0.00716 **
## all_doses_administered.y    -1.9425     0.7412  -2.621  0.00878 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) oldrpr prp_cs flly_.
## olderprop   -0.640
## prop_cases  -0.079 -0.207
## flly_vccnt.  0.714 -0.057 -0.054
## all_dss_dm. -0.741  0.088  0.043 -0.999
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## Model failed to converge with max|grad| = 0.00394599 (tol = 0.002, component 1)
## Model is nearly unidentifiable: large eigenvalue ratio
##  - Rescale variables?
```

```
Anova(modbm33)
```

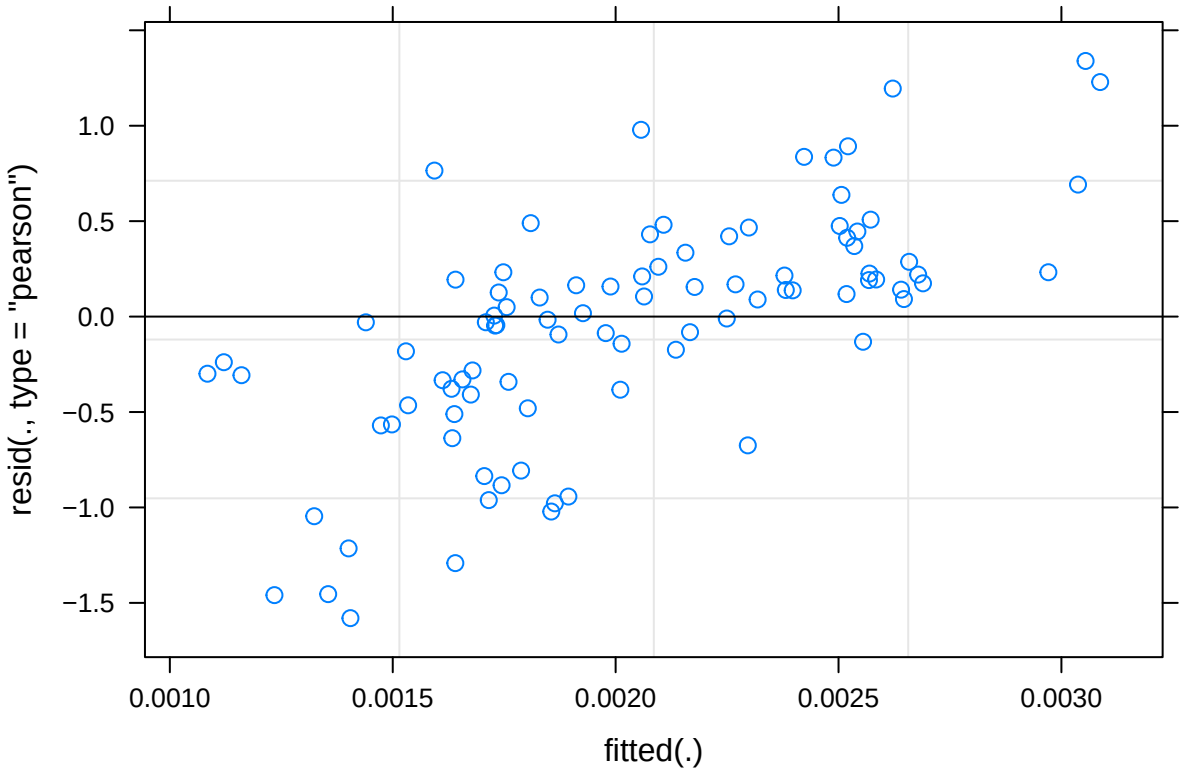
```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x)
##                             Chisq Df Pr(>Chisq)
## olderprop                 21.0744  1  4.418e-06 ***
## prop_cases                 5.8226  1   0.015822 *
## fully_vaccinated.y         7.2318  1   0.007162 **
## all_doses_administered.y   6.8679  1   0.008776 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
drop1(modbm33)
```

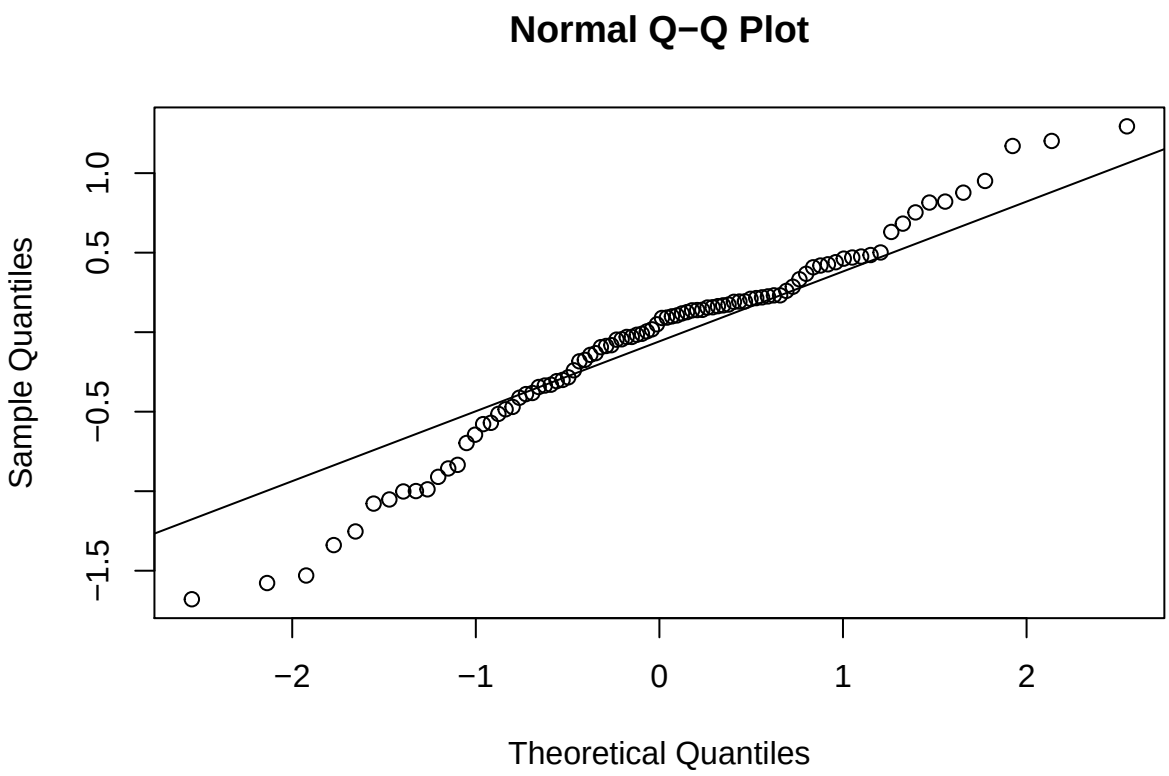
```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv, :
## Model failed to converge with max|grad| = 0.0236565 (tol = 0.002, component 1)

## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv, :
## Model failed to converge with max|grad| = 0.00229727 (tol = 0.002, component 1)

## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv, :
## Model failed to converge with max|grad| = 0.00333956 (tol = 0.002, component 1)

## Single term deletions
##
## Model:
## cbind(COVID_DEATHS.x, pop2021.x - COVID_DEATHS.x) ~ 1 + (1 |
##     `2013 code`:LOCATION_ID) + olderprop + prop_cases + fully_vaccinated.y +
##     all_doses_administered.y
```

```
##                              npar    AIC
## <none>                            819.81
## olderprop                     1 836.61
## prop_cases                    1 823.48
## fully_vaccinated.y            1 824.69
## all_doses_administered.y      1 824.36
```

```
plot(modbm33)
```




```
qqnorm(resid(modbm33));qqline(residuals(modbm33))
```



Poisson Mixed-Effects Model

```
summary(mod26.off)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: poisson  ( log )
## Formula:
## COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`:LOCATION_ID) +
##     prop_cases + COVID_COUNT.y + `Older (65 plus).y` + TrmpVote.y +
##     TotalVote.y + fully_vaccinated.y
##    Data: big_data3
##
##      AIC      BIC   logLik deviance df.resid
##    821.3    841.4   -402.6    805.3       84
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.70649 -0.32010 -0.01209  0.28626  1.53799
##
## Random effects:
##  Groups                  Name        Variance Std.Dev.
##  `2013 code`:LOCATION_ID (Intercept) 0.03887  0.1972
```

```
## Number of obs: 92, groups:  `2013 code`:LOCATION_ID, 92
##
## Fixed effects:
##                     Estimate Std. Error z value Pr(>|z|)
## (Intercept)          -8.8337     0.7685 -11.495  < 2e-16 ***
## prop_cases           13.9832     2.8271   4.946 7.57e-07 ***
## COVID_COUNT.y        -1.1864     0.2793  -4.248 2.16e-05 ***
## `Older (65 plus).y`   1.5559     0.2892   5.380 7.44e-08 ***
## TrmpVote.y            0.4408     0.2220   1.986  0.04708 *
## TotalVote.y          -1.0827     0.3923  -2.760  0.00579 **
## fully_vaccinated.y    0.3913     0.1731   2.260  0.02383 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) prp_cs COVID_ `O(65p TrmpV. TtlVt.
## prop_cases  -0.802
## COVID_COUNT  0.863 -0.805
## `O(65pls).` -0.438  0.389 -0.577
## TrmpVote.y  -0.274 -0.033 -0.120  0.157
## TotalVote.y -0.244  0.300 -0.165 -0.466 -0.590
## flly_vccnt.  0.052  0.075 -0.243  0.277  0.172 -0.569
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## Model failed to converge with max|grad| = 0.0194022 (tol = 0.002, component 1)
## Model is nearly unidentifiable: very large eigenvalue
##  - Rescale variables?
## Model is nearly unidentifiable: large eigenvalue ratio
##  - Rescale variables?
```

```
Anova(mod26.off)
```

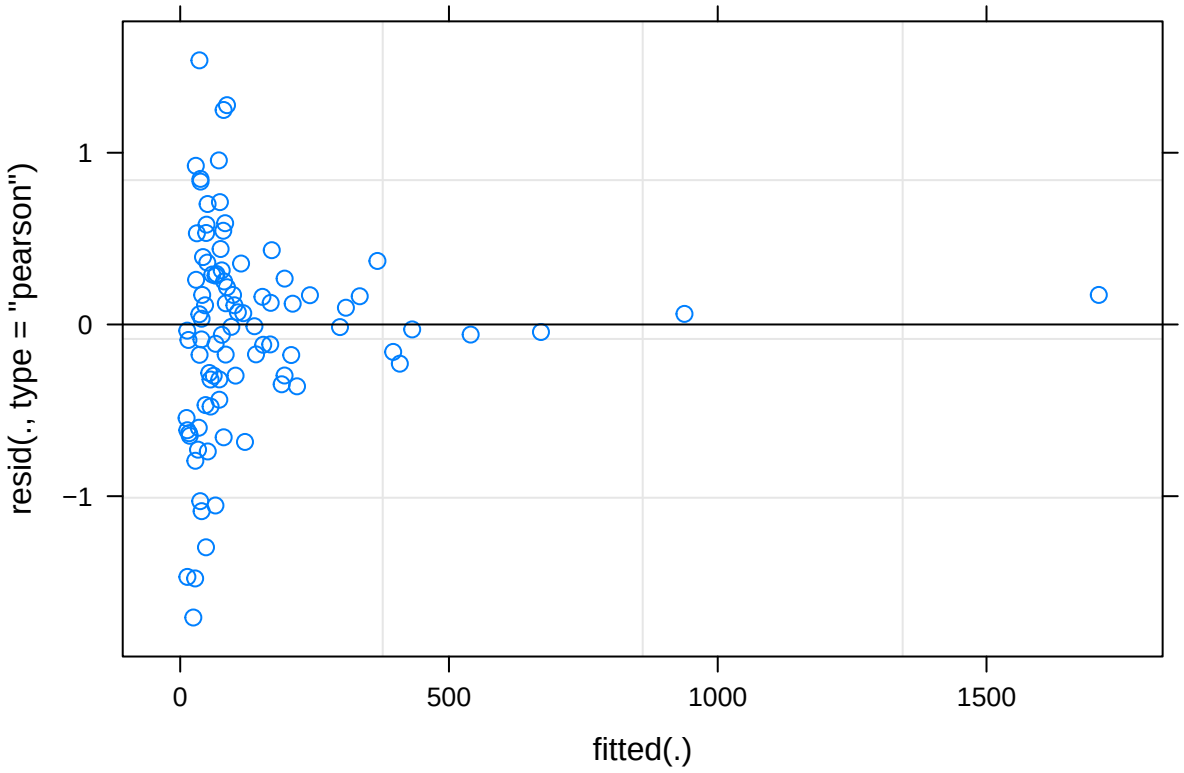
```
## Analysis of Deviance Table (Type II Wald chisquare tests)
##
## Response: COVID_DEATHS.x
##                       Chisq Df Pr(>Chisq)
## prop_cases          24.4635  1  7.573e-07 ***
## COVID_COUNT.y       18.0442  1  2.158e-05 ***
## `Older (65 plus).y` 28.9458  1  7.443e-08 ***
## TrmpVote.y           3.9424  1   0.047083 *
## TotalVote.y          7.6157  1   0.005786 **
## fully_vaccinated.y   5.1068  1   0.023832 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
drop1(mod26.off, test = "Chi")
```

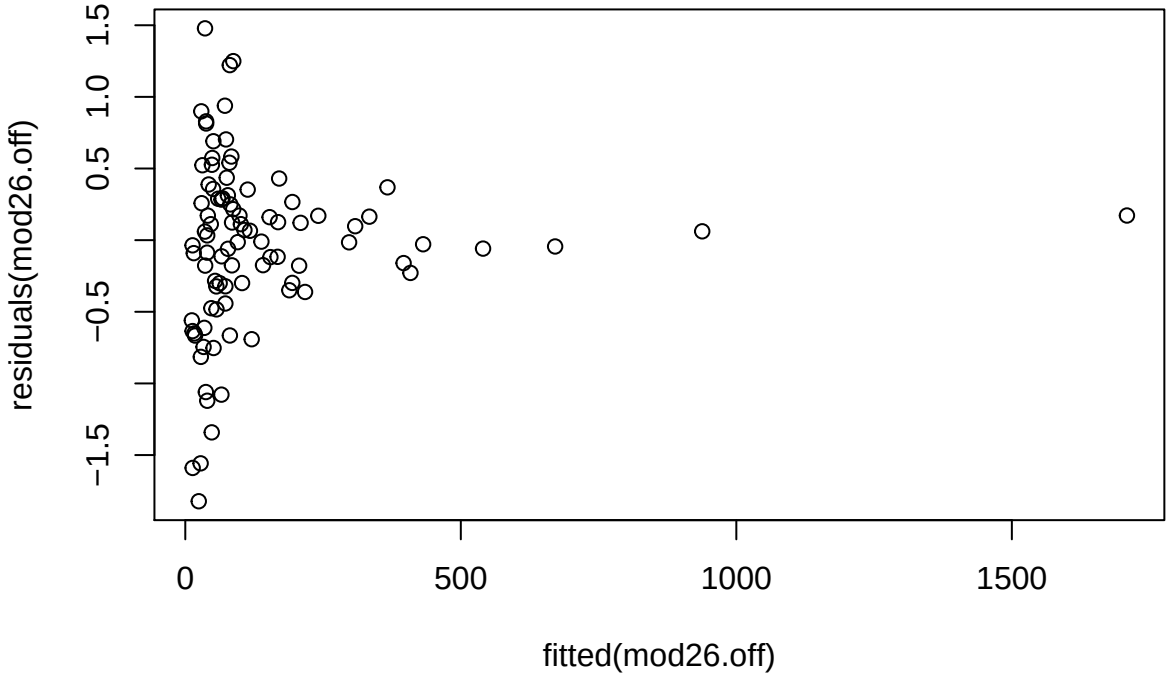
```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv, :
## Model failed to converge with max|grad| = 0.0282574 (tol = 0.002, component 1)

## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv, : Model is nearly unide
##  - Rescale variables?

## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv, :
## Model failed to converge with max|grad| = 0.0220516 (tol = 0.002, component 1)
```

```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv, : Model is nearly unider
##  - Rescale variables?;Model is nearly unidentifiable: large eigenvalue ratio
##  - Rescale variables?

## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv, :
## Model failed to converge with max|grad| = 0.0194904 (tol = 0.002, component 1)

## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv, : Model is nearly unider
##  - Rescale variables?

## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv, :
## Model failed to converge with max|grad| = 0.0566593 (tol = 0.002, component 1)

## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv, : Model is nearly unider
##  - Rescale variables?;Model is nearly unidentifiable: large eigenvalue ratio
##  - Rescale variables?

## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv, :
## Model failed to converge with max|grad| = 0.0179056 (tol = 0.002, component 1)

## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv, : Model is nearly unider
##  - Rescale variables?;Model is nearly unidentifiable: large eigenvalue ratio
##  - Rescale variables?

## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv, :
## Model failed to converge with max|grad| = 0.0162658 (tol = 0.002, component 1)

## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control$checkConv, : Model is nearly unider
##  - Rescale variables?;Model is nearly unidentifiable: large eigenvalue ratio
##  - Rescale variables?

## Single term deletions
##
## Model:
## COVID_DEATHS.x ~ offset(log(pop2021.x)) + (1 | `2013 code`:LOCATION_ID) +
##     prop_cases + COVID_COUNT.y + `Older (65 plus).y` + TrmpVote.y +
##     TotalVote.y + fully_vaccinated.y
##                      npar    AIC     LRT   Pr(Chi)
## <none>                    821.27
## prop_cases              1 841.03 21.7625 3.086e-06 ***
## COVID_COUNT.y           1 835.71 16.4393 5.023e-05 ***
## `Older (65 plus).y`     1 844.05 24.7798 6.427e-07 ***
## TrmpVote.y              1 823.21  3.9393  0.047169 *
## TotalVote.y             1 826.70  7.4315  0.006409 **
## fully_vaccinated.y      1 824.32  5.0570  0.024527 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
plot(mod26.off)
```




```
plot(fitted(mod26.off), residuals(mod26.off))
```


residuals(mod26.off)
1.5
1.0
0.5
−0.5
−1.5
0
500
1000
1500
fitted(mod26.off)

Data Sources

mask_data.txt https://github.com/nytimes/covid-19-data/blob/master/mask-use/mask-use-by-county.csv

covid_report_county.csv https://hub.mph.in.gov/dataset/covid-19-county-statistics/resource/8b8e6cd7-ede2-4c41-a9bd-4266df783145

county-vaccination-demographics.xlsx https://hub.mph.in.gov/dataset/covid-19-vaccinations-demographics-by-county-and-district/resource/82d99020-093f-41ac-95c7-d3c335b8c2ba

csvData.csv https://worldpopulationreview.com/us-counties/states/in

idwd_data_31.csv https://www.stats.indiana.edu/stats_dpage/dpage.asp?id=71&view_number=2&menu_level=&panel_number=

pres_votes.csv https://dataverse.harvard.edu/file.xhtml?persistentId=doi:10.7910/DVN/VOQCHQ/HEIJCQ&version=6.0

NCHSURCodes2013.xlsx https://www.cdc.gov/nchs/data/data_acces_files/NCHSURCodes2013.xlsx