visualizations

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```
library(tidyverse)
library(ggplot2)
```

```
closure <- read_csv("closure.csv")
closure <- closure[-(219:228),]
closure$`Income Group` <- factor(closure$`Income Group`, levels = c("High income", "Upper middle income
closure$Online <- factor(closure$Online)
dates <- read_csv("Dates.csv")
reopening <- read_csv("reopening.csv")
cases <- read_csv("owid-covid-data.csv")
cases <- cases[, -c(17:44, 52:59)]
```

```
summaries <- closure %>%
  group_by(`Income Group`) %>%
  summarize(case_mean = mean(`Number of confirmed cases at time of closure`, na.rm=T), weeks_closed = me
```

```
## `summarise()` ungrouping output (override with `.groups` argument)
```

```
summaries
```

```
## # A tibble: 4 x 5
##   `Income Group`      case_mean weeks_closed reopening_case online
##   <fct>                   <dbl>        <dbl>          <dbl>  <int>
## 1 High income             67.6          14.2         35024.     67
## 2 Upper middle income     39.8          22.6        153555      50
## 3 Lower middle income     14.7          19.3        159021.     37
## 4 Low income               4.46         20.4          9290.     16
```

```
closure$`Existing Cash Transfer Supplemented?`[is.na(closure$`Existing Cash Transfer Supplemented?`)] <-
closure$`Plans for Special Education? (Y/N)`[is.na(closure$`Plans for Special Education? (Y/N)`)] <- "N
```

```
closure %>%
  group_by(`Existing Cash Transfer Supplemented?`) %>%
  summarize(Online = mean(Online =="Yes", na.rm=T), `Not Online` = mean(Online=="No", na.rm=T))
```

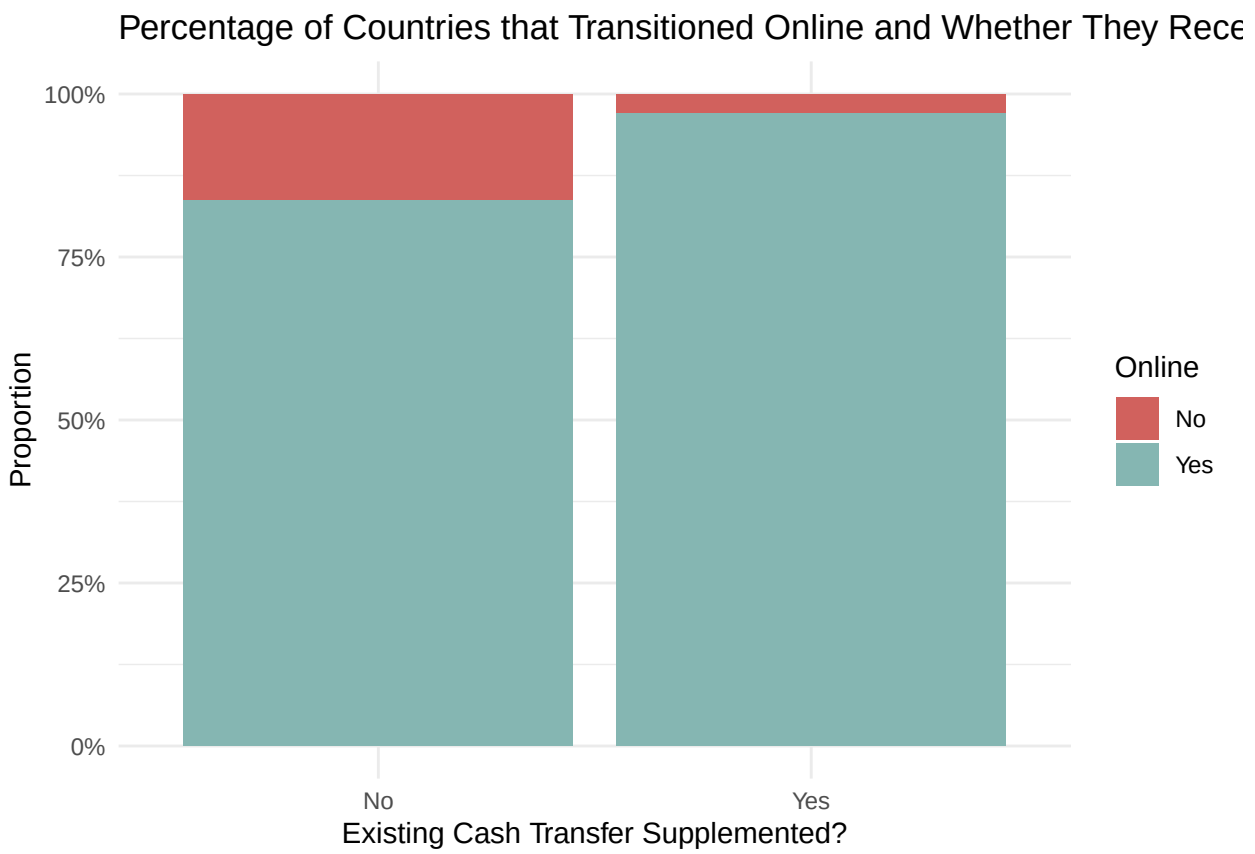
```
## `summarise()` ungrouping output (override with `.groups` argument)
```

```
## # A tibble: 2 x 3
##   `Existing Cash Transfer Supplemented?` Online `Not Online`
##   <chr>                                   <dbl>        <dbl>
## 1 No                                      0.836            0
## 2 Yes                                     0.970            0
```

```
a <- closure %>%
  ggplot(aes(`Existing Cash Transfer Supplemented?`, `Total Weeks closed`)) +
  geom_point() +
```

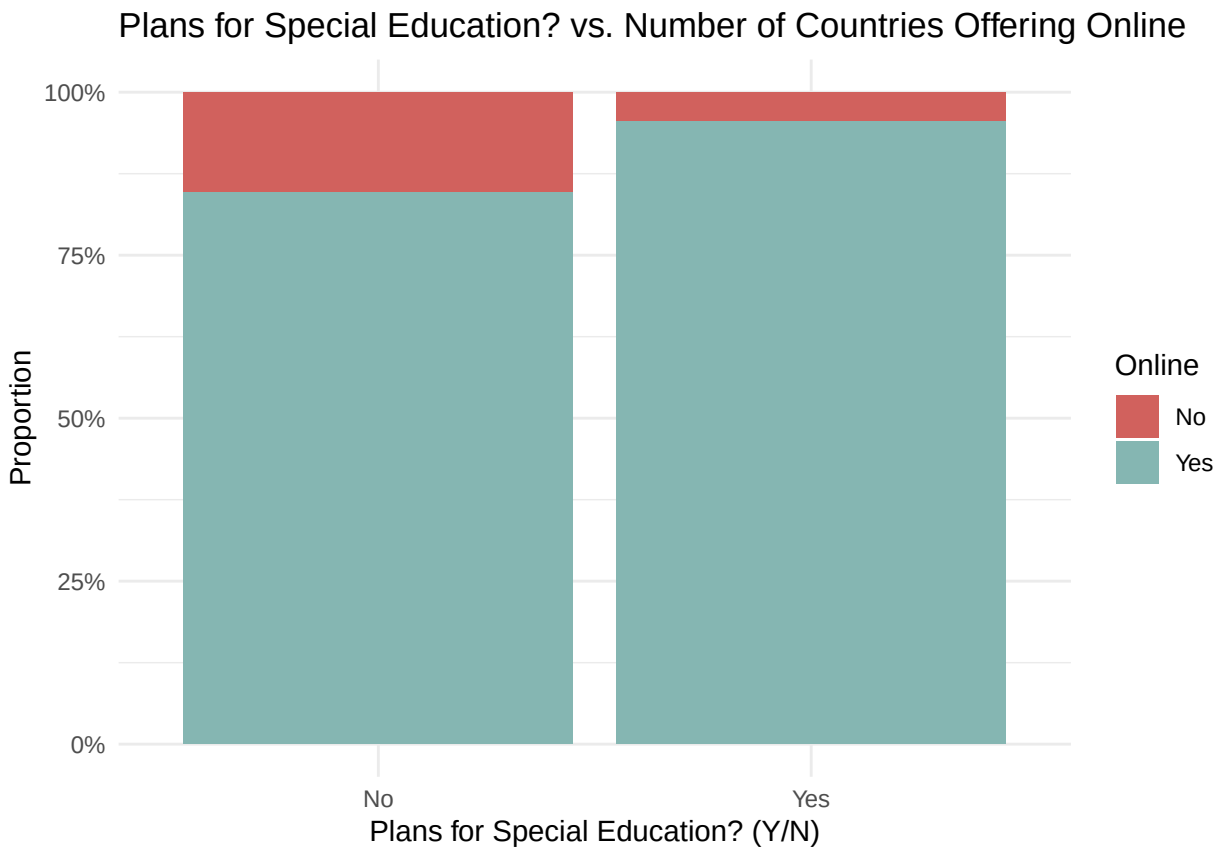
```
  #geom_smooth(method="lm", aes(color="Lm")) +
  stat_summary(fun=mean, geom="line", aes(group = 1, color = "Mean")) +
  scale_colour_manual(values = c("#D1615D", "#85B6B2")) +
  theme_minimal() +
  labs(title = "The Mean of Countries with Funds Supplemented and Countries without", color = NULL)

closure %>%
  group_by(`Existing Cash Transfer Supplemented?`) %>%
  filter(!is.na(`Online`)) %>%
  count(Online) %>%
  mutate(Proportion = n) %>%
  ggplot(aes(`Existing Cash Transfer Supplemented?`, Proportion, fill=Online)) +
  scale_fill_manual(values = c("#D1615D", "#85B6B2")) +
  geom_col(position='fill') +
  scale_y_continuous(labels = scales::percent) +
  theme_minimal() +
  #geom_label(aes(label = percent(percent)), position = "fill", color = "white", vjust = 1, show.legend
  #scale_y_continuous(labels = count) +
  #geom_smooth(method="lm", aes(color="Lm")) +
  #stat_summary(fun=mean, geom="line", aes(group = 1, color = "Mean")) +
  #scale_colour_manual(values = c("red", "blue")) +
  labs(title = "Percentage of Countries that Transitioned Online and Whether They Received Supplemental
```

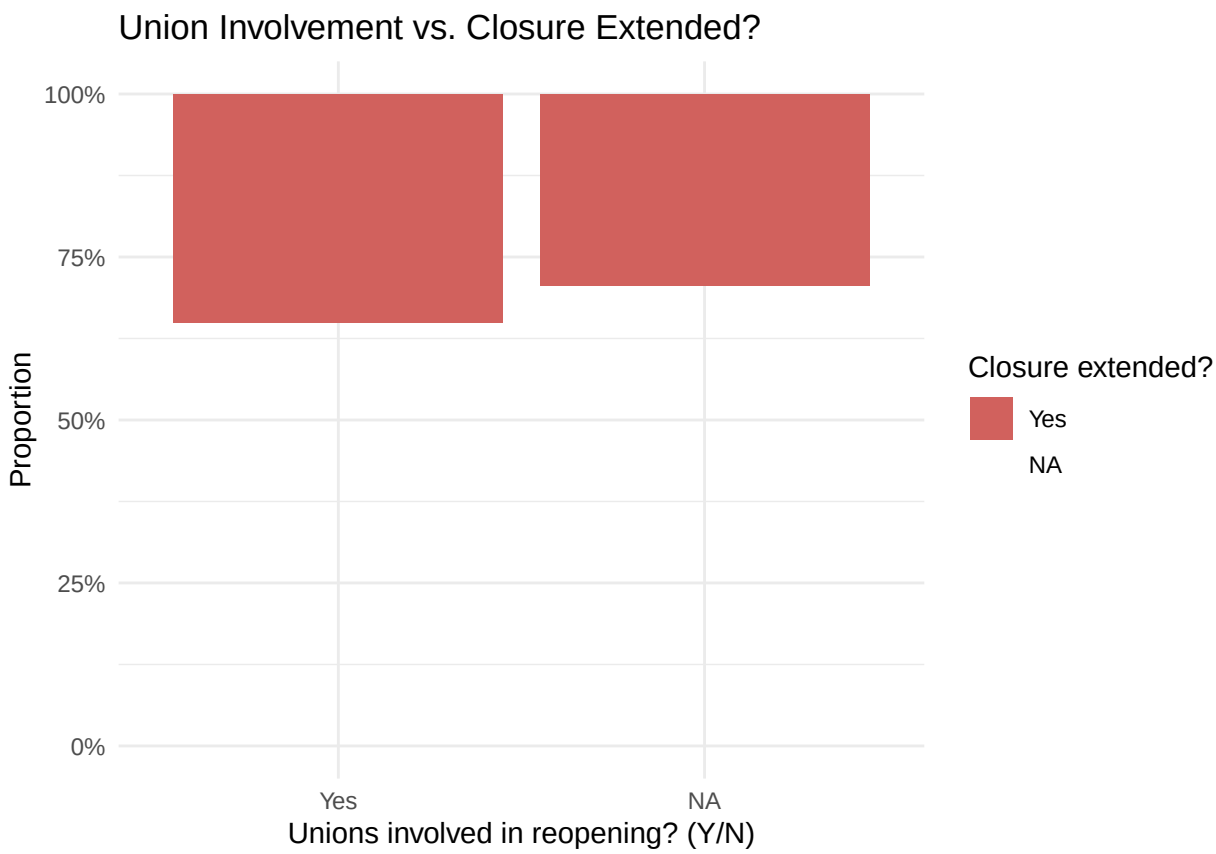



```
closure %>%
  group_by(`Plans for Special Education? (Y/N)`) %>%
  filter(!is.na(`Online`)) %>%
  count(Online) %>%
```

```
  mutate(Proportion = n) %>%
  ggplot(aes(`Plans for Special Education? (Y/N)`, Proportion, fill=Online)) +
  scale_fill_manual(values = c("#D1615D", "#85B6B2")) +
  scale_y_continuous(labels = scales::percent) +
  geom_col(position='fill') +
  theme_minimal() +
  #geom_label(aes(label = percent(percent)), position = "fill", color = "white", vjust = 1, show.legend
  #scale_y_continuous(labels = count) +
  #geom_smooth(method="lm", aes(color="Lm")) +
  #stat_summary(fun=mean, geom="line", aes(group = 1, color = "Mean")) +
  #scale_colour_manual(values = c("red", "blue")) +
  labs(title = "Plans for Special Education? vs. Number of Countries Offering Online", color = NULL)
```




```
reopening %>%
  group_by(`Unions involved in reopening? (Y/N)`) %>%
  count(`Closure extended?`) %>%
  mutate(Proportion = n) %>%
  ggplot(aes(`Unions involved in reopening? (Y/N)`, Proportion, fill=`Closure extended?`)) +
  scale_fill_manual(values = c("#D1615D", "#85B6B2")) +
  scale_y_continuous(labels = scales::percent) +
  geom_col(position='fill') +
  theme_minimal() +
  labs(title= "Union Involvement vs. Closure Extended?")
```

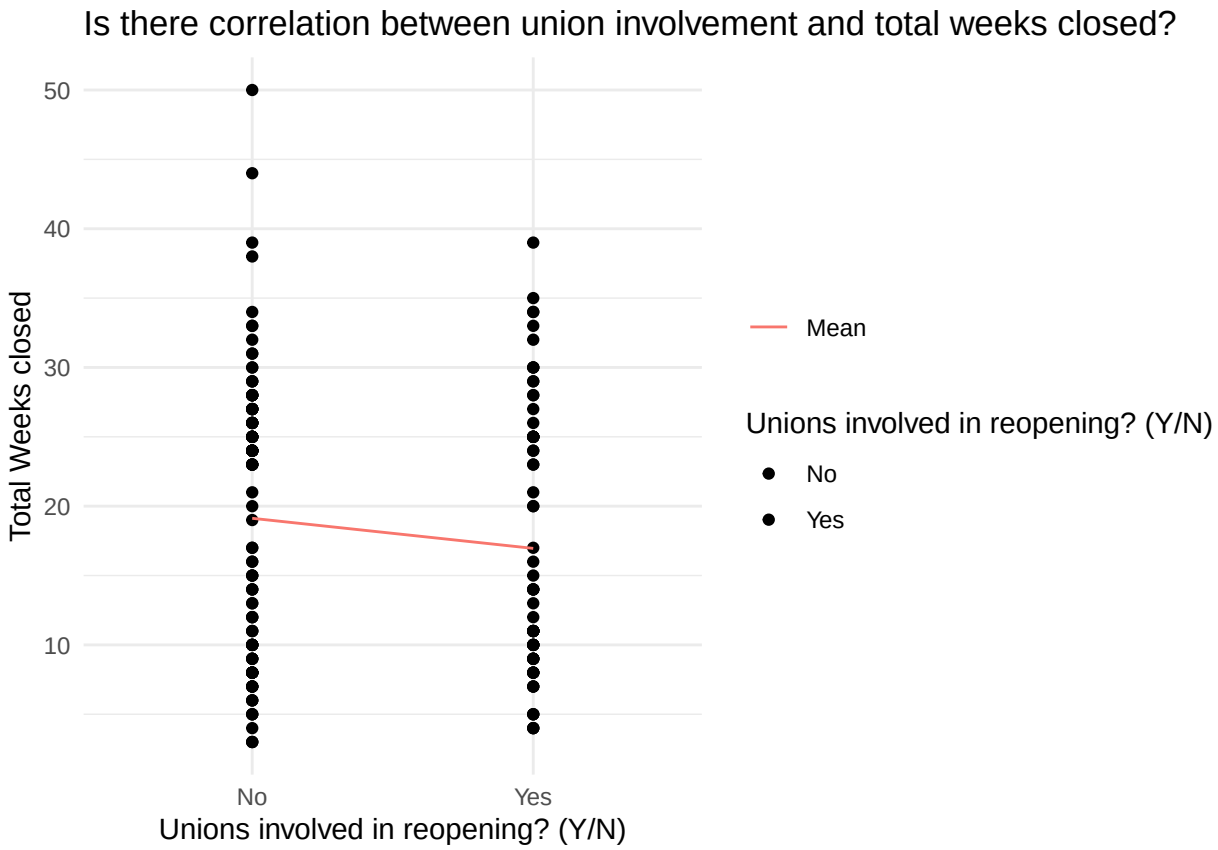



```
reopening$`Unions involved in reopening? (Y/N)`[is.na(reopening$`Unions involved in reopening? (Y/N)`)]
reopening$`Closure extended?`[is.na(reopening$`Closure extended?`)] <- "No"

reopening %>%
  #group_by(`Unions involved in reopening? (Y/N)`) %>%
  ggplot(aes(`Unions involved in reopening? (Y/N)`, `Total Weeks closed`, fill=`Unions involved in reop
  geom_point() +
  #geom_label(aes(label = percent(percent)), position = "fill", color = "white", vjust = 1, show.legend
  #scale_y_continuous(labels = count) +
  #geom_smooth(method="lm", aes(color="Lm")) +
  stat_summary(fun=mean, geom="line", aes(group = 1, color = "Mean")) +
  theme_minimal() +
  #scale_colour_manual(values = c("red", "blue")) +
  labs(title = "Is there correlation between union involvement and total weeks closed?", color = NULL)
```

```
## Warning: Removed 33 rows containing non-finite values (stat_summary).
```

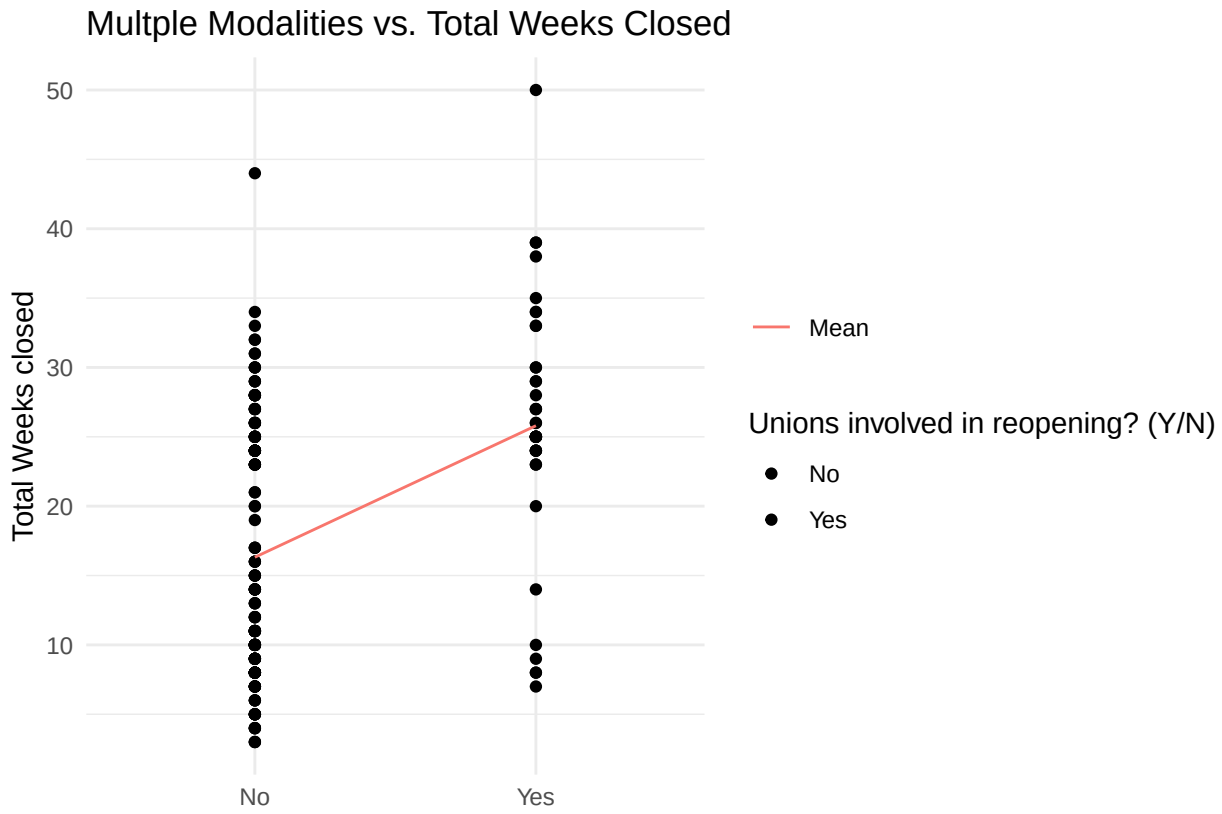
```
## Warning: Removed 33 rows containing missing values (geom_point).
```




```
reopening$`Reopening includes multiple modalities? (i.e., online and in-person) Y/N`[is.na(reopening$`R
reopening %>%
  #group_by(`Unions involved in reopening? (Y/N)`) %>%
  ggplot(aes(`Reopening includes multiple modalities? (i.e., online and in-person) Y/N`, `Total Weeks cl
  geom_point() +
  theme_minimal() +
  #geom_label(aes(label = percent(percent)), position = "fill", color = "white", vjust = 1, show.legend
  #scale_y_continuous(labels = count) +
  #geom_smooth(method="lm", aes(color="Lm")) +
  stat_summary(fun=mean, geom="line", aes(group = 1, color = "Mean")) +
  #scale_colour_manual(values = c("red", "blue")) +
  labs(title = "Multple Modalities vs. Total Weeks Closed", color = NULL)
```

```
## Warning: Removed 33 rows containing non-finite values (stat_summary).
```

```
## Warning: Removed 33 rows containing missing values (geom_point).
```



ening includes multiple modalities? (i.e., online and in−person) Y/N

```
closure %>%
  group_by(`Existing Cash Transfer Supplemented?`) %>%
  summarize(mean = mean(`Total Weeks closed`, na.rm=T))
```

```
## `summarise()` ungrouping output (override with `.groups` argument)
```

```
## # A tibble: 2 x 2
##   `Existing Cash Transfer Supplemented?`  mean
##   <chr>                                  <dbl>
## 1 No                                      17.8
## 2 Yes                                     21.6
```

```
reopenY <- reopening %>%
  filter(`Unions involved in reopening? (Y/N)`=='Yes')
reopenN <- reopening %>%
  filter(`Unions involved in reopening? (Y/N)`=='No')
t.test(reopenY$`Total Weeks closed`, reopenN$`Total Weeks closed`, alternative="less")
```

```
##
##  Welch Two Sample t-test
##
## data:  reopenY$`Total Weeks closed` and reopenN$`Total Weeks closed`
## t = -1.4965, df = 151.41, p-value = 0.06831
## alternative hypothesis: true difference in means is less than 0
## 95 percent confidence interval:
##       -Inf 0.2296612
## sample estimates:
## mean of x mean of y
```

```
##  16.95775  19.12605
```

```
#plot(closeDurVSunions)

closure1 <- closure
closure1$Online <- as.numeric(closure1$Online)
incomeVSonline<- lm(`Online`~`Income Group`, data=closure1)
summary(incomeVSonline)
```

```
##
## Call:
## lm(formula = Online ~ `Income Group`, data = closure1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.95714  0.04286  0.10714  0.15909  0.42857
##
## Coefficients:
##                                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)                        1.95714    0.03930  49.803  < 2e-16 ***
## `Income Group`Upper middle income -0.06429    0.05895  -1.091   0.2768
## `Income Group`Lower middle income -0.11623    0.06326  -1.838   0.0677 .
## `Income Group`Low income          -0.38571    0.07352  -5.246 4.04e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.3288 on 194 degrees of freedom
##   (20 observations deleted due to missingness)
## Multiple R-squared:  0.1276, Adjusted R-squared:  0.1141
## F-statistic: 9.461 on 3 and 194 DF,  p-value: 7.291e-06
```

```
#plot(incomeVSonline)

closure$`Sending work home with students / providing hardcopies of materials`[is.na(closure$`Sending wo


closeDurVSprovisions <- lm(`Total Weeks closed`~`Sending work home with students / providing hardcopies
summary(closeDurVSprovisions)
```

```
##
## Call:
## lm(formula = `Total Weeks closed` ~ `Sending work home with students / providing hardcopies of mater
##     data = closure)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -18.9000  -8.4562  -0.9563   7.5437  27.1000
##
## Coefficients:
##                                                                    Estimate
## (Intercept)                                                         17.4563
## `Sending work home with students / providing hardcopies of materials`Yes   5.4437
##                                                                    Std. Error
## (Intercept)                                                            0.7589
## `Sending work home with students / providing hardcopies of materials`Yes     1.9098
```

```
##                                                                        t value
## (Intercept)                                                              23.00
## `Sending work home with students / providing hardcopies of materials`Yes    2.85
##                                                                       Pr(>|t|)
## (Intercept)                                                            < 2e-16
## `Sending work home with students / providing hardcopies of materials`Yes 0.00485
##
## (Intercept)                                                           ***
## `Sending work home with students / providing hardcopies of materials`Yes **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9.599 on 188 degrees of freedom
##   (28 observations deleted due to missingness)
## Multiple R-squared:  0.04143,    Adjusted R-squared:  0.03633
## F-statistic: 8.125 on 1 and 188 DF,  p-value: 0.004853
```

```
#plot(closeDurVSprovisions)

closeDurVScash <- lm(`Total Weeks closed`~`Existing Cash Transfer Supplemented?`, data=closure)
summary(closeDurVScash)
```

```
##
## Call:
## lm(formula = `Total Weeks closed` ~ `Existing Cash Transfer Supplemented?`,
##     data = closure)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -14.843  -8.843  -1.343   7.157  32.157
##
## Coefficients:
##                                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)                              17.8434     0.7548  23.641   <2e-16
## `Existing Cash Transfer Supplemented?`Yes   3.7400     2.1236   1.761   0.0798
##
## (Intercept)                             ***
## `Existing Cash Transfer Supplemented?`Yes .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9.724 on 188 degrees of freedom
##   (28 observations deleted due to missingness)
## Multiple R-squared:  0.01623,    Adjusted R-squared:  0.011
## F-statistic: 3.102 on 1 and 188 DF,  p-value: 0.07984
```

```
#plot(closeDurVScash)
```

```
reopening1 <- reopening %>%
  inner_join(closure, by="Country")
reopening1$`Income Group.x` <- factor(reopening1$`Income Group.x`)
reopening1$`Existing Cash Transfer Supplemented?` <- factor(reopening1$`Existing Cash Transfer Supplemer
reopening1$`Unions involved in reopening? (Y/N)` <- factor(reopening1$`Unions involved in reopening? (Y/
mfull <- lm(`Total Weeks closed.x`~`Income Group.x`+`Unions involved in reopening? (Y/N)`+`Existing Cash
mreduced <- lm(`Total Weeks closed.x`~`Income Group.x`+`Unions involved in reopening? (Y/N)`, data=reope
```

```r
anova(mreduced, mfull)
```

```
## Analysis of Variance Table
##
## Model 1: `Total Weeks closed.x` ~ `Income Group.x` + `Unions involved in reopening? (Y/N)`
## Model 2: `Total Weeks closed.x` ~ `Income Group.x` + `Unions involved in reopening? (Y/N)` +
##     `Existing Cash Transfer Supplemented?`
##   Res.Df   RSS Df Sum of Sq      F Pr(>F)
## 1    184 15583
## 2    183 15551  1    31.982 0.3764 0.5403
```

```r
anova(mfull)
```

```
## Analysis of Variance Table
##
## Response: Total Weeks closed.x
##                                       Df  Sum Sq Mean Sq F value    Pr(>F)
## `Income Group.x`                       3  2255.9  751.97  8.8491 1.654e-05
## `Unions involved in reopening? (Y/N)`  1    95.0   94.96  1.1174    0.2919
## `Existing Cash Transfer Supplemented?`  1    32.0   31.98  0.3764    0.5403
## Residuals                            183 15550.9   84.98
##
## `Income Group.x`                       ***
## `Unions involved in reopening? (Y/N)`
## `Existing Cash Transfer Supplemented?`
## Residuals
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
anova(mreduced)
```

```
## Analysis of Variance Table
##
## Response: Total Weeks closed.x
##                                     Df  Sum Sq Mean Sq F value    Pr(>F)
## `Income Group.x`                     3  2255.9  751.97  8.8792 1.586e-05 ***
## `Unions involved in reopening? (Y/N)`  1    95.0   94.96  1.1212     0.291
## Residuals                          184 15582.9   84.69
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
summary(mfull)
```

```
##
## Call:
## lm(formula = `Total Weeks closed.x` ~ `Income Group.x` + `Unions involved in reopening? (Y/N)` +
##     `Existing Cash Transfer Supplemented?`, data = reopening1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -17.5220  -6.8333  -0.7305   6.8531  30.3609
##
## Coefficients:
##                                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)                            14.730      1.238  11.901  < 2e-16
## `Income Group.x`Low income              6.062      2.080   2.915  0.00400
```

```
## `Income Group.x`Lower middle income          4.909      1.822   2.694  0.00772
## `Income Group.x`Upper middle income          7.792      1.816   4.291 2.88e-05
## `Unions involved in reopening? (Y/N)`Yes    -1.492      1.413  -1.056  0.29229
## `Existing Cash Transfer Supplemented?`Yes    1.311      2.138   0.613  0.54032
##
## (Intercept)                                ***
## `Income Group.x`Low income                 **
## `Income Group.x`Lower middle income        **
## `Income Group.x`Upper middle income        ***
## `Unions involved in reopening? (Y/N)`Yes
## `Existing Cash Transfer Supplemented?`Yes
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9.218 on 183 degrees of freedom
##   (28 observations deleted due to missingness)
## Multiple R-squared:  0.1329, Adjusted R-squared:  0.1092
## F-statistic: 5.608 on 5 and 183 DF,  p-value: 7.803e-05
```

```
summary(mreduced)
```

```
##
## Call:
## lm(formula = `Total Weeks closed.x` ~ `Income Group.x` + `Unions involved in reopening? (Y/N)`,
##     data = reopening1)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -17.9048  -6.9048  -0.2914   6.6301  30.1365
##
## Coefficients:
##                                      Estimate Std. Error t value Pr(>|t|)
## (Intercept)                            14.785      1.232  11.996  < 2e-16
## `Income Group.x`Low income              6.008      2.074   2.896  0.00423
## `Income Group.x`Lower middle income     5.079      1.798   2.825  0.00526
## `Income Group.x`Upper middle income     8.120      1.732   4.688 5.37e-06
## `Unions involved in reopening? (Y/N)`Yes   -1.494      1.411  -1.059  0.29104
##
## (Intercept)                            ***
## `Income Group.x`Low income             **
## `Income Group.x`Lower middle income    **
## `Income Group.x`Upper middle income    ***
## `Unions involved in reopening? (Y/N)`Yes
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 9.203 on 184 degrees of freedom
##   (28 observations deleted due to missingness)
## Multiple R-squared:  0.1311, Adjusted R-squared:  0.1122
## F-statistic:  6.94 on 4 and 184 DF,  p-value: 3.175e-05
```