Mental Health Series

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Base Panel Construction - ZCTA-Week Level

Hospital Data - ZCTA-Week level

```
hosp_zcta <- read_csv("Data/Restricted MHA Data/minnepop_1620_agg_zipfull_MH_102222.csv") %>%
  arrange(zipcode, year, weekofyr) %>%
  select(-c(`_chk`, zippop_tag)) %>%
  filter(!(year==2016 & weekofyr==53))
```

ZCTAs and ACS 5-Year Estimates

```
#adding in 5-year ACS data
census_api_key("ecda17575f4d914b502c70f2bae7a5f3d253792d")

year <- lst(2016, 2017, 2018, 2019, 2020)

acs <- map_dfr(
  year,
  ~ get_acs(geography = "zcta",
                variables = c("B01001_001E", "B03003_003E",
                              "B02001_003E", "B02001_002E",
                              "B02001_004E", "B02001_008E",
                              "B02001_005E", "B02001_006E",
                              "B02001_007E", "B11001_003E",
                              "B17001_002E", "B01002_001E",
                              "B09010_002E", "B06009_005E",
                              "B01001_002E", "B99233_005E",
           "B23025_005E",
           "B19057_002E",
           "B11003_015E",
           "B06009_002E",
           "B25003_002E",
           "B05002_013E",
          "B19013_001E",
          "B23025_002E",
          "B07001_017E"),
                output = "wide",
                survey = "acs5",
                year = .x),  .id = "year") %>%
  rename(total_pop = B01001_001E,
         white_pop = B02001_002E,
```

```
         black_pop = B02001_003E,
         na_pop = B02001_004E,
         asian_pop = B02001_005E,
         hpi_pop = B02001_006E,
         other_pop = B02001_007E,
         biracial_pop = B02001_008E,
         hisp_pop = B03003_003E,
         ssi_snap = B09010_002E, #snap, ssi, public cash transfers
         med_age = B01002_001E,
         mar_fam = B11001_003E,
         povlevel = B17001_002E,
         bach_degree = B06009_005E,
         male = B01001_002E,
         nowork_12 = B99233_005E,
         total_ilf = B23025_002E,
         unemp = B23025_005E,
         pub_assist = B19057_002E,
         female_hh = B11003_015E,
         no_hs_dip = B06009_002E,
         res_mob = B07001_017E,
         own_hh = B25003_002E,
         foreign = B05002_013E,
       med_hh_inc = B19013_001E) %>%
  select(-ends_with("M", ignore.case = F), -GEOID) %>%
  mutate(zcta = str_sub(NAME, 6),
          unemp_rate = 100*unemp/total_ilf,
         pov_rate = 100*povlevel/total_pop,
         pub_assist_rate = 100*pub_assist/total_pop,
         female_hh_rate = 100*female_hh/total_pop,
         no_hs_dip_rate = 100*no_hs_dip/total_pop,
         bach_degree_rate = 100*bach_degree/total_pop,
         res_mob_rate = 100-100*res_mob/total_pop,
         own_hh_rate = 100*own_hh/total_pop,
         foreign_rate = 100*foreign/total_pop) %>%
  select(-NAME) %>%
  select(zcta, everything()) %>%
  mutate(year = as.numeric(year),
         zcta = as.numeric(zcta))

#joining to hospital data
hosp_panel <- hosp_zcta %>%
  left_join(acs, by = c("zipcode"="zcta", "year"))

#SF geometries - get all ZCTAs
zcta <- get_acs(geography = "zcta",
                  variables = "B01001_001",
                  output = "wide",
                  year = 2020, #change back to 2020
                  geometry = T,
                  survey = "acs5") %>%
  rename(zcta = GEOID,
         pop_2020 = B01001_001E) %>%
  select(-c(NAME, B01001_001M, pop_2020)) %>%
```

```
  mutate(zcta = as.numeric(zcta))
```

```
##   |                                                                      |
```

```
#minneapolis shapefile (source: openminneapolis.gov)
mpls <- st_read("Data/mpls_city-shp/16cdbbfa-ad10-493c-afaf-52b61f2e76e42020329-1-180h9ap.whbo.shp") %>%
   st_set_crs(st_crs(zcta))
```

```
## Reading layer `16cdbbfa-ad10-493c-afaf-52b61f2e76e42020329-1-180h9ap.whbo' from data source `C:\Users
##   using driver `ESRI Shapefile'
## Simple feature collection with 1 feature and 4 fields
## Geometry type: POLYGON
## Dimension:     XY
## Bounding box:  xmin: -93.32911 ymin: 44.89059 xmax: -93.19433 ymax: 45.05125
## Geodetic CRS:  WGS 84
```

```
#zctas that intersect MPLS
zcta_intersect <- zcta %>%
 st_filter(mpls, .predicate = st_intersects) %>%
  mutate(zcta_area = as.numeric(st_area(.)),
         zcta_area_sqkm = zcta_area*.000001,
         zcta_area_sqmi = zcta_area_sqkm*.386102,
         intersection_area = as.numeric(st_area(st_intersection(., mpls))),
         perc_intersection = round(intersection_area/zcta_area*100,2)) %>%
  filter(perc_intersection >= 5)

#filter hospital panel
panel <- hosp_panel %>%
  filter(zipcode %in% zcta_intersect$zcta) %>%
  mutate(zcta = zipcode)

#creating date bookends
panel <- panel %>%
  group_by(zipcode, year) %>%
  mutate(begin_date = ISOweek2date(paste(year, paste0("W", sprintf("%02d", weekofyr)), 1,sep = "-")),
         end_date = begin_date+weeks(1)-days(1))

#number of unique MPLS ZCTAs
n_zcta <- length(unique(panel$zcta))

#vector of intersecting ZCTAs for filtering downstream
zcta_universe <- unique(panel$zcta)
```

ZCTA-Week Level Police Data

```
#Minneapolis Police Department - Use of Force Dashboard
uof_spatial <- read_csv("Data/Police_Use_Of_Force.csv")  %>%
  mutate(date=ymd_hms(ResponseDate),
         year=isoyear(date),
         week=isoweek(date)) %>%
  select(OBJECTID, year, week, X, Y, Race) %>%
  st_as_sf(coords = c("X", "Y"), crs = "NAD83", remove=F) %>%
  mutate(intersection = as.integer(st_intersects(geometry, zcta)),
         zcta = ifelse(is.na(intersection), NA, zcta$zcta[intersection])) %>%
  st_drop_geometry() %>%
```

```
  filter(!is.na(zcta) & year >= 2016 & year <= 2021 & zcta %in% zcta_universe) %>%
  group_by(year, week, zcta, Race, .drop=F) %>%
  tally(name = "use_of_force") %>%
  filter(!is.na(Race) & Race!="not recorded") %>%
  ungroup() %>%
  complete(year, week, zcta=zcta_universe, Race, fill = list(use_of_force = 0)) %>%
  arrange(year, week, zcta, Race) %>%
  mutate(race = str_to_lower(Race)) %>%
  select(-Race) %>%
  pivot_wider(names_from = race,
              values_from = use_of_force,
              values_fill = 0,
              names_glue = "{race}_{.value}") %>%
  mutate(total_use_of_force = asian_use_of_force+black_use_of_force+`native american_use_of_force`+
           `other / mixed race_use_of_force`+`pacific islander_use_of_force`+unknown_use_of_force+
            white_use_of_force)

#MPD Stop Dashboard
stop_spatial <- read_csv("Data/Police_Stop_Data.csv") %>%
  mutate(date=ymd_hms(responseDate),
         year=isoyear(date),
         week=isoweek(date)) %>%
  select(OBJECTID, year, week, lat, long, race) %>%
  st_as_sf(coords = c("long", "lat"), crs = "NAD83", remove=F) %>%
  mutate(intersection = as.integer(st_intersects(geometry, zcta)),
         zcta = ifelse(is.na(intersection), NA, zcta$zcta[intersection])) %>%
  st_drop_geometry() %>%
  filter(!is.na(zcta) & year >= 2016 & year <= 2020 & zcta %in% zcta_universe) %>%
  group_by(year, week, zcta, race, .drop=F) %>%
  tally(name = "police_stops") %>%
   filter(!is.na(race) & race!="not recorded") %>%
  ungroup() %>%
  complete(year, week, zcta=zcta_universe, race, fill = list(police_stops = 0)) %>%
  mutate(race = str_to_lower(race)) %>%
  arrange(year, week, zcta, race) %>%
  pivot_wider(names_from = race,
              values_from = police_stops,
              values_fill = 0,
              names_glue = "{race}_{.value}") %>%
  mutate(total_police_stops = asian_police_stops+black_police_stops+
         `east african_police_stops`+latino_police_stops+`native american_police_stops`+
           other_police_stops+unknown_police_stops+white_police_stops)

#Officer Involved Shootings - MPD
ois_spatial <- read_csv("Data/Police_Officer_Involved_Shootings.csv") %>%
  mutate(date=ymd_hms(IncidentDate),
         year=isoyear(date),
         week=isoweek(date)) %>%
  select(OBJECTID, year, week, CenterLatitude, CenterLongitude, SubjectOfForceRace) %>%
  rename(race = SubjectOfForceRace,
         lat = CenterLatitude,
         long = CenterLongitude) %>%
  st_as_sf(coords = c("long", "lat"), crs = "NAD83", remove=F) %>%
```

```
  mutate(intersection = as.integer(st_intersects(geometry, zcta)),
         zcta = ifelse(is.na(intersection), NA, zcta$zcta[intersection])) %>%
  st_drop_geometry() %>%
  filter(!is.na(zcta) & year >= 2016 & year <= 2020 & zcta %in% zcta_universe) %>%
  group_by(year, week, zcta, race, .drop=F) %>%
  tally(name = "police_shootings") %>%
  filter(!is.na(race) & race!="not recorded") %>%
  ungroup() %>%
  complete(year=2016:2021, week=1:53, zcta=zcta_universe, race, fill = list(police_shootings = 0)) %>%
  mutate(race = str_to_lower(race)) %>%
  arrange(year, week, zcta, race) %>%
  pivot_wider(names_from = race,
              values_from = police_shootings,
              values_fill = 0,
              names_glue = "{race}_{.value}") %>%
  mutate(total_police_shootings = asian_police_shootings+black_police_shootings+
         hispanic_police_shootings+other_police_shootings+
           unknown_police_shootings+white_police_shootings)

panel <- panel %>%
  left_join(uof_spatial, by = c("year", "weekofyr"="week", "zcta"="zcta")) %>%
  left_join(stop_spatial, by = c("year", "weekofyr"="week", "zcta"="zcta")) %>%
  left_join(ois_spatial, by = c("year", "weekofyr"="week", "zcta"="zcta"))

#creating period indicators for panel
panel <- panel %>%
  mutate(post_floyd = as.factor(as.numeric(begin_date >= as.Date("2020-05-25"))),
         post_floyd_3 = as.factor(as.numeric(begin_date >= as.Date("2020-05-25")+months(3))),
         stay_at_home = as.factor(as.numeric(begin_date >= as.Date("2020-03-28") &
         state_of_emerg = as.factor(as.numeric(begin_date >= as.Date("2020-03-13"))),
         weeks_post = as.numeric(begin_date-as.Date("2020-05-25"))/7,
         t_post_floyd = ifelse(weeks_post >=0,
                               weeks_post,
                               0),
         uof_rate = total_use_of_force/total_pop*1000,
         stops_rate = total_police_stops/total_pop*1000,
         ois_rate = total_police_shootings/total_pop*1000) %>%
  group_by(zcta) %>%
  arrange(year, weekofyr) %>%
  mutate(t = row_number(),
         uof_lag = dplyr::lag(uof_rate, 1),
         stops_lag = dplyr::lag(stops_rate, 1),
         shoot_lag = dplyr::lag(ois_rate, 1))
```

Weather Data

```
# Minnesota DNR Daily Date
 # https://www.dnr.state.mn.us/climate/historical/daily-data.html?sid=mspthr&sname=Minneapolis/St%20Pau
 # Station Name: Minneapolis/St Paul Threaded Record - Station ID: mspthr

weather <- read_csv("Data/dnr_weather.csv") %>%
  mutate(year=isoyear(Date),
```

```
         week=isoweek(Date),
         precip_in = as.numeric(ifelse(`Precipitation (inches)`=="T", .001, `Precipitation (inches)`)),
         snow_in = as.numeric(ifelse(`Snow (inches)`=="T", .001, `Snow (inches)`)),
         tmax_f = `Maximum Temperature degrees (F)`) %>%
  filter(year >= 2016 & year <= 2020) %>%
  select(year, week, precip_in, snow_in, tmax_f) %>%
  group_by(year, week) %>%
  summarize(precip_in = mean(precip_in, na.rm = T),
            snow_in = mean(snow_in, na.rm = T),
            tmax_f = mean(tmax_f, na.rm = T))

#join to panel
panel <- panel %>% left_join(weather, by = c("year","weekofyr"="week"))
```

Time Series Construction - Week Level

Aggregate Hospital Panel to Week-Level

```
#panel to week-level, aggregating over ZCTAs
hosp_series <- panel %>%
  group_by(year, weekofyr) %>%
  summarize(mh_all_tot = sum(mh_all_tot, na.rm = T),
            white_mh_all_tot =  sum(white_mh_all_tot, na.rm = T),
            indig_mh_all_tot =  sum(indig_mh_all_tot, na.rm = T),
            asian_mh_all_tot =  sum(asian_mh_all_tot, na.rm = T),
            black_mh_all_tot =  sum(black_mh_all_tot, na.rm = T),
            latin_mh_all_tot =  sum(latin_mh_all_tot, na.rm = T),
            total_pop = sum(total_pop, na.rm = T),
            white_pop = sum(white_pop, na.rm = T),
            na_pop = sum(na_pop, na.rm = T),
            hisp_pop = sum(hisp_pop, na.rm = T),
            asian_pop = sum(asian_pop, na.rm = T),
            black_pop = sum(black_pop, na.rm = T)) %>%
  mutate(mh_incid_c = (mh_all_tot/total_pop)*1000,
         white_mh_incid_c = (white_mh_all_tot/white_pop)*1000,
         indig_mh_incid_c = (indig_mh_all_tot/na_pop)*1000,
         asian_mh_incid_c = (asian_mh_all_tot/asian_pop)*1000,
         black_mh_incid_c = (black_mh_all_tot/black_pop)*1000,
         latin_mh_incid_c = (latin_mh_all_tot/hisp_pop)*1000) %>%
  ungroup() %>%
  mutate(week_id = row_number())
```

Police Data Week-Level

```
#Minneapolis Police Department - Use of Force Dashboard
uof <- read_csv("Data/Police_Use_Of_Force.csv") %>%
  mutate(date=ymd_hms(ResponseDate),
         year=isoyear(date),
         week=isoweek(date)) %>%
  group_by(year, week, .drop=F) %>%
  tally(name = "use_of_force") %>%
  arrange(year, week) %>%
```

```
  ungroup() %>%
  select(year, week, everything())

#merge onto series
series <- hosp_series %>%
  left_join(uof, by=c("year", "weekofyr"="week")) %>%
  mutate(use_of_force_rate = (use_of_force/total_pop)*1000)

#MPD Officer Involved Shootings
ois <- read_csv("Data/Police_Officer_Involved_Shootings.csv") %>%
  mutate(date=ymd_hms(IncidentDate),
         year=isoyear(date),
         week=isoweek(date)) %>%
  group_by(year, week, .drop=F) %>%
  tally(name = "off_inv_shooting") %>%
  arrange(year, week) %>%
  ungroup() %>%
  select(year, week, everything())

#merge onto series
series <- series %>%
  left_join(ois, by=c("year", "weekofyr"="week")) %>%
  mutate(off_inv_shooting = ifelse(is.na(off_inv_shooting), 0, off_inv_shooting),
         off_inv_shooting_rate = (off_inv_shooting/total_pop)*1000)


#Minneapolis Police Department - Police Stops Dashboard
stop <- read_csv("Data/Police_Stop_Data.csv") %>%
  mutate(date=ymd_hms(responseDate),
         year=isoyear(date),
         week=isoweek(date)) %>%
  group_by(year, week, .drop=F) %>%
  tally(name = "police_stops")

#merge onto series
series <- series %>%
  left_join(stop, by = c("year", "weekofyr"="week")) %>%
  mutate(police_stop_rate = (police_stops/total_pop)*1000)


#creating date variable
#removing week 53 of 2020

series <- series %>%
  mutate(begin_date = ISOweek2date(paste(year, paste0("W", sprintf("%02d", weekofyr)), 1,sep = "-")),
         end_date = begin_date+weeks(1)-days(1)) %>%
  filter(!(year==2020 & weekofyr== 53)) %>%
  left_join(weather, by = c("year","weekofyr"="week"))
```

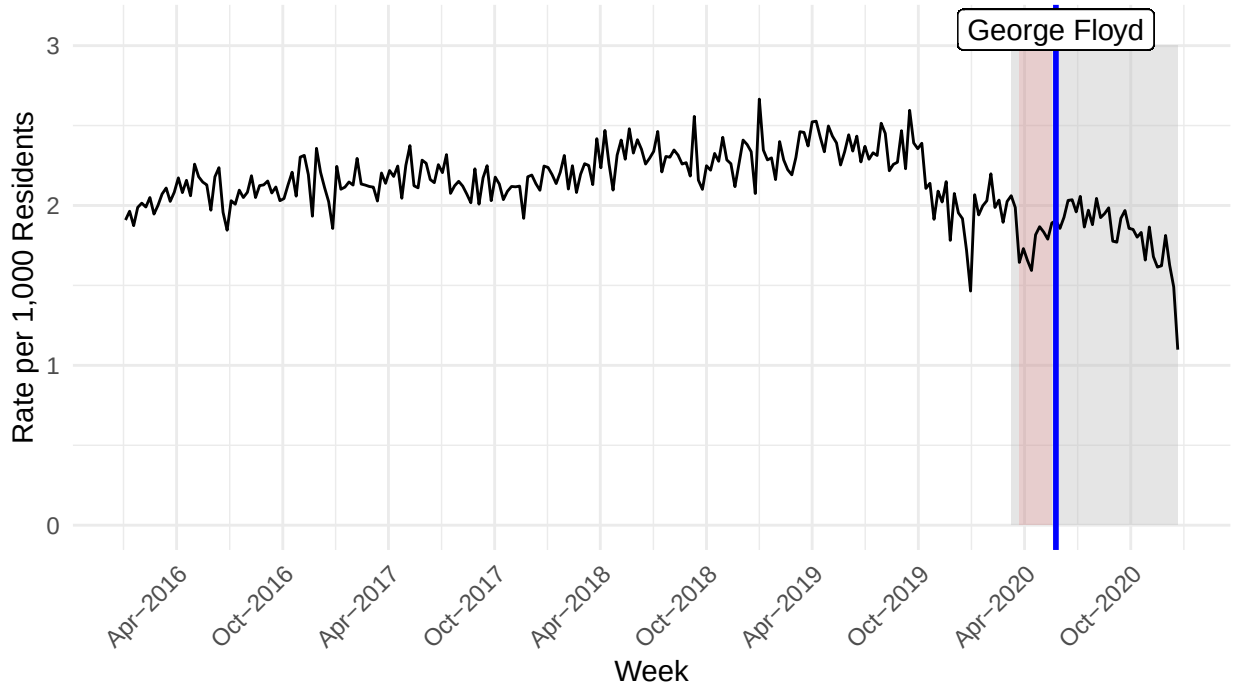
Time Series Vizualization

```
ggplot(series)+
  scale_x_date(date_labels = "%b-%Y", date_breaks = "6 months")+
```

```
 annotate(geom="rect",
  xmin = series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-03-13"))],
  xmax = series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-12-27"))],
  ymin = 0,
  ymax = 3,
  fill = "grey",
  alpha = .4) +
annotate(geom="rect",
  xmin = series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-03-28"))],
  xmax = series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-05-18"))],
  ymin = 0,
  ymax = 3,
  fill = "Red",
  alpha = .1) +
scale_fill_manual(values=c("grey","red"), labels=c("Stay at Home", "State of Emergency")) +
geom_line(aes(x=begin_date, y=mh_incid_c))+
geom_vline(xintercept=series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-05-25
            linetype="solid", color="blue", size=1) +
geom_label(aes(x=series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-05-25"))],
               y=3.1),
           label = "George Floyd", show.legend = FALSE)+
labs(title = "Figure 1: Weekly Mental Health Diagnoses, Minneapolis 2016-2020",
     subtitle = "MHA Hospital Data",
     x = "Week",
     y = "Rate per 1,000 Residents",
     fill = "MN COVID-19 Policy",
     caption = "The grey period represents the COVID-19 State of Emergency order,
     and the red represents the COVID-19 Stay at Home order.")+
theme_minimal()+
  theme(axis.text.x=element_text(angle=45, hjust=1))
```

Figure 1: Weekly Mental Health Diagnoses, Minneapolis 2016−2020

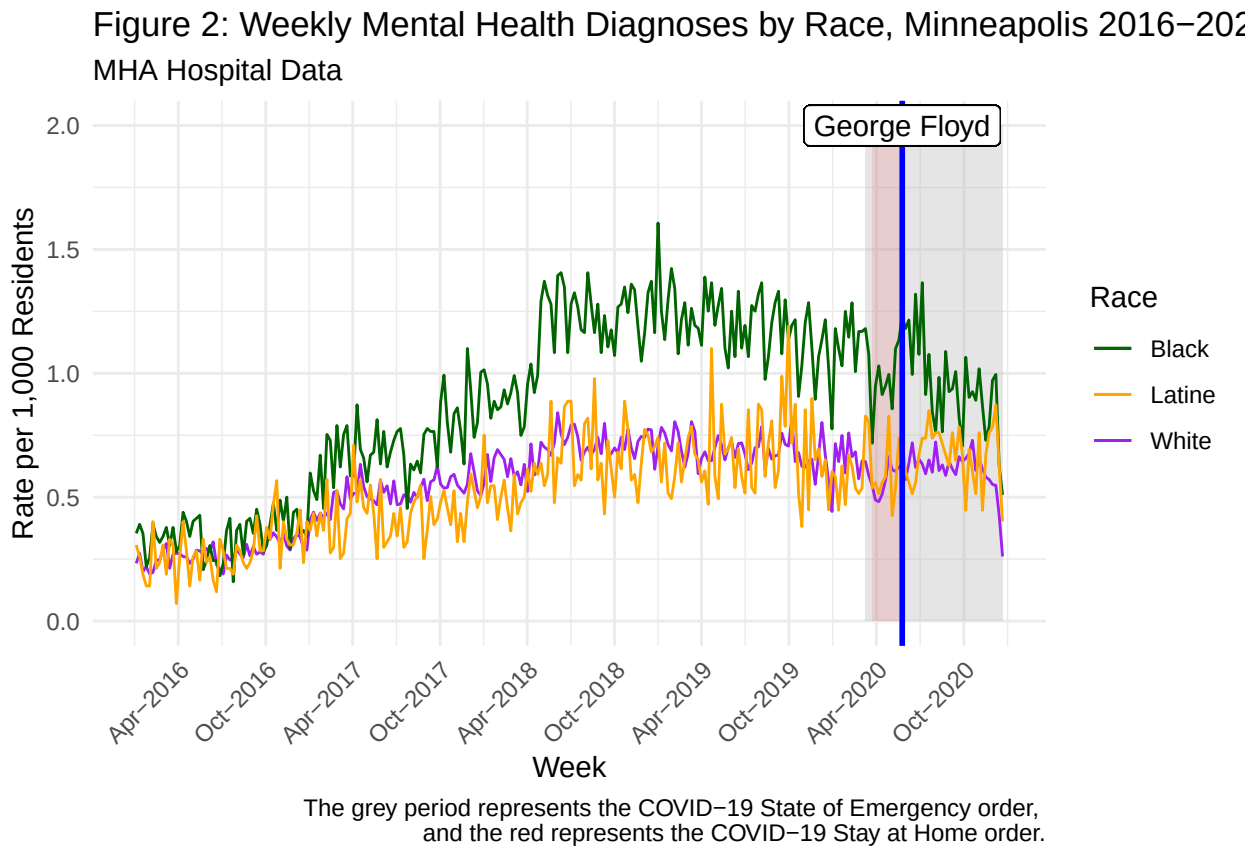
MHA Hospital Data



The grey period represents the COVID−19 State of Emergency order, and the red represents the COVID−19 Stay at Home order.

```
ggplot(series)+
  scale_x_date(date_labels = "%b-%Y", date_breaks = "6 months")+
   annotate(geom="rect",
    xmin = series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-03-13"))],
    xmax = series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-12-27"))],
    ymin = 0,
    ymax = 2,
    fill = "grey",
    alpha = .4) +
  annotate(geom="rect",
    xmin = series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-03-28"))],
    xmax = series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-05-18"))],
    ymin = 0,
    ymax = 2,
    fill = "Red",
    alpha = .1) +
  scale_fill_manual(values=c("grey","red"), labels=c("Stay at Home", "State of Emergency")) +
  geom_line(aes(x=begin_date, y=white_mh_incid_c, color = "White"))+
  geom_line(aes(x=begin_date, y=black_mh_incid_c, color = "Black"))+
  geom_line(aes(x=begin_date, y=latin_mh_incid_c, color = "Latine"))+
  geom_vline(xintercept=series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-05-25
             linetype="solid", color="blue", size=1) +
  geom_label(aes(x=series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-05-25"))],
                 y=2),
             label = "George Floyd", show.legend = FALSE)+
  labs(title = "Figure 2: Weekly Mental Health Diagnoses by Race, Minneapolis 2016-2020",
```

```
      subtitle = "MHA Hospital Data",
      x = "Week",
      y = "Rate per 1,000 Residents",
      fill = "MN COVID-19 Policy",
      color = "Race",
      caption = "The grey period represents the COVID-19 State of Emergency order,
      and the red represents the COVID-19 Stay at Home order.")+
  theme_minimal()+
    theme(axis.text.x=element_text(angle=45, hjust=1)) +
   scale_color_manual(values = c("darkgreen", "orange", "purple"))
```



Time Series Analysis

$$y_t = \beta_0 + \beta_1 Time_t + \theta Event_t + \beta_2 TimePost_t + \phi \mathbf{X}_t + \rho_1 y_{t-1} + \rho_2 y_{t-2} + \rho_3 y_{t-3} + \epsilon_t$$

```
series <- series %>%
  mutate(t = 1:length(mh_incid_c),
         post_floyd = as.factor(as.numeric(begin_date >= as.Date("2020-05-25"))),
         post_floyd_3 = as.factor(as.numeric(begin_date >= as.Date("2020-05-25")+months(3))),
         stay_at_home = as.factor(as.numeric(begin_date >= as.Date("2020-03-28") &
         state_of_emerg = as.factor(as.numeric(begin_date >= as.Date("2020-03-13"))),
         weeks_post = as.numeric(begin_date-as.Date("2020-05-25"))/7,
         t_post_floyd = ifelse(weeks_post >=0,
                               weeks_post,
                               0),
         uof_lag=lag(use_of_force_rate,1),
```

```
         stops_lag = lag(police_stop_rate,1),
         shoot_lag = lag(off_inv_shooting_rate,1))

mean(series$mh_incid_c[series$post_floyd==0 & series$weeks_post %in% c(-1, -2, -3, -4)])
```

```
## [1] 1.845131
```

```
mean(series$mh_incid_c[series$post_floyd==1 & series$weeks_post %in% c(0,1,2,3)])
```

```
## [1] 1.929959
```

```
mean(series$black_mh_incid_c[series$post_floyd==0 & series$weeks_post %in% c(-1, -2, -3, -4)])
```

```
## [1] 1.021377
```

```
mean(series$black_mh_incid_c[series$post_floyd==1 & series$weeks_post %in% c(0,1,2,3)])
```

```
## [1] 1.154474
```

```
mean(series$white_mh_incid_c[series$post_floyd==0 & series$weeks_post %in% c(-1, -2, -3, -4)])
```

```
## [1] 0.6247813
```

```
mean(series$white_mh_incid_c[series$post_floyd==1 & series$weeks_post %in% c(0,1,2,3)])
```

```
## [1] 0.6404627
```

```
mean(series$latin_mh_incid_c[series$post_floyd==0 & series$weeks_post %in% c(-1, -2, -3, -4)])
```

```
## [1] 0.6318638
```

```
mean(series$latin_mh_incid_c[series$post_floyd==1 & series$weeks_post %in% c(0,1,2,3)])
```

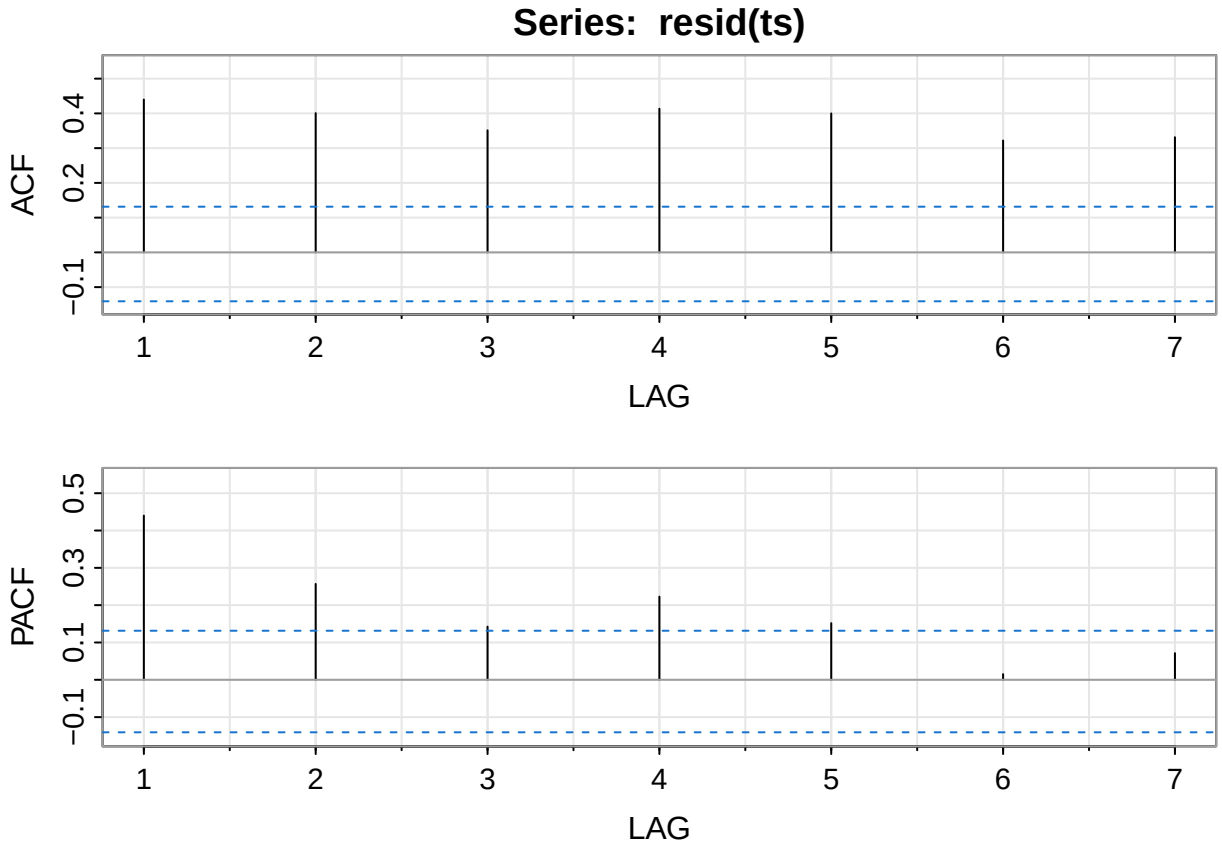
```
## [1] 0.5983135
```

```
ts <- lm(mh_incid_c~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
           tmax_f+snow_in+precip_in+
           uof_lag+stops_lag+shoot_lag,
                       data = series)
summary(ts)
```

```
##
## Call:
## lm(formula = mh_incid_c ~ t + state_of_emerg + stay_at_home +
##     post_floyd + t_post_floyd + tmax_f + snow_in + precip_in +
##     uof_lag + stops_lag + shoot_lag, data = series)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.74180 -0.06998  0.00004  0.08675  0.49258
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.090e+00  9.567e-02  21.845  < 2e-16 ***
## t                1.091e-04  3.045e-04   0.358 0.720385
## state_of_emerg1 -3.898e-01  9.412e-02  -4.141 5.06e-05 ***
## stay_at_home1   -9.756e-02  9.716e-02  -1.004 0.316495
## post_floyd1      9.963e-02  1.019e-01   0.977 0.329542
## t_post_floyd    -1.372e-02  3.525e-03  -3.893 0.000134 ***
```

```
## tmax_f           3.227e-03  6.547e-04   4.929 1.71e-06 ***
## snow_in          2.249e-02  2.845e-02   0.790 0.430197
## precip_in       -1.318e-01  9.986e-02  -1.320 0.188389
## uof_lag          3.454e-01  2.266e-01   1.524 0.129040
## stops_lag       -4.002e-02  3.732e-02  -1.072 0.284874
## shoot_lag       -1.344e+01  6.542e+00  -2.054 0.041213 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1515 on 204 degrees of freedom
##   (44 observations deleted due to missingness)
## Multiple R-squared:  0.5958, Adjusted R-squared:  0.574
## F-statistic: 27.34 on 11 and 204 DF,  p-value: < 2.2e-16
```

```
acf2(resid(ts), max.lag = 7)
```



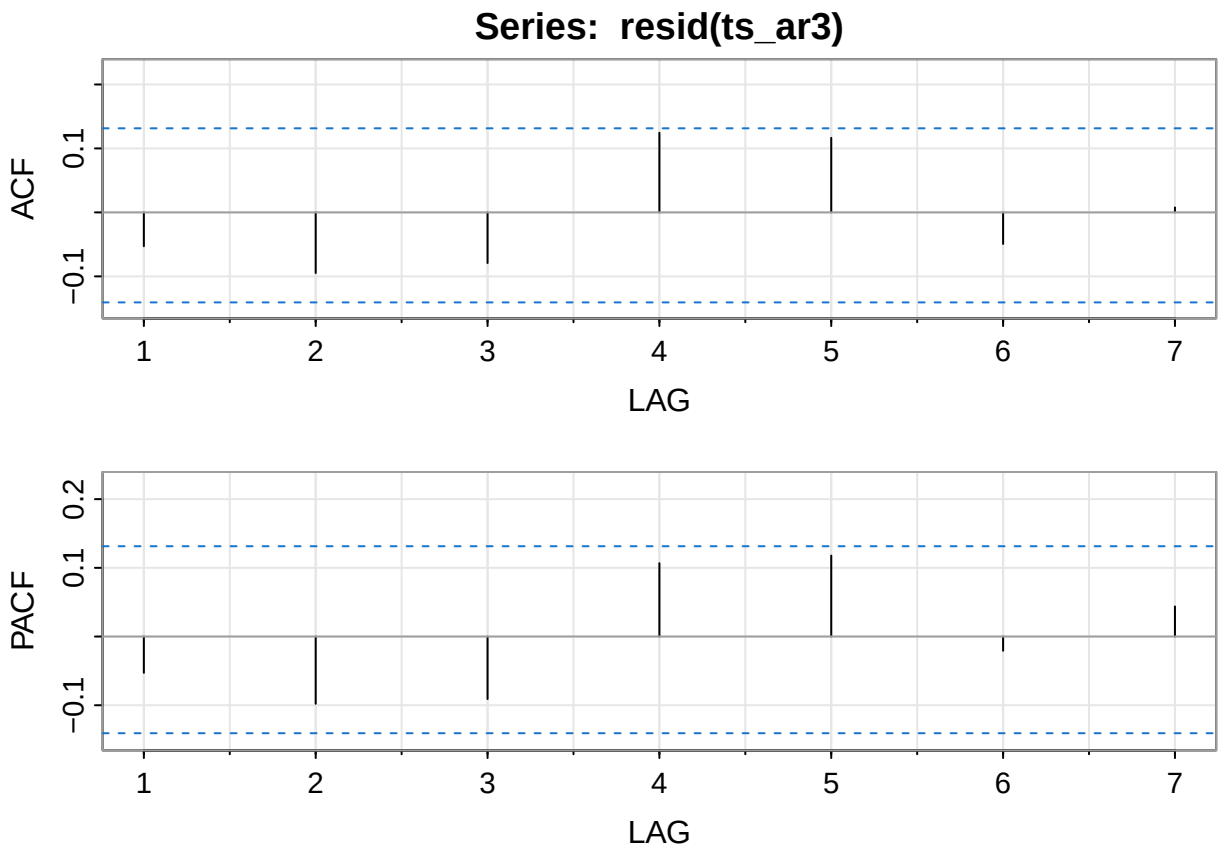

```
##      [,1] [,2] [,3] [,4] [,5] [,6] [,7]
## ACF  0.44 0.40 0.35 0.41 0.40 0.32 0.33
## PACF 0.44 0.26 0.14 0.22 0.15 0.02 0.07
```

```
ts_ar3<- lm(mh_incid_c~t+post_floyd+t_post_floyd+
              state_of_emerg+stay_at_home+
                          uof_lag+stops_lag+shoot_lag+
                         tmax_f+snow_in+precip_in+
                         dplyr::lag(mh_incid_c, 1)+ dplyr::lag(mh_incid_c, 2)+
             dplyr::lag(mh_incid_c, 3),
           data = series)
```

```r
summary(ts_ar3)
```

```
##
## Call:
## lm(formula = mh_incid_c ~ t + post_floyd + t_post_floyd + state_of_emerg +
##     stay_at_home + uof_lag + stops_lag + shoot_lag + tmax_f +
##     snow_in + precip_in + dplyr::lag(mh_incid_c, 1) + dplyr::lag(mh_incid_c,
##     2) + dplyr::lag(mh_incid_c, 3), data = series)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.47460 -0.07316  0.00035  0.06877  0.45214
##
## Coefficients:
##                               Estimate Std. Error t value Pr(>|t|)
## (Intercept)                  6.026e-01  1.763e-01   3.419 0.000761 ***
## t                           -8.530e-05  2.543e-04  -0.335 0.737660
## post_floyd1                  1.521e-01  8.530e-02   1.783 0.076035 .
## t_post_floyd                -9.641e-03  2.982e-03  -3.233 0.001432 **
## state_of_emerg1             -1.983e-01  8.114e-02  -2.444 0.015369 *
## stay_at_home1                6.598e-02  8.267e-02   0.798 0.425733
## uof_lag                      3.949e-01  1.899e-01   2.080 0.038777 *
## stops_lag                   -3.024e-02  3.122e-02  -0.969 0.333831
## shoot_lag                   -1.111e+01  5.476e+00  -2.029 0.043792 *
## tmax_f                       1.523e-03  5.772e-04   2.638 0.008983 **
## snow_in                      1.081e-02  2.382e-02   0.454 0.650417
## precip_in                   -2.597e-01  8.442e-02  -3.077 0.002385 **
## dplyr::lag(mh_incid_c, 1)    3.165e-01  6.910e-02   4.580 8.15e-06 ***
## dplyr::lag(mh_incid_c, 2)    2.676e-01  6.952e-02   3.849 0.000159 ***
## dplyr::lag(mh_incid_c, 3)    1.344e-01  6.850e-02   1.962 0.051191 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1261 on 201 degrees of freedom
##   (44 observations deleted due to missingness)
## Multiple R-squared:  0.7241, Adjusted R-squared:  0.7049
## F-statistic: 37.68 on 14 and 201 DF,  p-value: < 2.2e-16
```

```r
acf2(resid(ts_ar3), max.lag = 7)
```




```
##       [,1]  [,2]  [,3] [,4] [,5]  [,6] [,7]
## ACF  -0.05 -0.09 -0.08 0.12 0.12 -0.05 0.01
## PACF -0.05 -0.10 -0.09 0.11 0.12 -0.02 0.04
```

```
#race specific models

ts_ar3_white <- lm(white_mh_incid_c~t+post_floyd+t_post_floyd+
                     state_of_emerg+stay_at_home+
                          uof_lag+stops_lag+shoot_lag+
                         tmax_f+snow_in+precip_in+
                         dplyr::lag(white_mh_incid_c, 1)+ dplyr::lag(white_mh_incid_c, 2)+
                dplyr::lag(white_mh_incid_c, 3),
              data = series)
summary(ts_ar3_white)
```

```
##
## Call:
## lm(formula = white_mh_incid_c ~ t + post_floyd + t_post_floyd +
##     state_of_emerg + stay_at_home + uof_lag + stops_lag + shoot_lag +
##     tmax_f + snow_in + precip_in + dplyr::lag(white_mh_incid_c,
##     1) + dplyr::lag(white_mh_incid_c, 2) + dplyr::lag(white_mh_incid_c,
##     3), data = series)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.20534 -0.03435 -0.00292  0.03864  0.16128
##
```

```
## Coefficients:
##                                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)                      0.0583648  0.0430397   1.356  0.17660
## t                                0.0003492  0.0001858   1.880  0.06154 .
## post_floyd1                      0.0611223  0.0423438   1.443  0.15044
## t_post_floyd                    -0.0045809  0.0014674  -3.122  0.00206 **
## state_of_emerg1                 -0.0570625  0.0404843  -1.409  0.16023
## stay_at_home1                    0.0158191  0.0406328   0.389  0.69745
## uof_lag                          0.2325829  0.0952384   2.442  0.01547 *
## stops_lag                        0.0032765  0.0158027   0.207  0.83596
## shoot_lag                       -3.5962851  2.7322235  -1.316  0.18959
## tmax_f                           0.0004028  0.0002743   1.469  0.14346
## snow_in                          0.0115073  0.0118299   0.973  0.33186
## precip_in                       -0.0774247  0.0416193  -1.860  0.06430 .
## dplyr::lag(white_mh_incid_c, 1)  0.4580650  0.0696676   6.575 4.11e-10 ***
## dplyr::lag(white_mh_incid_c, 2)  0.1996833  0.0755440   2.643  0.00886 **
## dplyr::lag(white_mh_incid_c, 3)  0.1102985  0.0713478   1.546  0.12370
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.0628 on 201 degrees of freedom
##   (44 observations deleted due to missingness)
## Multiple R-squared:  0.711,  Adjusted R-squared:  0.6908
## F-statistic: 35.31 on 14 and 201 DF,  p-value: < 2.2e-16
```

```
ts_ar3_black <- lm(black_mh_incid_c~t+post_floyd+t_post_floyd+
                     state_of_emerg+stay_at_home+
                          uof_lag+stops_lag+shoot_lag+
                         tmax_f+snow_in+precip_in+
                         dplyr::lag(black_mh_incid_c, 1)+ dplyr::lag(black_mh_incid_c, 2)+
               dplyr::lag(black_mh_incid_c, 3),
             data = series)
summary(ts_ar3_black)
```

```
##
## Call:
## lm(formula = black_mh_incid_c ~ t + post_floyd + t_post_floyd +
##     state_of_emerg + stay_at_home + uof_lag + stops_lag + shoot_lag +
##     tmax_f + snow_in + precip_in + dplyr::lag(black_mh_incid_c,
##     1) + dplyr::lag(black_mh_incid_c, 2) + dplyr::lag(black_mh_incid_c,
##     3), data = series)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.36850 -0.09573  0.00568  0.08878  0.38651
##
## Coefficients:
##                                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)                      0.0141863  0.0889070   0.160  0.87339
## t                                0.0012463  0.0004333   2.877  0.00445 **
## post_floyd1                      0.2275118  0.0944478   2.409  0.01690 *
## t_post_floyd                    -0.0064742  0.0034013  -1.903  0.05841 .
## state_of_emerg1                 -0.2777338  0.0884739  -3.139  0.00195 **
## stay_at_home1                    0.1933975  0.0908916   2.128  0.03457 *
## uof_lag                          0.1002663  0.2101135   0.477  0.63374
```

```
## stops_lag                         0.0401415  0.0347963   1.154  0.25003
## shoot_lag                         0.9357288  6.0406071   0.155  0.87705
## tmax_f                            0.0002127  0.0006120   0.348  0.72850
## snow_in                          -0.0015209  0.0262945  -0.058  0.95393
## precip_in                        -0.1546230  0.0919942  -1.681  0.09436 .
## dplyr::lag(black_mh_incid_c, 1)   0.3404288  0.0687366   4.953 1.55e-06 ***
## dplyr::lag(black_mh_incid_c, 2)   0.1746462  0.0712275   2.452  0.01506 *
## dplyr::lag(black_mh_incid_c, 3)   0.2304896  0.0691261   3.334  0.00102 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1396 on 201 degrees of freedom
##   (44 observations deleted due to missingness)
## Multiple R-squared:  0.7485, Adjusted R-squared:  0.731
## F-statistic: 42.73 on 14 and 201 DF,  p-value: < 2.2e-16
```

```
ts_ar3_latin <- lm(latin_mh_incid_c~t+post_floyd+t_post_floyd+
                     state_of_emerg+stay_at_home+
                          uof_lag+stops_lag+shoot_lag+
                         tmax_f+snow_in+precip_in+
                         dplyr::lag(latin_mh_incid_c, 1)+ dplyr::lag(latin_mh_incid_c, 2)+
                dplyr::lag(latin_mh_incid_c, 3),
              data = series)
summary(ts_ar3_latin)
```

```
##
## Call:
## lm(formula = latin_mh_incid_c ~ t + post_floyd + t_post_floyd +
##     state_of_emerg + stay_at_home + uof_lag + stops_lag + shoot_lag +
##     tmax_f + snow_in + precip_in + dplyr::lag(latin_mh_incid_c,
##     1) + dplyr::lag(latin_mh_incid_c, 2) + dplyr::lag(latin_mh_incid_c,
##     3), data = series)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.32627 -0.08952 -0.00498  0.07227  0.46747
##
## Coefficients:
##                                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)                       0.1212575  0.0888653   1.365   0.1739
## t                                 0.0015661  0.0003621   4.325  2.4e-05 ***
## post_floyd1                       0.0220082  0.0922099   0.239   0.8116
## t_post_floyd                     -0.0010224  0.0031846  -0.321   0.7485
## state_of_emerg1                  -0.0957676  0.0853273  -1.122   0.2631
## stay_at_home1                    -0.0254365  0.0884428  -0.288   0.7739
## uof_lag                          -0.0604641  0.2052003  -0.295   0.7686
## stops_lag                         0.0244754  0.0338034   0.724   0.4699
## shoot_lag                        -0.7411583  5.9017391  -0.126   0.9002
## tmax_f                            0.0006496  0.0005993   1.084   0.2797
## snow_in                          -0.0166330  0.0258945  -0.642   0.5214
## precip_in                        -0.0139139  0.0906619  -0.153   0.8782
## dplyr::lag(latin_mh_incid_c, 1)   0.0759002  0.0708414   1.071   0.2853
## dplyr::lag(latin_mh_incid_c, 2)   0.1220236  0.0705143   1.730   0.0851 .
## dplyr::lag(latin_mh_incid_c, 3)   0.1010719  0.0706985   1.430   0.1544
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1366 on 201 degrees of freedom
##   (44 observations deleted due to missingness)
## Multiple R-squared:  0.395,  Adjusted R-squared:  0.3529
## F-statistic: 9.373 on 14 and 201 DF,  p-value: 8.539e-16
```

```
ts_ar3_indig <- lm(indig_mh_incid_c~t+post_floyd+t_post_floyd+
                     state_of_emerg+stay_at_home+
                          uof_lag+stops_lag+shoot_lag+
                         tmax_f+snow_in+precip_in+
                         dplyr::lag(indig_mh_incid_c, 1)+ dplyr::lag(indig_mh_incid_c, 2)+
               dplyr::lag(indig_mh_incid_c, 3),
             data = series)
summary(ts_ar3_indig)
```

```
##
## Call:
## lm(formula = indig_mh_incid_c ~ t + post_floyd + t_post_floyd +
##     state_of_emerg + stay_at_home + uof_lag + stops_lag + shoot_lag +
##     tmax_f + snow_in + precip_in + dplyr::lag(indig_mh_incid_c,
##     1) + dplyr::lag(indig_mh_incid_c, 2) + dplyr::lag(indig_mh_incid_c,
##     3), data = series)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.94493 -0.48732 -0.03297  0.41472  2.16175
##
## Coefficients:
##                                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)                        0.091617   0.511596   0.179 0.858055
## t                                  0.011116   0.002409   4.613 7.05e-06 ***
## post_floyd1                       -0.005883   0.542891  -0.011 0.991364
## t_post_floyd                      -0.028015   0.019477  -1.438 0.151886
## state_of_emerg1                   -1.078173   0.512933  -2.102 0.036801 *
## stay_at_home1                      0.615417   0.517587   1.189 0.235838
## uof_lag                            1.068696   1.219766   0.876 0.381995
## stops_lag                          0.129703   0.205592   0.631 0.528838
## shoot_lag                        -20.852896  34.969339  -0.596 0.551633
## tmax_f                             0.012843   0.003693   3.478 0.000619 ***
## snow_in                           -0.097473   0.152010  -0.641 0.522102
## precip_in                         -0.297496   0.534246  -0.557 0.578248
## dplyr::lag(indig_mh_incid_c, 1)    0.088732   0.070461   1.259 0.209381
## dplyr::lag(indig_mh_incid_c, 2)    0.003019   0.071388   0.042 0.966307
## dplyr::lag(indig_mh_incid_c, 3)    0.102202   0.070032   1.459 0.146026
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8054 on 201 degrees of freedom
##   (44 observations deleted due to missingness)
## Multiple R-squared:  0.4717, Adjusted R-squared:  0.4349
## F-statistic: 12.82 on 14 and 201 DF,  p-value: < 2.2e-16
```

```
ts_ar3_asian <- lm(asian_mh_incid_c~t+post_floyd+t_post_floyd+
                     state_of_emerg+stay_at_home+
```

```
                         uof_lag+stops_lag+shoot_lag+
                        tmax_f+snow_in+precip_in+
                        dplyr::lag(asian_mh_incid_c, 1)+ dplyr::lag(asian_mh_incid_c, 2)+
               dplyr::lag(asian_mh_incid_c, 3),
             data = series)
summary(ts_ar3_asian)
```

```
##
## Call:
## lm(formula = asian_mh_incid_c ~ t + post_floyd + t_post_floyd +
##     state_of_emerg + stay_at_home + uof_lag + stops_lag + shoot_lag +
##     tmax_f + snow_in + precip_in + dplyr::lag(asian_mh_incid_c,
##     1) + dplyr::lag(asian_mh_incid_c, 2) + dplyr::lag(asian_mh_incid_c,
##     3), data = series)
##
## Residuals:
##       Min        1Q    Median        3Q       Max
## -0.178998 -0.056140 -0.002342  0.054363  0.249322
##
## Coefficients:
##                                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)                       0.0893138  0.0508908   1.755 0.080781 .
## t                                 0.0006955  0.0001904   3.652 0.000332 ***
## post_floyd1                       0.0377839  0.0555733   0.680 0.497354
## t_post_floyd                     -0.0011112  0.0018789  -0.591 0.554914
## state_of_emerg1                  -0.1012373  0.0526218  -1.924 0.055784 .
## stay_at_home1                     0.0830828  0.0526227   1.579 0.115945
## uof_lag                           0.0032839  0.1202325   0.027 0.978238
## stops_lag                        -0.0059968  0.0198598  -0.302 0.762996
## shoot_lag                        -3.9811684  3.4672731  -1.148 0.252245
## tmax_f                            0.0003519  0.0003468   1.015 0.311359
## snow_in                          -0.0011587  0.0151301  -0.077 0.939033
## precip_in                        -0.0309254  0.0528962  -0.585 0.559443
## dplyr::lag(asian_mh_incid_c, 1)   0.0299524  0.0713825   0.420 0.675223
## dplyr::lag(asian_mh_incid_c, 2)   0.0269270  0.0709786   0.379 0.704815
## dplyr::lag(asian_mh_incid_c, 3) -0.0795650  0.0714834  -1.113 0.267014
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.08022 on 201 degrees of freedom
##   (44 observations deleted due to missingness)
## Multiple R-squared:  0.1816, Adjusted R-squared:  0.1246
## F-statistic: 3.185 on 14 and 201 DF,  p-value: 0.0001513
```

```
stargazer(ts_ar3, ts_ar3_white, ts_ar3_black, ts_ar3_latin,
          title = "Interrupted Time Series Models of Mental Health Diagnoses, Minneapolis 2016-2020",
          covariate.labels = c("T",
                               "Post-Killing", "T Post-Killing",
                               "COVID - State of Emerg.", "COVID - Stay at Home",
                               "MPD Use of Force t-1", "MPD Stops t-1",
                               "MPD OIS t-1",
                               "Mean Max. Temp.", "Snow (in.)", "Precip. (in.)",
                               "AR(1) Overall", "AR(2) Overall", "AR(3) Overall",
                               "AR(1) White", "AR(2) White", "AR(3) White",
```

```
                                "AR(1) Black", "AR(2) Black", "AR(3) Black",
                                "AR(1) Latine", "AR(2) Latine", "AR(3) Latine"),
          dep.var.caption = "Mental Health Diagnoses/1,000",
          dep.var.labels.include = FALSE,
          column.labels = c("Overall", "White", "Black", "Latine"),
          model.numbers = TRUE,
          single.row = FALSE,
          align = T,
          omit.stat = c("adj.rsq", "f"),
          font.size="footnotesize", no.space = T, column.sep.width = "1pt",
          #star.cutoffs = c(.05, .01, .001), star.char = c("*","**","***"),
          report = "vcs",
          ci=TRUE,
          ci.level=0.95,
          ci.separator = "|",
          notes = "95\\% Confidence Intervals in parentheses",
          header = F,
          notes.append = F)
```

ZCTA-Week Level Analysis

Panel Analysis

```
panel <- panel %>%
  mutate(black_pop_center = scale(black_pop, center = T, scale = T),
         post_floyd = as.factor(post_floyd),
         stay_at_home = as.factor(stay_at_home),
         state_of_emerg = as.factor(state_of_emerg),
         mh_rate = mh_all_tot/total_pop*1000,
         blk_mh_rate = black_mh_all_tot/black_pop*1000,
         white_mh_rate = white_mh_all_tot/white_pop*1000,
         latin_mh_rate = latin_mh_all_tot/hisp_pop*1000)

#CFA: CD
library(lavaan)

cd_model_1  <- ' cd =~ unemp_rate + pov_rate +  female_hh_rate + no_hs_dip_rate + black_pop
                 black_pop ~~ unemp_rate'

cfa_cd <- cfa(cd_model_1, data = panel, std.lv = T)
```

```
## Warning in lav_data_full(data = data, group = group, cluster = cluster, :
## lavaan WARNING: some observed variances are (at least) a factor 1000 times
## larger than others; use varTable(fit) to investigate
```

```
## Warning in lav_data_full(data = data, group = group, cluster = cluster, : lavaan WARNING: some obser
##   lavaan NOTE: use varTable(fit) to investigate
```

```
modificationindices(cfa_cd)
```

```
##              lhs op            rhs      mi    epc sepc.lv sepc.all sepc.nox
## 13     unemp_rate ~~       pov_rate   6.692  1.221   1.221    0.035    0.035
## 14     unemp_rate ~~ female_hh_rate  98.234 -0.805  -0.805   -0.196   -0.196
## 15     unemp_rate ~~ no_hs_dip_rate  77.525  1.305   1.305    0.148    0.148
```

Table 1: Interrupted Time Series Models of Mental Health Diagnoses, Minneapolis 2016-2020

	Mental Health Diagnoses/1,000			
	Overall	White	Black	Latine
	(1)	(2)	(3)	(4)
T	−0.0001	0.0003	0.001	0.002
	(-0.001|0.0004)	(-0.00001|0.001)	(0.0004|0.002)	(0.001|0.002)
Post-Killing	0.152	0.061	0.228	0.022
	(-0.015|0.319)	(-0.022|0.144)	(0.042|0.413)	(-0.159|0.203)
T Post-Killing	−0.010	−0.005	−0.006	−0.001
	(-0.015|-0.004)	(-0.007|-0.002)	(-0.013|0.0002)	(-0.007|0.005)
COVID - State of Emerg.	−0.198	−0.057	−0.278	−0.096
	(-0.357|-0.039)	(-0.136|0.022)	(-0.451|-0.104)	(-0.263|0.071)
COVID - Stay at Home	0.066	0.016	0.193	−0.025
	(-0.096|0.228)	(-0.064|0.095)	(0.015|0.372)	(-0.199|0.148)
MPD Use of Force t-1	0.395	0.233	0.100	−0.060
	(0.023|0.767)	(0.046|0.419)	(-0.312|0.512)	(-0.463|0.342)
MPD Stops t-1	−0.030	0.003	0.040	0.024
	(-0.091|0.031)	(-0.028|0.034)	(-0.028|0.108)	(-0.042|0.091)
MPD OIS t-1	−11.110	−3.596	0.936	−0.741
	(-21.844|-0.377)	(-8.951|1.759)	(-10.904|12.775)	(-12.308|10.826)
Mean Max. Temp.	0.002	0.0004	0.0002	0.001
	(0.0004|0.003)	(-0.0001|0.001)	(-0.001|0.001)	(-0.001|0.002)
Snow (in.)	0.011	0.012	−0.002	−0.017
	(-0.036|0.057)	(-0.012|0.035)	(-0.053|0.050)	(-0.067|0.034)
Precip. (in.)	−0.260	−0.077	−0.155	−0.014
	(-0.425|-0.094)	(-0.159|0.004)	(-0.335|0.026)	(-0.192|0.164)
AR(1) Overall	0.316			
	(0.181|0.452)			
AR(2) Overall	0.268			
	(0.131|0.404)			
AR(3) Overall	0.134			
	(0.0001|0.269)			
AR(1) White		0.458		
		(0.322|0.595)		
AR(2) White		0.200		
		(0.052|0.348)		
AR(3) White		0.110		
		(-0.030|0.250)		
AR(1) Black			0.340	
			(0.206|0.475)	
AR(2) Black			0.175	
			(0.035|0.314)	
AR(3) Black			0.230	
			(0.095|0.366)	
AR(1) Latine				0.076
				(-0.063|0.215)
AR(2) Latine				0.122
				(-0.016|0.260)
AR(3) Latine				0.101
				(-0.037|0.240)
Constant	0.603	0.058	0.014	0.121
	(0.257|0.948)	(-0.026|0.143)	(-0.160|0.188)	(-0.053|0.295)
Observations	216	216	216	216
R^2	0.724	0.711	0.749	0.395
Residual Std. Error (df = 201)	0.126	0.063	0.140	0.137

Note: 95% Confidence Intervals in parentheses

```
## 16       pov_rate ~~ female_hh_rate 667.761 -4.369  -4.369   -0.422   -0.422
## 17       pov_rate ~~ no_hs_dip_rate 592.734  8.179   8.179    0.369    0.369
## 19 female_hh_rate ~~ no_hs_dip_rate  13.188  0.339   0.339    0.128    0.128
```

```
summary(cfa_cd, fit.measures=TRUE, standardized = T)
```

```
## lavaan 0.6.15 ended normally after 47 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of model parameters                        11
##
##   Number of observations                          5742
##
## Model Test User Model:
##
##   Test statistic                              1186.074
##   Degrees of freedom                                 4
##   P-value (Chi-square)                           0.000
##
## Model Test Baseline Model:
##
##   Test statistic                             15500.990
##   Degrees of freedom                                10
##   P-value                                        0.000
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                    0.924
##   Tucker-Lewis Index (TLI)                       0.809
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)            -115690.433
##   Loglikelihood unrestricted model (H1)    -115097.396
##
##   Akaike (AIC)                              231402.865
##   Bayesian (BIC)                            231476.076
##   Sample-size adjusted Bayesian (SABIC)     231441.122
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.227
##   90 Percent confidence interval - lower         0.216
##   90 Percent confidence interval - upper         0.238
##   P-value H_0: RMSEA <= 0.050                    0.000
##   P-value H_0: RMSEA >= 0.080                    1.000
##
## Standardized Root Mean Square Residual:
##
##   SRMR                                           0.049
##
## Parameter Estimates:
##
##   Standard errors                             Standard
```

```
##   Information                                 Expected
##   Information saturated (h1) model          Structured
##
## Latent Variables:
##                    Estimate     Std.Err   z-value  P(>|z|)   Std.lv     Std.all
##   cd =~
##     unemp_rate          1.834     0.056   32.752    0.000       1.834    0.444
##     pov_rate            5.673     0.139   40.859    0.000       5.673    0.520
##     female_hh_rate      1.925     0.024   80.082    0.000       1.925    0.866
##     no_hs_dip_rate      3.434     0.046   74.115    0.000       3.434    0.822
##     black_pop        3606.213    40.331   89.416    0.000    3606.213    0.930
##
## Covariances:
##                    Estimate     Std.Err   z-value  P(>|z|)   Std.lv     Std.all
##  .unemp_rate ~~
##    .black_pop         422.838   109.450    3.863    0.000     422.838    0.080
##
## Variances:
##                    Estimate     Std.Err   z-value  P(>|z|)   Std.lv     Std.all
##    .unemp_rate          13.712     0.268   51.234    0.000      13.712    0.803
##    .pov_rate            86.768     1.673   51.873    0.000      86.768    0.729
##    .female_hh_rate       1.233     0.034   36.717    0.000       1.233    0.250
##    .no_hs_dip_rate       5.657     0.132   42.766    0.000       5.657    0.324
##    .black_pop      2047184.631 92832.942   22.052    0.000 2047184.631    0.136
##     cd                    1.000                                 1.000    1.000
```

```
cd_predict <- as.vector(lavPredict(cfa_cd, newdata = as.data.frame(panel)))
panel$conc_dis <- cd_predict
```

$$y_{ti} = \beta_{0i} + \beta_1 Time_t + \theta_i Event_t + \beta_2 TimePost_t + \phi \mathbf{X}_{ti} + \rho_1 y_{t-1} + \rho_2 y_{t-2} + \rho_3 y_{t-3} + \epsilon_{ti}$$

$$\beta_{0i} = \gamma_{00} + u_{0i}$$

$$\theta_i = \gamma_{10} + u_i$$

```
#random effects specifications
library(lme4)
library(lmerTest)

#RE random coefficient model
re <- lmer(mh_rate~t+post_floyd+t_post_floyd+
                        state_of_emerg+stay_at_home+
                         uof_lag+stops_lag+shoot_lag+
                        tmax_f+snow_in+precip_in+
             conc_dis+
              dplyr::lag(mh_rate, 1)+ dplyr::lag(mh_rate, 2)+
               dplyr::lag(mh_rate, 3)+
                       (post_floyd|zcta), data = panel)
```

```
## Warning: Some predictor variables are on very different scales: consider
## rescaling

## Warning: Some predictor variables are on very different scales: consider
## rescaling
```

```
summary(re)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula:
## mh_rate ~ t + post_floyd + t_post_floyd + state_of_emerg + stay_at_home +
##     uof_lag + stops_lag + shoot_lag + tmax_f + snow_in + precip_in +
##     conc_dis + dplyr::lag(mh_rate, 1) + dplyr::lag(mh_rate, 2) +
##     dplyr::lag(mh_rate, 3) + (post_floyd | zcta)
##    Data: panel
##
## REML criterion at convergence: 19403.6
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -11.1733  -0.1857  -0.0051   0.1692  15.0710
##
## Random effects:
##  Groups   Name        Variance Std.Dev. Corr
##  zcta     (Intercept) 16.204   4.025
##           post_floyd1  2.026   1.423    -1.00
##  Residual              2.152   1.467
## Number of obs: 5320, groups:  zcta, 22
##
## Fixed effects:
##                            Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)              2.861e+00  8.643e-01  2.147e+01   3.310  0.00326 **
## t                        7.629e-04  3.574e-04  4.886e+03   2.134  0.03285 *
## post_floyd1             -1.845e-01  3.712e-01  4.190e+01  -0.497  0.62174
## t_post_floyd            -3.707e-02  6.749e-03  5.279e+03  -5.492 4.16e-08 ***
## state_of_emerg1         -1.378e-01  2.012e-01  5.259e+03  -0.685  0.49356
## stay_at_home1           -5.033e-01  2.094e-01  5.261e+03  -2.404  0.01626 *
## uof_lag                 -6.569e-02  1.013e-02  5.280e+03  -6.482 9.84e-11 ***
## stops_lag                7.822e-03  4.799e-03  5.266e+03   1.630  0.10318
## shoot_lag               -3.098e+00  2.505e+00  5.283e+03  -1.237  0.21618
## tmax_f                   3.528e-03  1.182e-03  5.255e+03   2.984  0.00286 **
## snow_in                  9.525e-02  5.722e-02  5.254e+03   1.664  0.09608 .
## precip_in                3.351e-02  1.957e-01  5.256e+03   0.171  0.86403
## conc_dis                -1.608e-01  1.354e-01  2.250e+01  -1.188  0.24723
## dplyr::lag(mh_rate, 1) -8.160e-04  1.365e-02  5.304e+03  -0.060  0.95234
## dplyr::lag(mh_rate, 2)  3.758e-03  1.141e-02  5.286e+03   0.329  0.74195
## dplyr::lag(mh_rate, 3)  1.301e-02  1.140e-02  5.285e+03   1.141  0.25383
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
```

```
re_blk <- lmer(blk_mh_rate~t+post_floyd+t_post_floyd+
                         state_of_emerg+stay_at_home+
                          uof_lag+stops_lag+shoot_lag+
                         tmax_f+snow_in+precip_in+
             conc_dis+
              dplyr::lag(blk_mh_rate, 1)+ dplyr::lag(blk_mh_rate, 2)+
               dplyr::lag(blk_mh_rate, 3)+
                       (post_floyd|zcta), data = panel)
```

```
## Warning: Some predictor variables are on very different scales: consider
```

```
## rescaling

## Warning: Some predictor variables are on very different scales: consider
## rescaling
```

```
summary(re_blk)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: blk_mh_rate ~ t + post_floyd + t_post_floyd + state_of_emerg +
##     stay_at_home + uof_lag + stops_lag + shoot_lag + tmax_f +
##     snow_in + precip_in + conc_dis + dplyr::lag(blk_mh_rate,
##     1) + dplyr::lag(blk_mh_rate, 2) + dplyr::lag(blk_mh_rate,
##     3) + (post_floyd | zcta)
##    Data: panel
##
## REML criterion at convergence: 29185.6
##
## Scaled residuals:
##    Min     1Q Median     3Q    Max
## -2.683 -0.146 -0.021  0.088 35.992
##
## Random effects:
##  Groups   Name        Variance Std.Dev. Corr
##  zcta     (Intercept)  2.282   1.511
##           post_floyd1  1.559   1.249    -0.54
##  Residual             13.736   3.706
## Number of obs: 5320, groups:  zcta, 22
##
## Fixed effects:
##                               Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)                  7.565e-01  3.822e-01  2.762e+01   1.979  0.05783
## t                            5.833e-03  9.135e-04  5.138e+03   6.385 1.86e-10
## post_floyd1                  2.918e+00  6.045e-01  1.942e+02   4.827 2.80e-06
## t_post_floyd                -7.239e-02  1.707e-02  5.278e+03  -4.241 2.26e-05
## state_of_emerg1             -2.499e+00  5.085e-01  5.249e+03  -4.914 9.20e-07
## stay_at_home1                2.277e+00  5.285e-01  5.249e+03   4.309 1.67e-05
## uof_lag                     -9.975e-02  2.496e-02  3.188e+03  -3.996 6.58e-05
## stops_lag                    2.348e-02  1.159e-02  1.384e+03   2.027  0.04290
## shoot_lag                   -1.464e+00  6.414e+00  5.267e+03  -0.228  0.81951
## tmax_f                      -1.128e-03  2.984e-03  5.247e+03  -0.378  0.70540
## snow_in                     -1.148e-01  1.445e-01  5.245e+03  -0.795  0.42687
## precip_in                   -3.439e-01  4.946e-01  5.246e+03  -0.695  0.48689
## conc_dis                    -8.979e-01  2.716e-01  2.227e+01  -3.306  0.00318
## dplyr::lag(blk_mh_rate, 1) -8.113e-03  1.382e-02  5.304e+03  -0.587  0.55710
## dplyr::lag(blk_mh_rate, 2)  1.881e-02  1.313e-02  5.300e+03   1.433  0.15204
## dplyr::lag(blk_mh_rate, 3)  6.402e-03  1.311e-02  5.298e+03   0.488  0.62531
##
## (Intercept)                 .
## t                           ***
## post_floyd1                 ***
## t_post_floyd                ***
## state_of_emerg1             ***
## stay_at_home1               ***
## uof_lag                     ***
```

```
## stops_lag                   *
## shoot_lag
## tmax_f
## snow_in
## precip_in
## conc_dis                    **
## dplyr::lag(blk_mh_rate, 1)
## dplyr::lag(blk_mh_rate, 2)
## dplyr::lag(blk_mh_rate, 3)
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
```

```
re_white <- lmer(white_mh_rate~t+post_floyd+t_post_floyd+
                         state_of_emerg+stay_at_home+
                          uof_lag+stops_lag+shoot_lag+
                         tmax_f+snow_in+precip_in+
             conc_dis+
              dplyr::lag(white_mh_rate, 1)+ dplyr::lag(white_mh_rate, 2)+
               dplyr::lag(white_mh_rate, 3)+
                       (post_floyd|zcta), data = panel)
```

```
## Warning: Some predictor variables are on very different scales: consider
## rescaling

## Warning: Some predictor variables are on very different scales: consider
## rescaling
```

```
summary(re_white)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: white_mh_rate ~ t + post_floyd + t_post_floyd + state_of_emerg +
##     stay_at_home + uof_lag + stops_lag + shoot_lag + tmax_f +
##     snow_in + precip_in + conc_dis + dplyr::lag(white_mh_rate,
##     1) + dplyr::lag(white_mh_rate, 2) + dplyr::lag(white_mh_rate,
##     3) + (post_floyd | zcta)
##    Data: panel
##
## REML criterion at convergence: 11251.2
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -5.7724 -0.2816 -0.0224  0.2272 20.2499
##
## Random effects:
##  Groups   Name        Variance Std.Dev. Corr
##  zcta     (Intercept) 0.65634  0.8101
##           post_floyd1 0.01115  0.1056   0.14
##  Residual             0.46525  0.6821
## Number of obs: 5320, groups:  zcta, 22
##
## Fixed effects:
##                               Estimate Std. Error         df t value Pr(>|t|)
```

```
## (Intercept)                   3.337e-01  1.770e-01  1.557e+01   1.886 0.078122
## t                             2.856e-03  1.828e-04  4.962e+03  15.624  < 2e-16
## post_floyd1                  -2.101e-03  1.021e-01  8.315e+02  -0.021 0.983586
## t_post_floyd                 -1.303e-02  3.125e-03  5.277e+03  -4.170 3.09e-05
## state_of_emerg1              -1.849e-01  9.365e-02  5.242e+03  -1.975 0.048358
## stay_at_home1                -8.914e-02  9.725e-02  5.244e+03  -0.917 0.359403
## uof_lag                      -2.896e-02  4.692e-03  5.200e+03  -6.172 7.25e-10
## stops_lag                     8.292e-03  2.190e-03  3.531e+03   3.786 0.000155
## shoot_lag                    -1.567e+00  1.166e+00  5.272e+03  -1.345 0.178829
## tmax_f                        7.334e-04  5.497e-04  5.239e+03   1.334 0.182209
## snow_in                       1.227e-04  2.659e-02  5.238e+03   0.005 0.996319
## precip_in                    -6.866e-02  9.100e-02  5.241e+03  -0.754 0.450611
## conc_dis                     -5.142e-01  9.977e-02  1.110e+02  -5.154 1.12e-06
## dplyr::lag(white_mh_rate, 1) -4.577e-03  1.361e-02  5.289e+03  -0.336 0.736714
## dplyr::lag(white_mh_rate, 2)  4.465e-02  1.061e-02  5.252e+03   4.210 2.60e-05
## dplyr::lag(white_mh_rate, 3)  7.406e-03  1.061e-02  5.256e+03   0.698 0.485171
##
## (Intercept)                  .
## t                            ***
## post_floyd1
## t_post_floyd                 ***
## state_of_emerg1              *
## stay_at_home1
## uof_lag                      ***
## stops_lag                    ***
## shoot_lag
## tmax_f
## snow_in
## precip_in
## conc_dis                     ***
## dplyr::lag(white_mh_rate, 1)
## dplyr::lag(white_mh_rate, 2) ***
## dplyr::lag(white_mh_rate, 3)
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
```

```
re_latin <- lmer(latin_mh_rate~t+post_floyd+t_post_floyd+
                         state_of_emerg+stay_at_home+
                          uof_lag+stops_lag+shoot_lag+
                         tmax_f+snow_in+precip_in+
             conc_dis+
              dplyr::lag(latin_mh_rate, 1)+ dplyr::lag(latin_mh_rate, 2)+
               dplyr::lag(latin_mh_rate, 3)+
                       (post_floyd|zcta), data = panel)
```

```
## Warning: Some predictor variables are on very different scales: consider
## rescaling

## Warning: Some predictor variables are on very different scales: consider
## rescaling
```

```
summary(re_latin)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: latin_mh_rate ~ t + post_floyd + t_post_floyd + state_of_emerg +
##     stay_at_home + uof_lag + stops_lag + shoot_lag + tmax_f +
##     snow_in + precip_in + conc_dis + dplyr::lag(latin_mh_rate,
##     1) + dplyr::lag(latin_mh_rate, 2) + dplyr::lag(latin_mh_rate,
##     3) + (post_floyd | zcta)
##    Data: panel
##
## REML criterion at convergence: 37187.8
##
## Scaled residuals:
##    Min     1Q Median     3Q    Max
## -3.485 -0.087 -0.011  0.057 62.356
##
## Random effects:
##  Groups   Name        Variance Std.Dev. Corr
##  zcta     (Intercept)  1.7293  1.3150
##           post_floyd1  0.2414  0.4913   -1.00
##  Residual             79.1055  8.8941
## Number of obs: 5150, groups:  zcta, 22
##
## Fixed effects:
##                                 Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)                   -5.464e-02  5.806e-01  2.009e+02  -0.094  0.92511
## t                              6.866e-03  2.225e-03  5.131e+03   3.086  0.00204
## post_floyd1                   -3.447e-01  1.301e+00  3.951e+03  -0.265  0.79101
## t_post_floyd                   2.681e-02  4.059e-02  5.114e+03   0.661  0.50885
## state_of_emerg1               -9.535e-01  1.221e+00  5.117e+03  -0.781  0.43476
## stay_at_home1                  6.466e-02  1.268e+00  5.113e+03   0.051  0.95933
## uof_lag                        8.599e-01  9.095e-02  4.460e+03   9.454  < 2e-16
## stops_lag                     -1.163e-02  2.992e-02  1.064e+02  -0.389  0.69834
## shoot_lag                     -8.867e+00  1.530e+01  5.119e+03  -0.579  0.56235
## tmax_f                        -5.510e-03  7.270e-03  5.119e+03  -0.758  0.44856
## snow_in                       -5.237e-01  3.498e-01  5.113e+03  -1.497  0.13447
## precip_in                      6.403e+00  1.214e+00  5.116e+03   5.274 1.39e-07
## conc_dis                      -4.225e-01  2.952e-01  1.986e+01  -1.431  0.16794
## dplyr::lag(latin_mh_rate, 1) -6.657e-03  1.381e-02  5.083e+03  -0.482  0.62995
## dplyr::lag(latin_mh_rate, 2) -1.148e-02  1.308e-02  5.094e+03  -0.878  0.38007
## dplyr::lag(latin_mh_rate, 3) -6.900e-03  1.307e-02  5.094e+03  -0.528  0.59766
##
## (Intercept)
## t                             **
## post_floyd1
## t_post_floyd
## state_of_emerg1
## stay_at_home1
## uof_lag                       ***
## stops_lag
## shoot_lag
## tmax_f
## snow_in
```

```
## precip_in                    ***
## conc_dis
## dplyr::lag(latin_mh_rate, 1)
## dplyr::lag(latin_mh_rate, 2)
## dplyr::lag(latin_mh_rate, 3)
## ---
## 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 (nloptwrap) convergence code: 0 (OK)
## boundary (singular) fit: see help('isSingular')
```

```r
#extract random coefficients
re_pf_white <- as.data.frame(coef(re_white)$zcta) %>%
  select(post_floyd1) %>%
  mutate(zipcode = as.numeric(rownames(.))) %>%
  rename(post_floyd1_white = post_floyd1)

re_pf_blk <- as.data.frame(coef(re_blk)$zcta) %>%
  select(post_floyd1) %>%
  mutate(zipcode = as.numeric(rownames(.))) %>%
  rename(post_floyd1_blk = post_floyd1)

re_pf_latin <- as.data.frame(coef(re_latin)$zcta) %>%
  select(post_floyd1) %>%
  mutate(zipcode = as.numeric(rownames(.))) %>%
  rename(post_floyd1_latin = post_floyd1)


#aggregate to zip-level over years
zip_level <- panel %>%
  group_by(zcta) %>%
   summarize(mh_all_tot = sum(mh_all_tot, na.rm = T),
             total_pop = sum(total_pop, na.rm = T),
             conc_dis = mean(conc_dis, na.rm = T)) %>%
  mutate(mh_incid_c = (mh_all_tot/total_pop)*1000) %>%
  ungroup() %>%
  left_join(zcta, by = "zcta")

zip_level <- zip_level %>%
  left_join(re_pf_white, by = c("zcta" = "zipcode")) %>%
  left_join(re_pf_blk, by = c("zcta" = "zipcode")) %>%
  left_join(re_pf_latin, by = c("zcta" = "zipcode"))




#george floyd square
gfs <- geocode("George Floyd Square, Minneapolis", output = "latlon") %>%
  st_as_sf(coords = c("lon", "lat"), crs = "NAD83", remove=F) %>%
  mutate(name = "George Floyd Square")

re_coef_map_white <- ggplot() +
  geom_sf(data = zip_level, aes(geometry = geometry, fill = post_floyd1_white), color = "lightgrey") +
```

```
  geom_sf(data = mpls, aes(geometry = geometry), color = "black", alpha = 0)+
  geom_sf(data = gfs, aes(geometry = geometry), color = "black")+
  geom_text_repel(data = gfs, aes(x=lon, y=lat, label = name),
                  size = 2,
                 fontface = "bold")+
  scale_fill_distiller(palette = "Spectral",
                       limits = c(min(zip_level$post_floyd1_latin),
                                  max(zip_level$post_floyd1_blk)))+
  labs(title = "Figure 3: RE Coefficients-White Residents",
       subtitle = "Rate per 1,000",
       fill = "Post-Killing Change")+
  theme(axis.text.x = element_blank(),
        axis.text.y = element_blank(),
  axis.line = element_blank(),
  axis.ticks = element_blank(),
  panel.border = element_blank(),
  panel.grid = element_blank(),
  axis.title = element_blank(),
  panel.background = element_blank(),
  panel.grid.major = element_line(colour="transparent"),
  plot.subtitle = element_text(face="italic"),
  strip.background = element_rect(fill = "white",
                 colour = "black"))+
  ggspatial::annotation_scale()+
  ggspatial::annotation_north_arrow(which_north = "true",
                                    location = "tr")

re_coef_map_blk <- ggplot() +
  geom_sf(data = zip_level, aes(geometry = geometry, fill = post_floyd1_blk), color = "lightgrey") +
  geom_sf(data = mpls, aes(geometry = geometry), color = "black", alpha = 0)+
  geom_sf(data = gfs, aes(geometry = geometry), color = "black")+
  geom_text_repel(data = gfs, aes(x=lon, y=lat, label = name),
                  size = 2,
                 fontface = "bold")+
 scale_fill_distiller(palette = "Spectral",
                       limits = c(min(zip_level$post_floyd1_latin),
                                  max(zip_level$post_floyd1_blk)))+
  labs(title = "Figure 4: RE Coefficients-Black Residents",
       subtitle = "Rate per 1,000",
       fill = "Post-Killing Change")+
  theme(axis.text.x = element_blank(),
        axis.text.y = element_blank(),
  axis.line = element_blank(),
  axis.ticks = element_blank(),
  panel.border = element_blank(),
  panel.grid = element_blank(),
  axis.title = element_blank(),
  panel.background = element_blank(),
  panel.grid.major = element_line(colour="transparent"),
  plot.subtitle = element_text(face="italic"),
  strip.background = element_rect(fill = "white",
                 colour = "black"))+
  ggspatial::annotation_scale()+
```

```
  ggspatial::annotation_north_arrow(which_north = "true",
                                    location = "tr")

re_coef_map_latin <- ggplot() +
  geom_sf(data = zip_level, aes(geometry = geometry, fill = post_floyd1_latin), color = "lightgrey") +
  geom_sf(data = mpls, aes(geometry = geometry), color = "black", alpha = 0)+
  geom_sf(data = gfs, aes(geometry = geometry), color = "black")+
  geom_text_repel(data = gfs, aes(x=lon, y=lat, label = name),
                  size = 2,
                 fontface = "bold")+
 scale_fill_distiller(palette = "Spectral",
                      limits = c(min(zip_level$post_floyd1_latin),
                                 max(zip_level$post_floyd1_blk)))+
  labs(title = "Figure 5: RE Coefficients-Latine Residents",
       subtitle = "Rate per 1,000",
       fill = "Post-Killing Change")+
  theme(axis.text.x = element_blank(),
        axis.text.y = element_blank(),
  axis.line = element_blank(),
  axis.ticks = element_blank(),
  panel.border = element_blank(),
  panel.grid = element_blank(),
  axis.title = element_blank(),
  panel.background = element_blank(),
  panel.grid.major = element_line(colour="transparent"),
  plot.subtitle = element_text(face="italic"),
  strip.background = element_rect(fill = "white",
                 colour = "black"))+
  ggspatial::annotation_scale()+
  ggspatial::annotation_north_arrow(which_north = "true",
                                    location = "tr")

cd_map <- ggplot() +
  geom_sf(data = zip_level, aes(geometry = geometry, fill = conc_dis), color="lightgrey") +
  geom_sf(data = mpls, aes(geometry = geometry), color = "black", alpha = 0)+
  geom_sf(data = gfs, aes(geometry = geometry), color = "black")+
  geom_text_repel(data = gfs, aes(x=lon, y=lat, label = name),
                  size = 2,
                 fontface = "bold")+
  scale_fill_distiller(palette = "Spectral")+
  labs(title = "Figure 6: Concentrated Disadvantage",
       subtitle = "Standard Deviation Units",
       fill = "Conc. Disad.")+
   theme(axis.text.x = element_blank(),
         axis.text.y = element_blank(),
  axis.line = element_blank(),
  axis.ticks = element_blank(),
  panel.border = element_blank(),
  panel.grid = element_blank(),
  axis.title = element_blank(),
  panel.background = element_blank(),
  panel.grid.major = element_line(colour="transparent"),
  plot.subtitle = element_text(face="italic"),
```

```
  strip.background = element_rect(fill = "white",
                colour = "black"))+
  ggspatial::annotation_scale()+
  ggspatial::annotation_north_arrow(which_north = "true",
                                    location = "tr")

#RE random coefficient model - interaction
re_int <- lmer(mh_rate~t+post_floyd+t_post_floyd+
                         state_of_emerg+stay_at_home+
                          uof_lag+stops_lag+shoot_lag+
                         tmax_f+snow_in+precip_in+conc_dis+
                  post_floyd:conc_dis+
              dplyr::lag(mh_rate, 1)+ dplyr::lag(mh_rate, 2)+
               dplyr::lag(mh_rate, 3)+
                       (1+post_floyd|zcta), data = panel)
```

```
## Warning: Some predictor variables are on very different scales: consider
## rescaling
```

```
## Warning: Some predictor variables are on very different scales: consider
## rescaling
```

```
summary(re_int)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula:
## mh_rate ~ t + post_floyd + t_post_floyd + state_of_emerg + stay_at_home +
##     uof_lag + stops_lag + shoot_lag + tmax_f + snow_in + precip_in +
##     conc_dis + post_floyd:conc_dis + dplyr::lag(mh_rate, 1) +
##     dplyr::lag(mh_rate, 2) + dplyr::lag(mh_rate, 3) + (1 + post_floyd |
##     zcta)
##    Data: panel
##
## REML criterion at convergence: 19387.7
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -11.2181  -0.1877  -0.0094   0.1726  15.1220
##
## Random effects:
##  Groups   Name        Variance Std.Dev. Corr
##  zcta     (Intercept) 16.889   4.110
##           post_floyd1  2.232   1.494    -1.00
##  Residual              2.145   1.464
## Number of obs: 5320, groups:  zcta, 22
##
## Fixed effects:
##                           Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)             2.913e+00  8.822e-01  2.134e+01   3.302  0.00334 **
## t                       3.852e-04  3.674e-04  5.292e+03   1.048  0.29454
## post_floyd1            -1.939e-01  3.834e-01  3.922e+01  -0.506  0.61593
## t_post_floyd           -3.574e-02  6.743e-03  5.283e+03  -5.300 1.21e-07 ***
## state_of_emerg1        -1.462e-01  2.009e-01  5.282e+03  -0.728  0.46686
```

```
## stay_at_home1          -4.979e-01  2.091e-01  5.282e+03  -2.382  0.01727 *
## uof_lag                -6.324e-02  1.013e-02  5.291e+03  -6.244 4.61e-10 ***
## stops_lag               4.657e-03  4.844e-03  5.285e+03   0.961  0.33643
## shoot_lag              -2.904e+00  2.501e+00  5.282e+03  -1.161  0.24561
## tmax_f                  3.560e-03  1.180e-03  5.282e+03   3.015  0.00258 **
## snow_in                 9.468e-02  5.713e-02  5.282e+03   1.657  0.09754 .
## precip_in               4.813e-02  1.954e-01  5.282e+03   0.246  0.80544
## conc_dis               -1.098e+00  2.554e-01  2.151e+03  -4.297 1.81e-05 ***
## dplyr::lag(mh_rate, 1) -1.259e-04  1.363e-02  5.303e+03  -0.009  0.99263
## dplyr::lag(mh_rate, 2)  5.719e-03  1.140e-02  5.294e+03   0.501  0.61606
## dplyr::lag(mh_rate, 3)  1.132e-02  1.139e-02  5.295e+03   0.994  0.32028
## post_floyd1:conc_dis    5.118e-01  1.185e-01  4.007e+02   4.320 1.97e-05 ***
## ---
## 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 (nloptwrap) convergence code: 0 (OK)
## boundary (singular) fit: see help('isSingular')
```

```
re_int_blk <- lmer(blk_mh_rate~t+post_floyd+t_post_floyd+
                         state_of_emerg+stay_at_home+
                          uof_lag+stops_lag+shoot_lag+
                         tmax_f+snow_in+precip_in+conc_dis+
                   post_floyd:conc_dis+
               dplyr::lag(blk_mh_rate, 1)+ dplyr::lag(blk_mh_rate, 2)+
                dplyr::lag(blk_mh_rate, 3)+
                        (1+post_floyd|zcta), data = panel)
```

```
## Warning: Some predictor variables are on very different scales: consider
## rescaling

## Warning: Some predictor variables are on very different scales: consider
## rescaling
```

```
summary(re_int_blk)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: blk_mh_rate ~ t + post_floyd + t_post_floyd + state_of_emerg +
##     stay_at_home + uof_lag + stops_lag + shoot_lag + tmax_f +
##     snow_in + precip_in + conc_dis + post_floyd:conc_dis + dplyr::lag(blk_mh_rate,
##     1) + dplyr::lag(blk_mh_rate, 2) + dplyr::lag(blk_mh_rate,
##     3) + (1 + post_floyd | zcta)
##    Data: panel
##
## REML criterion at convergence: 29186
##
## Scaled residuals:
##    Min     1Q Median     3Q    Max
## -2.682 -0.146 -0.021  0.088 35.962
##
## Random effects:
##  Groups   Name        Variance Std.Dev. Corr
##  zcta     (Intercept)  2.324   1.524
##           post_floyd1  1.715   1.310    -0.55
```

```
##  Residual             13.735   3.706
## Number of obs: 5320, groups:  zcta, 22
##
## Fixed effects:
##                              Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)                 7.578e-01  3.848e-01  2.591e+01   1.969   0.0597
## t                           5.831e-03  9.158e-04  4.988e+03   6.367 2.10e-10
## post_floyd1                 2.918e+00  6.104e-01  1.695e+02   4.780 3.79e-06
## t_post_floyd               -7.238e-02  1.708e-02  5.276e+03  -4.238 2.30e-05
## state_of_emerg1            -2.497e+00  5.084e-01  5.250e+03  -4.912 9.30e-07
## stay_at_home1               2.275e+00  5.285e-01  5.249e+03   4.305 1.70e-05
## uof_lag                    -1.000e-01  2.496e-02  3.179e+03  -4.007 6.30e-05
## stops_lag                   2.309e-02  1.162e-02  1.299e+03   1.988   0.0471
## shoot_lag                  -1.463e+00  6.414e+00  5.266e+03  -0.228   0.8196
## tmax_f                     -1.127e-03  2.984e-03  5.248e+03  -0.378   0.7057
## snow_in                    -1.147e-01  1.445e-01  5.246e+03  -0.794   0.4272
## precip_in                  -3.431e-01  4.946e-01  5.247e+03  -0.694   0.4879
## conc_dis                   -9.089e-01  3.129e-01  2.166e+01  -2.905   0.0083
## dplyr::lag(blk_mh_rate, 1) -8.101e-03  1.382e-02  5.303e+03  -0.586   0.5577
## dplyr::lag(blk_mh_rate, 2)  1.894e-02  1.314e-02  5.296e+03   1.442   0.1495
## dplyr::lag(blk_mh_rate, 3)  6.399e-03  1.311e-02  5.298e+03   0.488   0.6255
## post_floyd1:conc_dis        1.675e-02  3.237e-01  1.492e+01   0.052   0.9594
##
## (Intercept)                 .
## t                           ***
## post_floyd1                 ***
## t_post_floyd                ***
## state_of_emerg1             ***
## stay_at_home1               ***
## uof_lag                     ***
## stops_lag                   *
## shoot_lag
## tmax_f
## snow_in
## precip_in
## conc_dis                    **
## dplyr::lag(blk_mh_rate, 1)
## dplyr::lag(blk_mh_rate, 2)
## dplyr::lag(blk_mh_rate, 3)
## post_floyd1:conc_dis
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
```

```
re_int_white <- lmer(white_mh_rate~t+post_floyd+t_post_floyd+
                       state_of_emerg+stay_at_home+
                        uof_lag+stops_lag+shoot_lag+
                       tmax_f+snow_in+precip_in+conc_dis+
                  post_floyd:conc_dis+
              dplyr::lag(white_mh_rate, 1)+ dplyr::lag(white_mh_rate, 2)+
               dplyr::lag(white_mh_rate, 3)+
                      (1+post_floyd|zcta), data = panel)
```

```
## Warning: Some predictor variables are on very different scales: consider
```

```
## rescaling

## Warning: Some predictor variables are on very different scales: consider
## rescaling
```

```
summary(re_int_white)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: white_mh_rate ~ t + post_floyd + t_post_floyd + state_of_emerg +
##     stay_at_home + uof_lag + stops_lag + shoot_lag + tmax_f +
##     snow_in + precip_in + conc_dis + post_floyd:conc_dis + dplyr::lag(white_mh_rate,
##     1) + dplyr::lag(white_mh_rate, 2) + dplyr::lag(white_mh_rate,
##     3) + (1 + post_floyd | zcta)
##    Data: panel
##
## REML criterion at convergence: 11243.3
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -5.7510 -0.2846 -0.0215  0.2314 20.2107
##
## Random effects:
##  Groups   Name        Variance Std.Dev. Corr
##  zcta     (Intercept) 0.74751  0.8646
##           post_floyd1 0.01762  0.1328   -0.98
##  Residual             0.46481  0.6818
## Number of obs: 5320, groups:  zcta, 22
##
## Fixed effects:
##                                 Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)                    3.416e-01  1.883e-01  1.579e+01   1.814  0.08873
## t                              2.839e-03  1.829e-04  4.990e+03  15.520  < 2e-16
## post_floyd1                   -1.727e-02  1.033e-01  3.744e+02  -0.167  0.86734
## t_post_floyd                  -1.245e-02  3.122e-03  5.274e+03  -3.988 6.75e-05
## state_of_emerg1               -1.855e-01  9.360e-02  5.252e+03  -1.982  0.04751
## stay_at_home1                 -9.026e-02  9.719e-02  5.254e+03  -0.929  0.35314
## uof_lag                       -2.976e-02  4.704e-03  5.248e+03  -6.326 2.73e-10
## stops_lag                      6.901e-03  2.214e-03  3.860e+03   3.117  0.00184
## shoot_lag                     -1.513e+00  1.164e+00  5.274e+03  -1.299  0.19385
## tmax_f                         7.382e-04  5.495e-04  5.249e+03   1.343  0.17921
## snow_in                        2.890e-04  2.658e-02  5.248e+03   0.011  0.99133
## precip_in                     -6.531e-02  9.096e-02  5.250e+03  -0.718  0.47282
## conc_dis                      -5.843e-01  1.013e-01  1.348e+02  -5.767 5.27e-08
## dplyr::lag(white_mh_rate, 1) -4.552e-03  1.361e-02  5.294e+03  -0.335  0.73793
## dplyr::lag(white_mh_rate, 2)  4.450e-02  1.061e-02  5.271e+03   4.193 2.80e-05
## dplyr::lag(white_mh_rate, 3)  7.018e-03  1.061e-02  5.270e+03   0.661  0.50849
## post_floyd1:conc_dis           1.874e-01  3.560e-02  2.301e+01   5.264 2.43e-05
##
## (Intercept)                   .
## t                             ***
## post_floyd1
## t_post_floyd                  ***
## state_of_emerg1               *
## stay_at_home1
```

```
## uof_lag                       ***
## stops_lag                     **
## shoot_lag
## tmax_f
## snow_in
## precip_in
## conc_dis                      ***
## dplyr::lag(white_mh_rate, 1)
## dplyr::lag(white_mh_rate, 2) ***
## dplyr::lag(white_mh_rate, 3)
## post_floyd1:conc_dis          ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
```

```
re_int_latin <- lmer(latin_mh_rate~t+post_floyd+t_post_floyd+
                        state_of_emerg+stay_at_home+
                         uof_lag+stops_lag+shoot_lag+
                        tmax_f+snow_in+precip_in+conc_dis+
                   post_floyd:conc_dis+
              dplyr::lag(latin_mh_rate, 1)+ dplyr::lag(latin_mh_rate, 2)+
               dplyr::lag(latin_mh_rate, 3)+
                      (1+post_floyd|zcta), data = panel)
```

```
## Warning: Some predictor variables are on very different scales: consider
## rescaling

## Warning: Some predictor variables are on very different scales: consider
## rescaling
```

```
summary(re_int_latin)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: latin_mh_rate ~ t + post_floyd + t_post_floyd + state_of_emerg +
##     stay_at_home + uof_lag + stops_lag + shoot_lag + tmax_f +
##     snow_in + precip_in + conc_dis + post_floyd:conc_dis + dplyr::lag(latin_mh_rate,
##     1) + dplyr::lag(latin_mh_rate, 2) + dplyr::lag(latin_mh_rate,
##     3) + (1 + post_floyd | zcta)
##    Data: panel
##
## REML criterion at convergence: 37187.4
##
## Scaled residuals:
##    Min     1Q Median     3Q    Max
## -3.489 -0.087 -0.011  0.058 62.350
##
## Random effects:
##  Groups   Name        Variance Std.Dev. Corr
##  zcta     (Intercept)  1.7787  1.3337
##           post_floyd1  0.2815  0.5306   -1.00
##  Residual             79.1087  8.8943
## Number of obs: 5150, groups:  zcta, 22
##
```

```
## Fixed effects:
##                                 Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)                   -4.450e-02  5.828e-01  1.866e+02  -0.076  0.93923
## t                              6.836e-03  2.226e-03  5.121e+03   3.071  0.00214
## post_floyd1                   -3.699e-01  1.302e+00  3.787e+03  -0.284  0.77634
## t_post_floyd                   2.786e-02  4.062e-02  5.113e+03   0.686  0.49282
## state_of_emerg1               -9.574e-01  1.221e+00  5.115e+03  -0.784  0.43290
## stay_at_home1                  6.886e-02  1.268e+00  5.112e+03   0.054  0.95669
## uof_lag                        8.614e-01  9.096e-02  4.468e+03   9.470  < 2e-16
## stops_lag                     -1.325e-02  3.017e-02  9.929e+01  -0.439  0.66147
## shoot_lag                     -8.711e+00  1.531e+01  5.117e+03  -0.569  0.56934
## tmax_f                        -5.506e-03  7.270e-03  5.118e+03  -0.757  0.44891
## snow_in                       -5.239e-01  3.498e-01  5.112e+03  -1.497  0.13434
## precip_in                      6.407e+00  1.214e+00  5.115e+03   5.278 1.36e-07
## conc_dis                      -5.116e-01  3.278e-01  1.929e+01  -1.561  0.13481
## dplyr::lag(latin_mh_rate, 1) -6.709e-03  1.382e-02  5.083e+03  -0.486  0.62728
## dplyr::lag(latin_mh_rate, 2) -1.154e-02  1.308e-02  5.094e+03  -0.883  0.37748
## dplyr::lag(latin_mh_rate, 3) -6.916e-03  1.307e-02  5.093e+03  -0.529  0.59686
## post_floyd1:conc_dis           2.579e-01  4.051e-01  1.142e+02   0.637  0.52568
##
## (Intercept)
## t                             **
## post_floyd1
## t_post_floyd
## state_of_emerg1
## stay_at_home1
## uof_lag                       ***
## stops_lag
## shoot_lag
## tmax_f
## snow_in
## precip_in                     ***
## conc_dis
## dplyr::lag(latin_mh_rate, 1)
## dplyr::lag(latin_mh_rate, 2)
## dplyr::lag(latin_mh_rate, 3)
## post_floyd1:conc_dis
## ---
## 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 (nloptwrap) convergence code: 0 (OK)
## boundary (singular) fit: see help('isSingular')
```

```
#specifying varcov objects from model estimates
var_re_white <- VarCorr(re_white)
var_re_int_white <- VarCorr(re_int_white)
var_re_black <- VarCorr(re_blk)
var_re_int_black <- VarCorr(re_int_blk)
var_re_latin <- VarCorr(re_latin)
var_re_int_latin <- VarCorr(re_int_latin)
class(re_white) <- "lmerMod"
class(re_blk) <- "lmerMod"
class(re_latin) <- "lmerMod"
```

```
class(re_int_blk) <- "lmerMod"
class(re_int_white) <- "lmerMod"
class(re_int_blk) <- "lmerMod"
class(re_int_latin) <- "lmerMod"



library(patchwork)

(re_coef_map_white+re_coef_map_blk)/(re_coef_map_latin+cd_map)
```

Figure 3: RE Coefficients−White F

Rate per 1,000

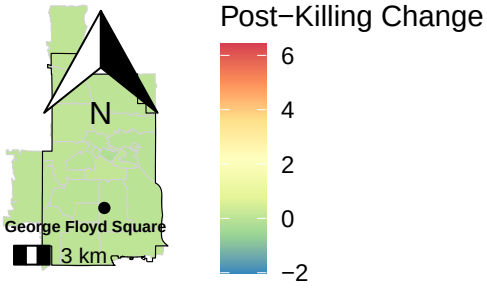


Figure 4: RE Coefficients−Black Reside

Rate per 1,000

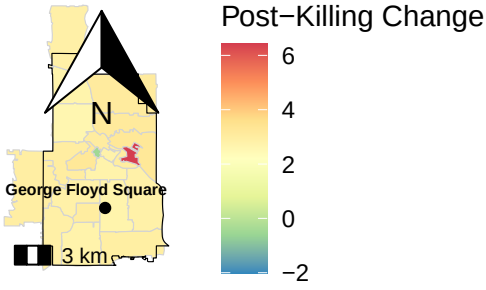


Figure 5: RE Coefficients−Latine F

Rate per 1,000

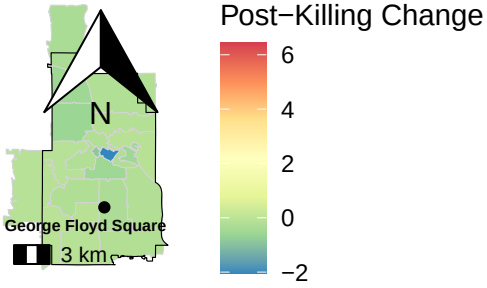
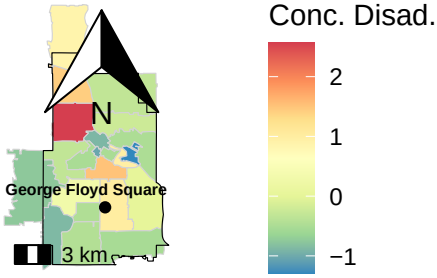


Figure 6: Concentrated Disadvantage

Standard Deviation Units




```
stargazer(re_white, re_blk, re_latin, re_int_white, re_int_blk, re_int_latin,
          title = "Interrupted Time Series RE Models of Mental Health Diagnoses, Minneapolis 2016-2020",
          covariate.labels = c("T",
                               "Post-Killing", "T Post-Killing",
                               "COVID - State of Emerg.", "COVID - Stay at Home",
                               "MPD Use of Force t-1", "MPD Stops t-1",
                               "MPD OIS t-1",
                               "Mean Max. Temp.", "Snow (in.)", "Precip. (in.)",
                               "Conc. Disad.",
                               "AR(1)-White", "AR(2)-White", "AR(3)-White",
                               "AR(1)-Black", "AR(2)-Black", "AR(3)-Black",
                               "AR(1)-Latine", "AR(2)-Latine", "AR(3)-Latine",
                               "Post-KillingXConc.Disad."),
          dep.var.caption = "Mental Health Diagnoses/1,000",
          dep.var.labels.include = FALSE,
```

```
          column.labels = c("White", "Black", "Latine",
                            "White w/ Int.","Black w/ Int.", "Latine w/ Interaction"),
          model.numbers = TRUE,
          single.row = FALSE,
          align = T,
          omit.stat = "adj.rsq",
          font.size="footnotesize",
          no.space = T,
          column.sep.width = "1pt",
          #star.cutoffs = c(.05, .01, .001), star.char = c("*","**","***"),
          report = "vcs",
          ci=TRUE,
          ci.level=0.95,
          ci.separator = "|",
          notes = "95\\% Confidence Intervals in parentheses",
          header = F,
          notes.append = F,
          add.lines = list(c("Resid. Var.", round(attr(VarCorr(re_white), "sc")^2,2),
                             round(attr(VarCorr(re_int_white), "sc")^2,2),
                             round(attr(VarCorr(re_blk), "sc")^2,2),
                             round(attr(VarCorr(re_int_blk), "sc")^2,2),
                              round(attr(VarCorr(re_latin), "sc")^2,2),
                             round(attr(VarCorr(re_int_latin), "sc")^2,2)),
                                      c("ZCTA Var.",
                                        round(var_re_white$zcta[1,1],2),
                                        round(var_re_int_white$zcta[1,1],2),
                                        round(var_re_black$zcta[1,1],2),
                                        round(var_re_int_black$zcta[1,1],2),
                                        round(var_re_latin$zcta[1,1],2),
                                        round(var_re_int_latin$zcta[1,1],2)),
                             c("Post-Floyd Var.",
                                        round(var_re_white$zcta[2,2],2),
                                        round(var_re_int_white$zcta[2,2],2),
                                        round(var_re_black$zcta[2,2],2),
                                        round(var_re_int_black$zcta[2,2],2),
                                        round(var_re_latin$zcta[2,2],2),
                                        round(var_re_int_latin$zcta[2,2],2))))
```

```
results_table<-standardizedSolution(cfa_cd) %>%
  filter(row_number() %in% c(1:6)) %>%
  dplyr::select(LHS=lhs, Specification=op, RHS=rhs, 'Std(Beta)'=est.std, SE=se,
                'P-Value'=pvalue) %>%
  mutate(LHS = case_when(
    LHS=="cd"~"Conc. Dis.",
    LHS=="unemp_rate"~"Unemp. Rate"),
         RHS = case_when(
           RHS=="unemp_rate"~"Unemp. Rate",
           RHS=="pov_rate"~"Poverty Rate",
           RHS=="female_hh_rate"~"Female-HH Rate",
           RHS=="no_hs_dip_rate"~"No HS Diploma Rate",
           RHS=="black_pop"~"Black Pop"
         ),
    Specification = case_when(
      Specification=="=~"~"FL",
```

Table 2: Interrupted Time Series RE Models of Mental Health Diagnoses, Minneapolis 2016-2020

	Mental Health Diagnoses/1,000					
	White	Black	Latine	White w/ Int.	Black w/ Int.	Latine w/ Interaction
	(1)	(2)	(3)	(4)	(5)	(6)
T	0.003	0.006	0.007	0.003	0.006	0.007
	(0.002|0.003)	(0.004|0.008)	(0.003|0.011)	(0.002|0.003)	(0.004|0.008)	(0.002|0.011)
Post-Killing	−0.002	2.918	−0.345	−0.017	2.918	−0.370
	(-0.202|0.198)	(1.733|4.103)	(-2.894|2.204)	(-0.220|0.185)	(1.721|4.114)	(-2.921|2.182)
T Post-Killing	−0.013	−0.072	0.027	−0.012	−0.072	0.028
	(-0.019|-0.007)	(-0.106|-0.039)	(-0.053|0.106)	(-0.019|-0.006)	(-0.106|-0.039)	(-0.052|0.107)
COVID - State of Emerg.	−0.185	−2.499	−0.953	−0.186	−2.497	−0.957
	(-0.368|-0.001)	(-3.495|-1.502)	(-3.346|1.439)	(-0.369|-0.002)	(-3.494|-1.501)	(-3.350|1.435)
COVID - Stay at Home	−0.089	2.277	0.065	−0.090	2.275	0.069
	(-0.280|0.101)	(1.241|3.313)	(-2.420|2.549)	(-0.281|0.100)	(1.239|3.311)	(-2.416|2.554)
MPD Use of Force t-1	−0.029	−0.100	0.860	−0.030	−0.100	0.861
	(-0.038|-0.020)	(-0.149|-0.051)	(0.682|1.038)	(-0.039|-0.021)	(-0.149|-0.051)	(0.683|1.040)
MPD Stops t-1	0.008	0.023	−0.012	0.007	0.023	−0.013
	(0.004|0.013)	(0.001|0.046)	(-0.070|0.047)	(0.003|0.011)	(0.0003|0.046)	(-0.072|0.046)
MPD OIS t-1	−1.567	−1.464	−8.867	−1.513	−1.463	−8.711
	(-3.852|0.717)	(-14.034|11.107)	(-38.863|21.129)	(-3.795|0.769)	(-14.034|11.109)	(-38.714|21.292)
Mean Max. Temp.	0.001	−0.001	−0.006	0.001	−0.001	−0.006
	(-0.0003|0.002)	(-0.007|0.005)	(-0.020|0.009)	(-0.0003|0.002)	(-0.007|0.005)	(-0.020|0.009)
Snow (in.)	0.0001	−0.115	−0.524	0.0003	−0.115	−0.524
	(-0.052|0.052)	(-0.398|0.168)	(-1.209|0.162)	(-0.052|0.052)	(-0.398|0.168)	(-1.210|0.162)
Precip. (in.)	−0.069	−0.344	6.403	−0.065	−0.343	6.407
	(-0.247|0.110)	(-1.313|0.625)	(4.023|8.782)	(-0.244|0.113)	(-1.312|0.626)	(4.028|8.787)
Conc. Disad.	−0.514	−0.898	−0.423	−0.584	−0.909	−0.512
	(-0.710|-0.319)	(-1.430|-0.366)	(-1.001|0.156)	(-0.783|-0.386)	(-1.522|-0.296)	(-1.154|0.131)
AR(1)-White	−0.005			−0.005		
	(-0.031|0.022)			(-0.031|0.022)		
AR(2)-White	0.045			0.045		
	(0.024|0.065)			(0.024|0.065)		
AR(3)-White	0.007			0.007		
	(-0.013|0.028)			(-0.014|0.028)		
AR(1)-Black		−0.008			−0.008	
		(-0.035|0.019)			(-0.035|0.019)	
AR(2)-Black		0.019			0.019	
		(-0.007|0.045)			(-0.007|0.045)	
AR(3)-Black		0.006			0.006	
		(-0.019|0.032)			(-0.019|0.032)	
AR(1)-Latine			−0.007			−0.007
			(-0.034|0.020)			(-0.034|0.020)
AR(2)-Latine			−0.011			−0.012
			(-0.037|0.014)			(-0.037|0.014)
AR(3)-Latine			−0.007			−0.007
			(-0.033|0.019)			(-0.033|0.019)
Post-KillingXConc.Disad.				0.187	0.017	0.258
				(0.118|0.257)	(-0.618|0.651)	(-0.536|1.052)
Constant	0.334	0.757	−0.055	0.342	0.758	−0.044
	(-0.013|0.681)	(0.007|1.506)	(-1.193|1.083)	(-0.027|0.711)	(0.004|1.512)	(-1.187|1.098)
Resid. Var.	0.47	0.46	13.74	13.73	79.11	79.11
ZCTA Var.	0.66	0.75	2.28	2.32	1.73	1.78
Post-Floyd Var.	0.01	0.02	1.56	1.72	0.24	0.28
Observations	5,320	5,320	5,150	5,320	5,320	5,150
Log Likelihood	-5,625.624	-14,592.800	-18,593.900	-5,621.669	-14,593.020	-18,593.690
Akaike Inf. Crit.	11,291.250	29,225.600	37,227.810	11,285.340	29,228.050	37,229.390
Bayesian Inf. Crit.	11,422.830	29,357.180	37,358.750	11,423.500	29,366.210	37,366.870

Note: 95% Confidence Intervals in parentheses

```
      Specification=="~~"~"Cov."),
     `P-Value` = round(`P-Value`, 2))



stargazer(results_table, summary = FALSE, header = F,
           type="latex", style="aer", align = T,
           title="CFA Measurement Model of Concentrated Disadvantage",
           notes="$LR\\chi^2$ vs. saturated (4) = 1186, p < .05,  CFI = .926, SRMR = .049")
```

Table 3: CFA Measurement Model of Concentrated Disadvantage

	LHS	Specification	RHS	Std(Beta)	SE	P-Value
1	Conc. Dis.	FL	Unemp. Rate	0.444	0.012	0
2	Conc. Dis.	FL	Poverty Rate	0.520	0.010	0
3	Conc. Dis.	FL	Female-HH Rate	0.866	0.004	0
4	Conc. Dis.	FL	No HS Diploma Rate	0.822	0.005	0
5	Conc. Dis.	FL	Black Pop	0.930	0.004	0
6	Unemp. Rate	Cov.	Black Pop	0.080	0.020	0

$LR\chi^2$ vs. saturated (4) = 1186, p < .05, CFI = .926, SRMR = .049