Mental Health Series

Ryan Larson

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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,
                  geometry = T,
                  survey = "acs5") %>%
  rename(zcta = GEOID,
         pop_2019 = B01001_001E) %>%
  select(-c(NAME, B01001_001M, pop_2019)) %>%
```

```
  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),) %>%
  group_by(zcta) %>%
  arrange(year, weekofyr) %>%
  mutate(t = row_number(),
         uof_lag = dplyr::lag(total_use_of_force, 1),
         stops_lag = dplyr::lag(total_police_stops, 1),
         shoot_lag = dplyr::lag(total_police_shootings, 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

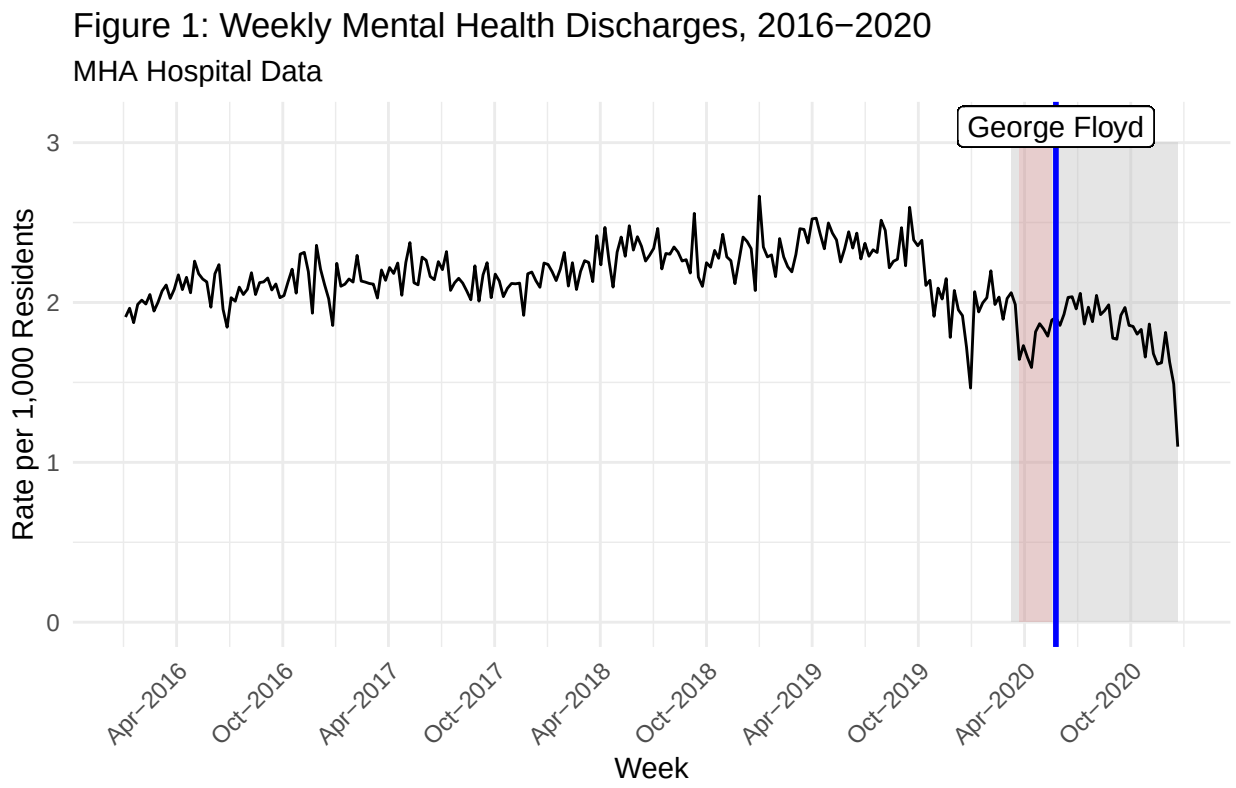
```
#Minneapolis Police Department - Use of Force Dashboard
uof <- read_csv("Data/Police_Use_Of_Force.csv") %>%
  mutate(date=ymd_hms(ResponseDate),
         year=isoyear(date),
         week=isoweek(date)) %>%
  group_by(year, week, .drop=F) %>%
  tally(name = "use_of_force") %>%
  arrange(year, week)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

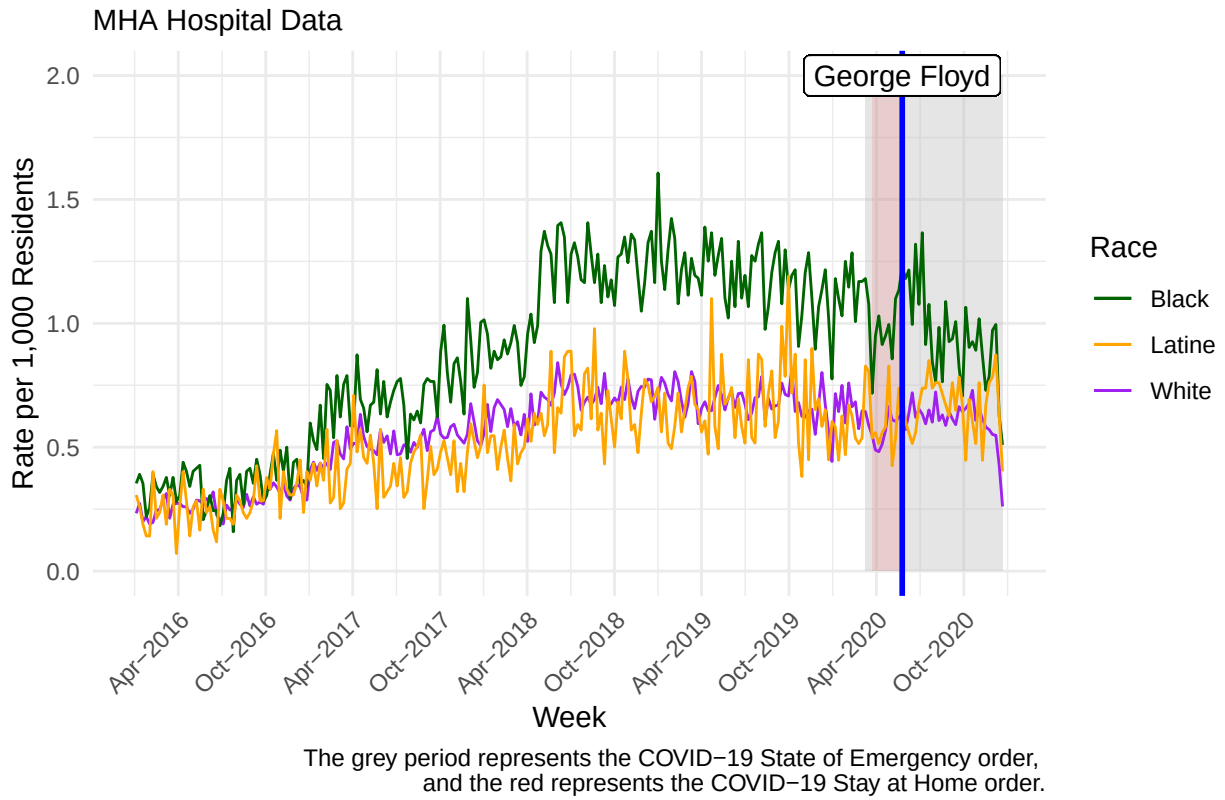
```
  ymin = 0,
  ymax = 3,
  fill = "grey",
  alpha = .4) +
annotate(geom="rect",
  xmin = series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-03-28"))],
  xmax = series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-05-18"))],
  ymin = 0,
  ymax = 3,
  fill = "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 Discharges, 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))
```




```
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 Discharges by Patient Race, 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"))
```

Figure 2: Weekly Mental Health Discharges by Patient Race, 2016−2020



Time Series Analysis

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

```
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)])
```

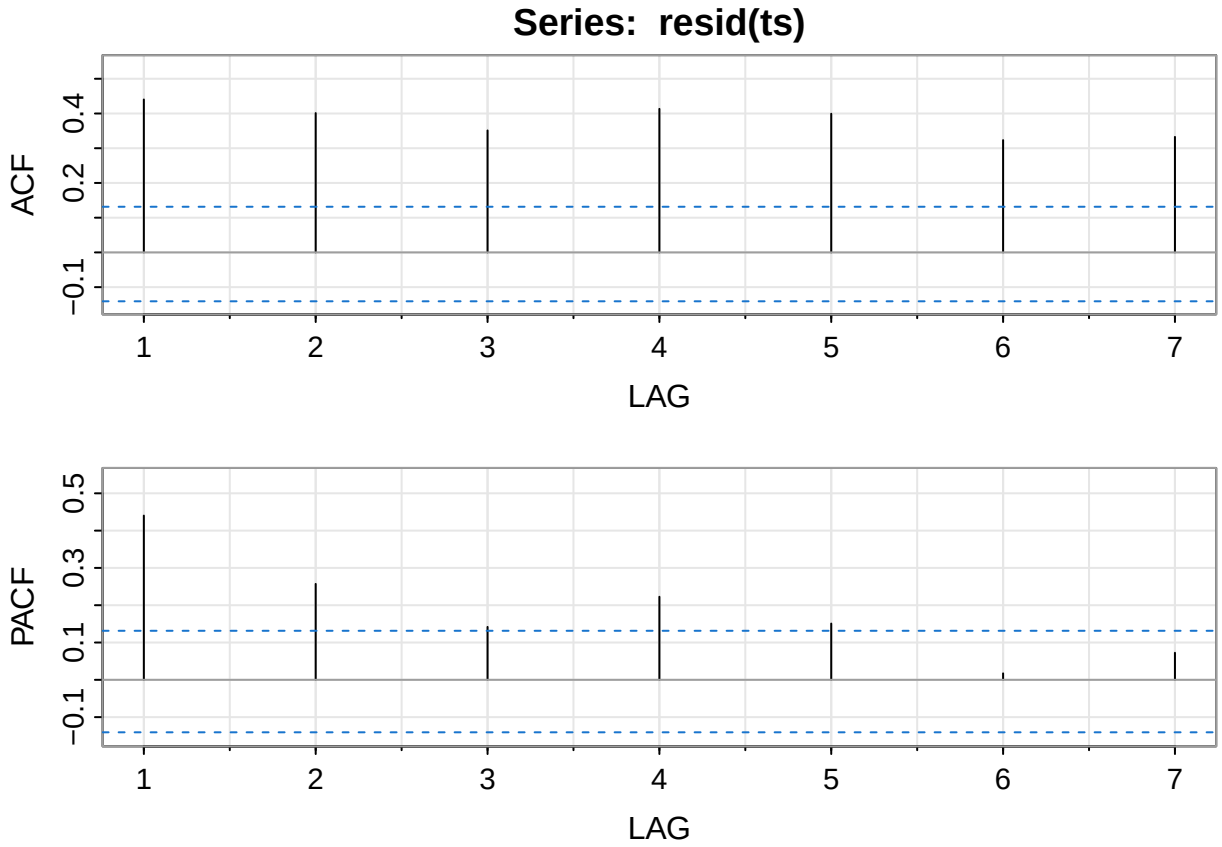
```
## [1] 0.5983135
```

```
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
## -0.74151 -0.06959 -0.00027  0.08705  0.49370
##
## Coefficients:
##                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)      2.088e+00  9.561e-02  21.840  < 2e-16 ***
## t                1.090e-04  3.042e-04   0.358 0.720605
## state_of_emerg1 -3.895e-01  9.404e-02  -4.142 5.05e-05 ***
## stay_at_home1   -9.748e-02  9.707e-02  -1.004 0.316456
## post_floyd1      9.962e-02  1.018e-01   0.978 0.329139
## t_post_floyd    -1.377e-02  3.505e-03  -3.928 0.000117 ***
```

```
## tmax_f           3.226e-03  6.541e-04   4.931 1.69e-06 ***
## snow_in          2.271e-02  2.842e-02   0.799 0.425180
## precip_in       -1.316e-01  9.978e-02  -1.319 0.188612
## uof_lag          3.674e-01  2.248e-01   1.634 0.103788
## stops_lag       -4.011e-02  3.728e-02  -1.076 0.283296
## shoot_lag       -1.348e+01  6.536e+00  -2.062 0.040472 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1514 on 204 degrees of freedom
##   (44 observations deleted due to missingness)
## Multiple R-squared:  0.5965, Adjusted R-squared:  0.5747
## F-statistic: 27.42 on 11 and 204 DF,  p-value: < 2.2e-16
```

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

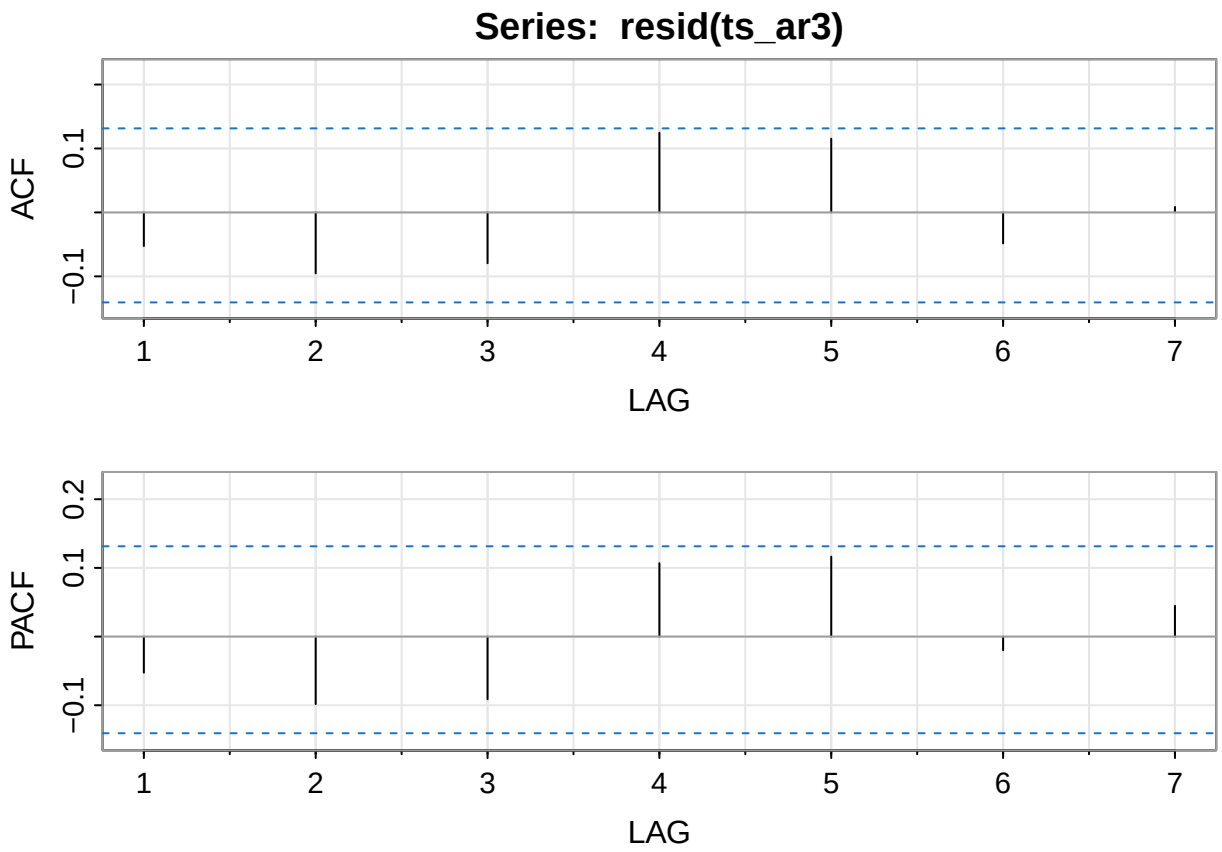



```
##      [,1] [,2] [,3] [,4] [,5] [,6] [,7]
## ACF  0.44 0.40 0.35 0.41 0.40 0.32 0.33
## PACF 0.44 0.26 0.14 0.22 0.15 0.02 0.07
```

```
ts_ar3<- lm(mh_incid_c~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                         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)
summary(ts_ar3)
```

```
##
## Call:
## lm(formula = mh_incid_c ~ t + state_of_emerg + stay_at_home +
##     post_floyd + t_post_floyd + 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
## -0.47466 -0.07480  0.00068  0.06902  0.45274
##
## Coefficients:
##                              Estimate Std. Error t value Pr(>|t|)
## (Intercept)                 6.013e-01  1.760e-01   3.416 0.000770 ***
## t                          -8.503e-05  2.540e-04  -0.335 0.738164
## state_of_emerg1            -1.982e-01  8.105e-02  -2.445 0.015335 *
## stay_at_home1               6.603e-02  8.258e-02   0.800 0.424862
## post_floyd1                 1.521e-01  8.520e-02   1.785 0.075803 .
## t_post_floyd               -9.658e-03  2.966e-03  -3.256 0.001325 **
## uof_lag                     4.116e-01  1.884e-01   2.185 0.030036 *
## stops_lag                  -3.021e-02  3.118e-02  -0.969 0.333756
## shoot_lag                  -1.114e+01  5.470e+00  -2.036 0.043053 *
## tmax_f                      1.522e-03  5.766e-04   2.640 0.008951 **
## snow_in                     1.109e-02  2.379e-02   0.466 0.641547
## precip_in                  -2.594e-01  8.433e-02  -3.076 0.002389 **
## dplyr::lag(mh_incid_c, 1)  3.154e-01  6.905e-02   4.567  8.6e-06 ***
## dplyr::lag(mh_incid_c, 2)  2.679e-01  6.944e-02   3.859 0.000154 ***
## dplyr::lag(mh_incid_c, 3)  1.350e-01  6.843e-02   1.973 0.049870 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.126 on 201 degrees of freedom
##   (44 observations deleted due to missingness)
## Multiple R-squared:  0.7247, Adjusted R-squared:  0.7055
## F-statistic:  37.8 on 14 and 201 DF,  p-value: < 2.2e-16
```

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




```
##       [,1] [,2]  [,3] [,4] [,5]  [,6] [,7]
## ACF  -0.05 -0.1 -0.08 0.12 0.12 -0.05 0.01
## PACF -0.05 -0.1 -0.09 0.11 0.12 -0.02 0.04
```

```
#race specific models

ts_ar3_white <- lm(white_mh_incid_c~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                          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 + state_of_emerg + stay_at_home +
##     post_floyd + t_post_floyd + 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
## -0.205278 -0.034589 -0.002865  0.038491  0.161720
##
## Coefficients:
```

```
##                                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)                      0.0576327  0.0429775   1.341  0.18144
## t                                0.0003495  0.0001854   1.885  0.06085 .
## state_of_emerg1                 -0.0570246  0.0404216  -1.411  0.15987
## stay_at_home1                    0.0159212  0.0405788   0.392  0.69521
## post_floyd1                      0.0610518  0.0422839   1.444  0.15034
## t_post_floyd                    -0.0045808  0.0014591  -3.140  0.00195 **
## uof_lag                          0.2409374  0.0943712   2.553  0.01142 *
## stops_lag                        0.0032860  0.0157758   0.208  0.83521
## shoot_lag                       -3.6088769  2.7283081  -1.323  0.18742
## tmax_f                           0.0004023  0.0002739   1.469  0.14338
## snow_in                          0.0116618  0.0118124   0.987  0.32471
## precip_in                       -0.0772824  0.0415641  -1.859  0.06444 .
## dplyr::lag(white_mh_incid_c, 1)  0.4573811  0.0695599   6.575  4.1e-10 ***
## dplyr::lag(white_mh_incid_c, 2)  0.2006716  0.0754443   2.660  0.00845 **
## dplyr::lag(white_mh_incid_c, 3)  0.1099192  0.0712538   1.543  0.12449
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.06272 on 201 degrees of freedom
##   (44 observations deleted due to missingness)
## Multiple R-squared:  0.7117, Adjusted R-squared:  0.6917
## F-statistic: 35.45 on 14 and 201 DF,  p-value: < 2.2e-16
```

```
ts_ar3_black <- lm(black_mh_incid_c~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                         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 + state_of_emerg + stay_at_home +
##     post_floyd + t_post_floyd + 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
## -0.36839 -0.09540  0.00568  0.08856  0.38696
##
## Coefficients:
##                                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)                      0.0133141  0.0889231   0.150 0.881131
## t                                0.0012456  0.0004332   2.875 0.004470 **
## state_of_emerg1                 -0.2775568  0.0884554  -3.138 0.001958 **
## stay_at_home1                    0.1934573  0.0908775   2.129 0.034491 *
## post_floyd1                      0.2276755  0.0944241   2.411 0.016800 *
## t_post_floyd                    -0.0065160  0.0033862  -1.924 0.055731 .
## uof_lag                          0.1122348  0.2087306   0.538 0.591378
## stops_lag                        0.0400787  0.0347849   1.152 0.250613
## shoot_lag                        0.9174678  6.0390611   0.152 0.879401
```

```
## tmax_f                           0.0002117  0.0006119   0.346 0.729732
## snow_in                         -0.0014666  0.0262880  -0.056 0.955563
## precip_in                       -0.1545481  0.0919805  -1.680 0.094467 .
## dplyr::lag(black_mh_incid_c, 1)  0.3398593  0.0687560   4.943 1.62e-06 ***
## dplyr::lag(black_mh_incid_c, 2)  0.1749467  0.0712258   2.456 0.014889 *
## dplyr::lag(black_mh_incid_c, 3)  0.2308650  0.0691262   3.340 0.000999 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1395 on 201 degrees of freedom
##   (44 observations deleted due to missingness)
## Multiple R-squared:  0.7486, Adjusted R-squared:  0.7311
## F-statistic: 42.75 on 14 and 201 DF,  p-value: < 2.2e-16
```

```
ts_ar3_latin <- lm(latin_mh_incid_c~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                         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 + state_of_emerg + stay_at_home +
##     post_floyd + t_post_floyd + 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
## -0.32579 -0.08927 -0.00465  0.07260  0.46798
##
## Coefficients:
##                                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)                      0.1204987  0.0889065   1.355   0.1768
## t                                0.0015655  0.0003621   4.323 2.42e-05 ***
## state_of_emerg1                 -0.0954767  0.0853309  -1.119   0.2645
## stay_at_home1                   -0.0255143  0.0884495  -0.288   0.7733
## post_floyd1                      0.0222977  0.0922099   0.242   0.8092
## t_post_floyd                    -0.0011048  0.0031700  -0.349   0.7278
## uof_lag                         -0.0464674  0.2038473  -0.228   0.8199
## stops_lag                        0.0243096  0.0338002   0.719   0.4728
## shoot_lag                       -0.7723934  5.9016926  -0.131   0.8960
## tmax_f                           0.0006489  0.0005994   1.083   0.2803
## snow_in                         -0.0166781  0.0258966  -0.644   0.5203
## precip_in                       -0.0139046  0.0906698  -0.153   0.8783
## dplyr::lag(latin_mh_incid_c, 1)  0.0758069  0.0708497   1.070   0.2859
## dplyr::lag(latin_mh_incid_c, 2)  0.1223659  0.0705450   1.735   0.0843 .
## dplyr::lag(latin_mh_incid_c, 3)  0.1008496  0.0707014   1.426   0.1553
## ---
## 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:  0.3949, Adjusted R-squared:  0.3527
## F-statistic: 9.369 on 14 and 201 DF,  p-value: 8.675e-16
```

```
ts_ar3_indig <- lm(indig_mh_incid_c~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                         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 + state_of_emerg + stay_at_home +
##     post_floyd + t_post_floyd + 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
## -1.94513 -0.47980 -0.03261  0.41043  2.16181
##
## Coefficients:
##                                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)                        0.089262   0.511650   0.174 0.861681
## t                                  0.011113   0.002409   4.613 7.07e-06 ***
## state_of_emerg1                   -1.077793   0.512862  -2.102 0.036841 *
## stay_at_home1                      0.615713   0.517523   1.190 0.235556
## post_floyd1                       -0.006802   0.542786  -0.013 0.990014
## t_post_floyd                      -0.027923   0.019385  -1.440 0.151310
## uof_lag                            1.091052   1.211417   0.901 0.368857
## stops_lag                          0.129736   0.205540   0.631 0.528629
## shoot_lag                        -20.886282  34.962687  -0.597 0.550921
## tmax_f                             0.012841   0.003692   3.478 0.000619 ***
## snow_in                           -0.096711   0.151970  -0.636 0.525252
## precip_in                         -0.297486   0.534188  -0.557 0.578220
## dplyr::lag(indig_mh_incid_c, 1)    0.089007   0.070456   1.263 0.207945
## dplyr::lag(indig_mh_incid_c, 2)    0.002713   0.071394   0.038 0.969725
## dplyr::lag(indig_mh_incid_c, 3)    0.102463   0.070031   1.463 0.145002
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.8053 on 201 degrees of freedom
##   (44 observations deleted due to missingness)
## Multiple R-squared:  0.4718, Adjusted R-squared:  0.435
## F-statistic: 12.82 on 14 and 201 DF,  p-value: < 2.2e-16
```

```
ts_ar3_asian <- lm(asian_mh_incid_c~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                         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 + state_of_emerg + stay_at_home +
##     post_floyd + t_post_floyd + 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
## -0.178990 -0.056598 -0.002371  0.053889  0.249423
##
## Coefficients:
##                                    Estimate Std. Error t value Pr(>|t|)
## (Intercept)                       0.0890906  0.0509010   1.750 0.081597 .
## t                                 0.0006954  0.0001904   3.652 0.000332 ***
## state_of_emerg1                  -0.1011590  0.0526152  -1.923 0.055941 .
## stay_at_home1                     0.0830573  0.0526202   1.578 0.116039
## post_floyd1                       0.0378355  0.0555700   0.681 0.496743
## t_post_floyd                     -0.0011296  0.0018702  -0.604 0.546511
## uof_lag                           0.0070316  0.1193611   0.059 0.953082
## stops_lag                        -0.0060339  0.0198558  -0.304 0.761529
## shoot_lag                        -3.9888752  3.4669359  -1.151 0.251285
## tmax_f                            0.0003517  0.0003468   1.014 0.311636
## snow_in                          -0.0011596  0.0151291  -0.077 0.938978
## precip_in                        -0.0309055  0.0528961  -0.584 0.559695
## dplyr::lag(asian_mh_incid_c, 1)   0.0300318  0.0713681   0.421 0.674350
## dplyr::lag(asian_mh_incid_c, 2)   0.0269563  0.0709769   0.380 0.704502
## dplyr::lag(asian_mh_incid_c, 3) -0.0796674  0.0714802  -1.115 0.266379
## ---
## 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: 0.0001512
```

```
stargazer(ts_ar3, ts_ar3_white, ts_ar3_black, ts_ar3_latin,
          title = "Interrupted Time Series Models of Mental Health Discharges",
          covariate.labels = c("T","COVID - State of Emergency", "COVID - Stay at Home",
                               "Post-Killing", "T Post-Killing",
                               "MPD Use of Force t-1", "MPD Stops t-1",
                               "MPD Officer Involved Shootings 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 Discharges",
          dep.var.labels.include = FALSE,
          column.labels = c("Overall", "White", "Black", "Latine"),
          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("*","**","***"))
```

% Table created by stargazer v.5.2.3 by Marek Hlavac, Social Policy Institute. E-mail: marek.hlavac at gmail.com % Date and time: Tue, Apr 11, 2023 - 12:37:59 AM % Requires LaTeX packages: dcolumn

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)
```

```
## Warning: package 'lavaan' was built under R version 4.2.3
```

```
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
## 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
```

Table 1: Interrupted Time Series Models of Mental Health Discharges

	Mental Health Discharges			
	Overall	White	Black	Latine
	(1)	(2)	(3)	(4)
T	−0.0001	0.0003	0.001**	0.002***
	(0.0003)	(0.0002)	(0.0004)	(0.0004)
COVID - State of Emergency	−0.198*	−0.057	−0.278**	−0.095
	(0.081)	(0.040)	(0.088)	(0.085)
COVID - Stay at Home	0.066	0.016	0.193*	−0.026
	(0.083)	(0.041)	(0.091)	(0.088)
Post-Killing	0.152	0.061	0.228*	0.022
	(0.085)	(0.042)	(0.094)	(0.092)
T Post-Killing	−0.010**	−0.005**	−0.007	−0.001
	(0.003)	(0.001)	(0.003)	(0.003)
MPD Use of Force t-1	0.412*	0.241*	0.112	−0.046
	(0.188)	(0.094)	(0.209)	(0.204)
MPD Stops t-1	−0.030	0.003	0.040	0.024
	(0.031)	(0.016)	(0.035)	(0.034)
MPD Officer Involved Shootings t-1	−11.137*	−3.609	0.917	−0.772
	(5.470)	(2.728)	(6.039)	(5.902)
Mean Max. Temp.	0.002**	0.0004	0.0002	0.001
	(0.001)	(0.0003)	(0.001)	(0.001)
Snow (in.)	0.011	0.012	−0.001	−0.017
	(0.024)	(0.012)	(0.026)	(0.026)
Precip. (in.)	−0.259**	−0.077	−0.155	−0.014
	(0.084)	(0.042)	(0.092)	(0.091)
AR(1) Overall	0.315***			
	(0.069)			
AR(2) Overall	0.268***			
	(0.069)			
AR(3) Overall	0.135*			
	(0.068)			
AR(1) White		0.457***		
		(0.070)		
AR(2) White		0.201**		
		(0.075)		
AR(3) White		0.110		
		(0.071)		
AR(1) Black			0.340***	
			(0.069)	
AR(2) Black			0.175*	
			(0.071)	
AR(3) Black			0.231***	
			(0.069)	
AR(1) Latine				0.076
				(0.071)
AR(2) Latine				0.122
				(0.071)
AR(3) Latine				0.101
				(0.071)
Constant	0.601***	0.058	0.013	0.120
	(0.176)	(0.043)	(0.089)	(0.089)
Observations	216	216	216	216
R^2	0.725	0.712	0.749	0.395
Residual Std. Error (df = 201)	0.126	0.063	0.140	0.137
F Statistic (df = 14; 201)	37.797***	35.448***	42.751***	9.369***
Note:				*p<0.05; **p<0.01; ***p<0.001

```
##   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
```

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

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

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

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

```
## Warning: package 'lme4' was built under R version 4.2.3
```

```
library(lmerTest)



#RE random coefficient model
re <- lmer(mh_rate~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                         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)
summary(re)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula:
## mh_rate ~ t + state_of_emerg + stay_at_home + post_floyd + t_post_floyd +
##     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: 19463.2
##
## Scaled residuals:
```

```
##      Min       1Q   Median       3Q      Max
## -10.7712  -0.1859  -0.0061   0.1722  14.4836
##
## Random effects:
##  Groups   Name        Variance Std.Dev. Corr
##  zcta     (Intercept) 15.647   3.956
##           post_floyd1  2.036   1.427    -1.00
##  Residual              2.171   1.473
## Number of obs: 5320, groups:  zcta, 22
##
## Fixed effects:
##                            Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)              2.844e+00  8.497e-01  2.160e+01   3.347  0.00297 **
## t                        9.017e-04  3.754e-04  4.642e+03   2.402  0.01633 *
## state_of_emerg1         -1.627e-01  2.025e-01  5.251e+03  -0.804  0.42172
## stay_at_home1           -4.903e-01  2.105e-01  5.253e+03  -2.330  0.01986 *
## post_floyd1             -1.797e-01  3.726e-01  4.223e+01  -0.482  0.63209
## t_post_floyd            -3.673e-02  6.808e-03  5.280e+03  -5.395 7.15e-08 ***
## uof_lag                 -8.334e-03  7.339e-03  5.072e+03  -1.136  0.25621
## stops_lag                3.004e-04  1.015e-03  5.270e+03   0.296  0.76720
## shoot_lag               -1.040e-01  1.536e-01  5.273e+03  -0.677  0.49832
## tmax_f                   3.351e-03  1.188e-03  5.246e+03   2.820  0.00482 **
## snow_in                  9.422e-02  5.750e-02  5.245e+03   1.639  0.10135
## precip_in                2.141e-02  1.966e-01  5.246e+03   0.109  0.91329
## conc_dis                -2.671e-01  1.434e-01  1.902e+01  -1.863  0.07801 .
## dplyr::lag(mh_rate, 1) -4.467e-04  1.372e-02  5.303e+03  -0.033  0.97402
## dplyr::lag(mh_rate, 2)  5.058e-03  1.148e-02  5.295e+03   0.441  0.65940
## dplyr::lag(mh_rate, 3)  1.256e-02  1.148e-02  5.295e+03   1.095  0.27372
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
re_blk <- lmer(blk_mh_rate~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                         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)
summary(re_blk)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: blk_mh_rate ~ t + state_of_emerg + stay_at_home + post_floyd +
##     t_post_floyd + 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: 29216.9
##
## Scaled residuals:
##    Min     1Q Median     3Q    Max
## -2.462 -0.147 -0.022  0.091 35.896
##
```

```
## Random effects:
##  Groups   Name        Variance Std.Dev. Corr
##  zcta     (Intercept)  2.244   1.498
##           post_floyd1  1.682   1.297    -0.54
##  Residual             13.792   3.714
## Number of obs: 5320, groups:  zcta, 22
##
## Fixed effects:
##                                Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)                   7.397e-01  3.811e-01  3.478e+01   1.941  0.06041
## t                             6.099e-03  9.587e-04  5.169e+03   6.362 2.16e-10
## state_of_emerg1              -2.541e+00  5.104e-01  5.255e+03  -4.978 6.65e-07
## stay_at_home1                 2.291e+00  5.299e-01  5.255e+03   4.323 1.57e-05
## post_floyd1                   2.919e+00  6.108e-01  1.888e+02   4.780 3.52e-06
## t_post_floyd                 -7.183e-02  1.717e-02  5.282e+03  -4.182 2.93e-05
## uof_lag                      -1.278e-02  1.850e-02  5.250e+03  -0.691  0.48987
## stops_lag                     1.513e-03  2.523e-03  4.834e+03   0.600  0.54870
## shoot_lag                    -5.735e-02  3.892e-01  5.264e+03  -0.147  0.88284
## tmax_f                       -1.461e-03  2.991e-03  5.252e+03  -0.488  0.62539
## snow_in                      -1.159e-01  1.448e-01  5.250e+03  -0.800  0.42356
## precip_in                    -3.540e-01  4.956e-01  5.251e+03  -0.714  0.47515
## conc_dis                     -9.596e-01  2.680e-01  2.440e+01  -3.581  0.00148
## dplyr::lag(blk_mh_rate, 1) -7.610e-03  1.376e-02  5.304e+03  -0.553  0.58018
## dplyr::lag(blk_mh_rate, 2)  1.844e-02  1.316e-02  5.299e+03   1.401  0.16125
## dplyr::lag(blk_mh_rate, 3)  5.986e-03  1.314e-02  5.299e+03   0.456  0.64864
##
## (Intercept)                  .
## t                            ***
## state_of_emerg1              ***
## stay_at_home1                ***
## post_floyd1                  ***
## t_post_floyd                 ***
## 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
```

```
re_white <- lmer(white_mh_rate~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                          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)
summary(re_white)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
```

```
## lmerModLmerTest]
## Formula: white_mh_rate ~ t + state_of_emerg + stay_at_home + post_floyd +
##     t_post_floyd + 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: 11310
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -5.1373 -0.2822 -0.0192  0.2304 20.5374
##
## Random effects:
##  Groups   Name        Variance Std.Dev. Corr
##  zcta     (Intercept) 0.84842  0.9211
##           post_floyd1 0.02105  0.1451   0.19
##  Residual             0.46865  0.6846
## Number of obs: 5320, groups:  zcta, 22
##
## Fixed effects:
##                                  Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)                     3.283e-01  2.002e-01  1.530e+01   1.640 0.121409
## t                               2.763e-03  1.899e-04  5.044e+03  14.550  < 2e-16
## state_of_emerg1                -1.863e-01  9.414e-02  5.244e+03  -1.979 0.047844
## stay_at_home1                  -9.076e-02  9.767e-02  5.245e+03  -0.929 0.352782
## post_floyd1                     6.414e-03  1.048e-01  5.571e+02   0.061 0.951241
## t_post_floyd                   -1.256e-02  3.151e-03  5.277e+03  -3.985 6.85e-05
## uof_lag                        -4.194e-03  3.422e-03  5.284e+03  -1.226 0.220427
## stops_lag                       1.548e-03  4.673e-04  4.662e+03   3.313 0.000928
## shoot_lag                      -7.885e-02  7.137e-02  5.261e+03  -1.105 0.269319
## tmax_f                          6.052e-04  5.520e-04  5.241e+03   1.096 0.272951
## snow_in                         1.093e-03  2.670e-02  5.239e+03   0.041 0.967336
## precip_in                      -6.533e-02  9.134e-02  5.241e+03  -0.715 0.474513
## conc_dis                       -6.932e-01  1.042e-01  1.635e+02  -6.653 4.13e-10
## dplyr::lag(white_mh_rate, 1) -6.313e-03  1.368e-02  5.283e+03  -0.462 0.644404
## dplyr::lag(white_mh_rate, 2)  4.382e-02  1.067e-02  5.274e+03   4.107 4.07e-05
## dplyr::lag(white_mh_rate, 3)  5.571e-03  1.067e-02  5.273e+03   0.522 0.601496
##
## (Intercept)
## t                             ***
## state_of_emerg1               *
## stay_at_home1
## post_floyd1
## t_post_floyd                  ***
## 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
```

```
re_latin <- lmer(latin_mh_rate~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                          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)
summary(re_latin)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: latin_mh_rate ~ t + state_of_emerg + stay_at_home + post_floyd +
##     t_post_floyd + 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: 37285.4
##
## Scaled residuals:
##    Min     1Q Median     3Q    Max
## -1.366 -0.087 -0.007  0.061 62.301
##
## Random effects:
##  Groups   Name        Variance  Std.Dev. Corr
##  zcta     (Intercept)  4.431975 2.10523
##           post_floyd1  0.004099 0.06402  -1.00
##  Residual             80.193582 8.95509
## Number of obs: 5150, groups:  zcta, 22
##
## Fixed effects:
##                                Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)                   1.039e-01  6.850e-01  8.346e+01   0.152  0.87979
## t                             6.531e-03  2.332e-03  5.110e+03   2.800  0.00512
## state_of_emerg1              -8.826e-01  1.231e+00  5.115e+03  -0.717  0.47342
## stay_at_home1                -7.083e-02  1.277e+00  5.113e+03  -0.055  0.95577
## post_floyd1                  -3.693e-01  1.307e+00  5.084e+03  -0.282  0.77759
## t_post_floyd                  2.290e-02  4.104e-02  5.113e+03   0.558  0.57688
## uof_lag                       8.549e-02  4.548e-02  4.883e+03   1.880  0.06022
## stops_lag                    -9.693e-04  6.044e-03  2.218e+03  -0.160  0.87258
## shoot_lag                    -2.136e-01  9.533e-01  5.116e+03  -0.224  0.82275
## tmax_f                       -3.514e-03  7.328e-03  5.116e+03  -0.479  0.63162
## snow_in                      -4.927e-01  3.523e-01  5.113e+03  -1.398  0.16203
## precip_in                     6.569e+00  1.222e+00  5.114e+03   5.374 8.04e-08
## conc_dis                     -9.553e-01  4.679e-01  2.443e+01  -2.042  0.05211
## dplyr::lag(latin_mh_rate, 1) -7.422e-03  1.396e-02  5.134e+03  -0.532  0.59505
## dplyr::lag(latin_mh_rate, 2) -1.327e-02  1.320e-02  5.134e+03  -1.005  0.31502
## dplyr::lag(latin_mh_rate, 3) -7.395e-03  1.320e-02  5.134e+03  -0.560  0.57536
##
```

```
## (Intercept)
## t                           **
## state_of_emerg1
## stay_at_home1
## post_floyd1
## t_post_floyd
## 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
## optimizer (nloptwrap) convergence code: 0 (OK)
## boundary (singular) fit: see help('isSingular')
```

```
#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)


#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"))



#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")+
  labs(title = "Figure 3: RE Coefficients-White",
       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"))

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")+
  labs(title = "Figure 4: RE Coefficients - Black",
       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"))

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 5: Concentrated Disadvantage \n by ZCTA",
       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"))

#RE random coefficient model - interaction
re_int <- lmer(mh_rate~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                         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)

re_int_blk <- lmer(blk_mh_rate~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                         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)
summary(re_int_blk)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: blk_mh_rate ~ t + state_of_emerg + stay_at_home + post_floyd +
##     t_post_floyd + 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: 29217.2
##
## Scaled residuals:
##    Min     1Q Median     3Q    Max
## -2.473 -0.147 -0.021  0.090 35.883
##
## Random effects:
##  Groups   Name        Variance Std.Dev. Corr
```

```
##  zcta     (Intercept)  2.314   1.521
##           post_floyd1  1.873   1.369    -0.57
##  Residual             13.791   3.714
## Number of obs: 5320, groups:  zcta, 22
##
## Fixed effects:
##                               Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)                  7.426e-01  3.853e-01  3.184e+01   1.927  0.06290
## t                            6.071e-03  9.625e-04  5.093e+03   6.307 3.08e-10
## state_of_emerg1             -2.539e+00  5.104e-01  5.255e+03  -4.974 6.76e-07
## stay_at_home1                2.289e+00  5.298e-01  5.255e+03   4.320 1.59e-05
## post_floyd1                  2.917e+00  6.179e-01  1.599e+02   4.721 5.09e-06
## t_post_floyd                -7.162e-02  1.719e-02  5.280e+03  -4.167 3.13e-05
## uof_lag                     -1.286e-02  1.851e-02  5.247e+03  -0.695  0.48709
## stops_lag                    1.531e-03  2.526e-03  4.904e+03   0.606  0.54432
## shoot_lag                   -5.578e-02  3.892e-01  5.262e+03  -0.143  0.88604
## tmax_f                      -1.463e-03  2.991e-03  5.252e+03  -0.489  0.62492
## snow_in                     -1.158e-01  1.448e-01  5.251e+03  -0.799  0.42407
## precip_in                   -3.522e-01  4.956e-01  5.252e+03  -0.711  0.47728
## conc_dis                    -1.012e+00  3.113e-01  2.728e+01  -3.250  0.00306
## dplyr::lag(blk_mh_rate, 1) -7.585e-03  1.376e-02  5.303e+03  -0.551  0.58141
## dplyr::lag(blk_mh_rate, 2)  1.864e-02  1.316e-02  5.294e+03   1.416  0.15683
## dplyr::lag(blk_mh_rate, 3)  6.038e-03  1.314e-02  5.297e+03   0.460  0.64584
## post_floyd1:conc_dis         1.069e-01  3.336e-01  1.546e+01   0.320  0.75299
##
## (Intercept)                 .
## t                           ***
## state_of_emerg1             ***
## stay_at_home1               ***
## post_floyd1                 ***
## t_post_floyd                ***
## 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
```

```
re_int_white <- lmer(white_mh_rate~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                        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)
summary(re_int_white)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
```

```
## lmerModLmerTest]
## Formula: white_mh_rate ~ t + state_of_emerg + stay_at_home + post_floyd +
##     t_post_floyd + 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: 11297.6
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -5.2079 -0.2846 -0.0182  0.2317 20.4758
##
## Random effects:
##  Groups   Name        Variance Std.Dev. Corr
##  zcta     (Intercept) 0.90170  0.9496
##           post_floyd1 0.03385  0.1840   -0.98
##  Residual             0.46836  0.6844
## Number of obs: 5320, groups:  zcta, 22
##
## Fixed effects:
##                                 Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)                    3.319e-01  2.062e-01  1.568e+01   1.610 0.127348
## t                              2.739e-03  1.899e-04  5.095e+03  14.427  < 2e-16
## state_of_emerg1               -1.833e-01  9.410e-02  5.253e+03  -1.948 0.051463
## stay_at_home1                 -9.327e-02  9.762e-02  5.254e+03  -0.955 0.339401
## post_floyd1                   -4.030e-03  1.073e-01  1.930e+02  -0.038 0.970087
## t_post_floyd                  -1.196e-02  3.147e-03  5.275e+03  -3.800 0.000146
## uof_lag                       -4.534e-03  3.411e-03  5.211e+03  -1.329 0.183810
## stops_lag                      1.604e-03  4.687e-04  4.930e+03   3.423 0.000625
## shoot_lag                     -7.694e-02  7.132e-02  5.267e+03  -1.079 0.280737
## tmax_f                         5.984e-04  5.518e-04  5.249e+03   1.085 0.278177
## snow_in                        1.401e-03  2.669e-02  5.248e+03   0.052 0.958150
## precip_in                     -6.255e-02  9.131e-02  5.250e+03  -0.685 0.493395
## conc_dis                      -7.310e-01  1.036e-01  1.734e+02  -7.053 3.99e-11
## dplyr::lag(white_mh_rate, 1) -6.185e-03  1.367e-02  5.289e+03  -0.453 0.650872
## dplyr::lag(white_mh_rate, 2)  4.338e-02  1.068e-02  5.280e+03   4.064 4.90e-05
## dplyr::lag(white_mh_rate, 3)  5.033e-03  1.067e-02  5.280e+03   0.472 0.637191
## post_floyd1:conc_dis           2.535e-01  3.872e-02  2.499e+01   6.547 7.40e-07
##
## (Intercept)
## t                             ***
## state_of_emerg1               .
## stay_at_home1
## post_floyd1
## t_post_floyd                  ***
## 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
```

```
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)
class(re_white) <- "lmerMod"
class(re_blk) <- "lmerMod"
class(re_int_white) <- "lmerMod"
class(re_int_blk) <- "lmerMod"


library(patchwork)

re_coef_map_white+re_coef_map_blk+cd_map
```

Figure 3: RE Coefficients−\ Post−Killing Change

Rate per 1,000

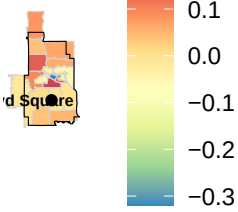


Figure 4: RE Coefficients − Post−Killing Change

Rate per 1,000

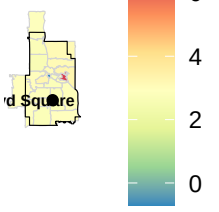
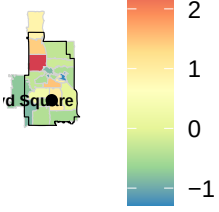


Figure 5: Concentrate by ZCTA

Conc. Disad.

Standard Deviation Units




```
stargazer(re_white, re_blk,  re_int_white, re_int_blk,
          title = "Interrupted Time Series Random Coefficient Models of Black Mental Health",
          covariate.labels = c("T","COVID - State of Emergency", "COVID - Stay at Home",
                               "Post-Killing", "T Post-Killing",
                               "MPD Use of Force t-1", "MPD Stops t-1",
                               "MPD Officer Involved Shootings 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",
                            "Post-Floyd X Conc.Disad."),
          dep.var.caption = "Mental Health Discharges",
          dep.var.labels.include = FALSE,
          column.labels = c("White", "Black",
                            "White w/ Int.","Black w/ Int."),
          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("*","**","***"),
          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)),
                                      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)),
                             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))))
```

% Table created by stargazer v.5.2.3 by Marek Hlavac, Social Policy Institute. E-mail: marek.hlavac at gmail.com % Date and time: Tue, Apr 11, 2023 - 12:38:03 AM % Requires LaTeX packages: dcolumn

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

Table 2: Interrupted Time Series Random Coefficient Models of Black Mental Health

	Mental Health Discharges			
	White	Black	White w/ Int.	Black w/ Int.
	(1)	(2)	(3)	(4)
T	0.003***	0.006***	0.003***	0.006***
	(0.0002)	(0.001)	(0.0002)	(0.001)
COVID - State of Emergency	−0.186*	−2.541***	−0.183	−2.539***
	(0.094)	(0.510)	(0.094)	(0.510)
COVID - Stay at Home	−0.091	2.291***	−0.093	2.289***
	(0.098)	(0.530)	(0.098)	(0.530)
Post-Killing	0.006	2.919***	−0.004	2.917***
	(0.105)	(0.611)	(0.107)	(0.618)
T Post-Killing	−0.013***	−0.072***	−0.012***	−0.072***
	(0.003)	(0.017)	(0.003)	(0.017)
MPD Use of Force t-1	−0.004	−0.013	−0.005	−0.013
	(0.003)	(0.019)	(0.003)	(0.019)
MPD Stops t-1	0.002***	0.002	0.002***	0.002
	(0.0005)	(0.003)	(0.0005)	(0.003)
MPD Officer Involved Shootings t-1	−0.079	−0.057	−0.077	−0.056
	(0.071)	(0.389)	(0.071)	(0.389)
Mean Max. Temp.	0.001	−0.001	0.001	−0.001
	(0.001)	(0.003)	(0.001)	(0.003)
Snow (in.)	0.001	−0.116	0.001	−0.116
	(0.027)	(0.145)	(0.027)	(0.145)
Precip. (in.)	−0.065	−0.354	−0.063	−0.352
	(0.091)	(0.496)	(0.091)	(0.496)
Conc. Disad.	−0.693***	−0.960***	−0.731***	−1.012**
	(0.104)	(0.268)	(0.104)	(0.311)
AR(1)-White	−0.006		−0.006	
	(0.014)		(0.014)	
AR(2)-White	0.044***		0.043***	
	(0.011)		(0.011)	
AR(3)-White	0.006		0.005	
	(0.011)		(0.011)	
AR(1)-Black		−0.008		−0.008
		(0.014)		(0.014)
AR(2)-Black		0.018		0.019
		(0.013)		(0.013)
AR(3)-Black		0.006		0.006
		(0.013)		(0.013)
Post-Floyd X Conc.Disad.			0.253***	0.107
			(0.039)	(0.334)
Constant	0.328	0.740	0.332	0.743
	(0.200)	(0.381)	(0.206)	(0.385)
Resid. Var.	0.47	0.47	13.79	13.79
ZCTA Var.	0.85	0.9	2.24	2.31
Post-Floyd Var.	0.02	0.03	1.68	1.87
Observations	5,320	5,320	5,320	5,320
Log Likelihood	-5,655.008	-14,608.450	-5,648.819	-14,608.600
Akaike Inf. Crit.	11,350.010	29,256.900	11,339.640	29,259.210
Bayesian Inf. Crit.	11,481.600	29,388.480	11,477.800	29,397.370
Note:				*p<0.05; **p<0.01; ***p<0.001

```
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