Gun Series

Ryan Larson

7/30/2021

Base Panel Construction - ZCTA-Week Level

Hospital Data - ZCTA-Week level

```
hosp_zcta <- read_csv("Data/Restricted MHA Data/minnepop_1620_agg_zipfull_updated.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",
```

```r
                              "B01001_002E", "B99233_005E",
                              "B06009_002E", "B23025_005E",
                              "B23025_002E", "B11003_015E",
                              "B19013_001E"),
                 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,
        no_hs_dip = B06009_002E,
        unemp = B23025_005E,
        total_ilf = B23025_002E,
        female_hh = B11003_015E,
        med_hh_inc = B19013_001E) %>%
  select(-ends_with("M", ignore.case = F), -GEOID) %>%
  mutate(zcta = str_sub(NAME, 6)) %>%
  select(-NAME) %>%
  select(zcta, everything()) %>%
  mutate(year = as.numeric(year)) %>%
  mutate_at(vars(-zcta, -year, -total_pop, -med_age,
                 -unemp, -total_ilf, -med_hh_inc),
            list(~(./total_pop)*100)) %>%
  mutate(unemp_rate = 100*unemp/total_ilf,
         zcta = as.numeric(zcta))
```

```r
#LOCF imputation of 2020 until 2020 ACS release (12/9/2021)
#acs_2020 <- acs %>%
  #complete(zcta, year = 2016:2020) %>%
  #group_by(zcta) %>%
  #mutate_at(vars(-zcta, -year),
  #          funs(if(sum(!is.na(.))<1) {.} else{na_locf(., option = "locf")})) %>%
  #filter(year==2020)

#acs_imp <- acs %>%
 # rbind(acs_2020) %>%
  #mutate(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))
```

```
##   |                                                                            |
```

```r
#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\rlarson21\Documents\Research\Gun-
##   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 >= 2)

#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),
         assault_undet_incid_c = (assault_tot+undeter_tot)/total_pop*100000)

#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) %>%
```

```r
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 <= 2021 & 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)) %>%
```

```r
  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 <= 2021 & 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)
```

```r
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")) %>%
  mutate(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)

#creating period indicators for panel
panel <- panel %>%
  mutate(post_floyd = as.numeric(begin_date >= as.Date("2020-05-25")),
         post_floyd_3 = as.numeric(begin_date >= as.Date("2020-05-25")+months(3)),
         stay_at_home = as.numeric(begin_date >= as.Date("2020-03-28") &
         state_of_emerg = 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),
         months_post = factor(case_when(
           weeks_post <= 0 ~ "0 Months Post",
           weeks_post %in% c(1:4) ~ "1 Months Post",
           weeks_post %in% c(5:8) ~ "2 Months Post",
           weeks_post %in% c(9:12) ~ "3 Months Post",
           weeks_post %in% c(13:16) ~ "4 Months Post",
           weeks_post %in% c(17:20) ~ "5 Months Post",
           weeks_post %in% c(21:24) ~ "6 Months Post",
           weeks_post %in% c(25:31) ~ "7+ Months Post"),
           levels = c("0 Months Post","1 Months Post","2 Months Post",
                      "3 Months Post","4 Months Post","5 Months Post",
                      "6 Months Post","7+ Months Post")),
         period = factor(case_when(
           post_floyd==0 & post_floyd_3==0 ~ "Pre-Killing",
           post_floyd>=1 & post_floyd_3==0 ~ "0-3 Months Post-Killing",
           post_floyd>=1 & post_floyd_3>=1 ~ "3+ Months Post-Killing"),
           levels = c("Pre-Killing", "0-3 Months Post-Killing", "3+ Months Post-Killing"))) %>%
  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))
```

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(assault_tot = sum(assault_tot, na.rm = T),
            unintent_tot = sum(unintent_tot, na.rm = T),
            suicide_tot = sum(suicide_tot, na.rm = T),
            undeter_tot = sum(undeter_tot, na.rm = T),
            legal_tot = sum(legal_tot, na.rm = T),
            combined_tot = sum(combined_tot, na.rm = T),
            total_pop = sum(total_pop, na.rm = T)) %>%
  mutate(assault_incid_c = (assault_tot/total_pop)*100000,
         unintent_incid_c = (unintent_tot/total_pop)*100000,
         suicide_incid_c = (suicide_tot/total_pop)*100000,
         undeter_incid_c = (undeter_tot/total_pop)*100000,
         legal_incid_c = (legal_tot/total_pop)*100000,
         combined_incid_c = (combined_tot/total_pop)*100000,
         assault_unintent_incid_c = (assault_tot+unintent_tot)/total_pop*100000) %>%
  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") %>%
```

```r
  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")) %>%
```

```r
  mutate(police_stop_rate = (police_stops/total_pop)*1000)


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

Weather Data

```r
# Minnesota DNR Daily Date
 # https://www.dnr.state.mn.us/climate/historical/daily-data.html?sid=mspthr&sname=Minneapolis/St%20Paul%20Threaded%20Record&sdate=2010-01
 # 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 series
series <- series %>% left_join(weather, by = c("year","weekofyr"="week"))
```

Sunset Data

```r
#setting lat-lon for MPLS
mpls_lonlat <- geocode("Minneapolis, MN", output = "latlon", source="google")

#scrape sunset times for each begin date
  #mutate to UTC-6 CST
```

```r
    #calculate hours of darkness before midnight
sun_series <- getSunlightTimes(date = seq(min(series$begin_date),
                                 max(series$begin_date),
                                 "days"),
                               lat = 44.97775    ,
                               lon = -93.26501,
                               keep = "sunset",
                               tz = "UTC") %>%
  mutate(sunset = sunset-hours(6),
         midnight = as.POSIXlt(date+days(1), format = '%Y-%m-%d %H:%M:%S'),
         dark = as.numeric(midnight-sunset),
         year = year(date),
         week = isoweek(date)) %>%
  group_by(year, week) %>%
  summarize(dark_before_12 = mean(dark, na.rm = T))


#joining to series
series <- series %>%
  left_join(sun_series, by = c("year", "weekofyr"="week"))
```

School Data

```r
#created manually from online MPLS Public School Calendars: https://mpls.k12.mn.us/calendars
school <- series %>%
  select(year, weekofyr, begin_date, end_date) %>%
  mutate(days_in_week = as.numeric((end_date-begin_date))+1,
         days_in_school = NA_integer_)

school[1,6] <- 5
school[2,6] <- 4
school[3,6] <- 3
school[4,6] <- 5
school[5,6] <- 5
school[6,6] <- 4
school[7,6] <- 4
school[8,6] <- 5
school[9,6] <- 5
```

```
school[10,6] <- 4
school[11,6] <- 4
school[12,6] <- 5
school[13,6] <- 0
school[14,6] <- 5
school[15,6] <- 5
school[16,6] <- 5
school[17,6] <- 5
school[18,6] <- 5
school[19,6] <- 5
school[20,6] <- 5
school[21,6] <- 5
school[22,6] <- 4
school[23,6] <- 2
school[24,6] <- 0
school[25,6] <- 0
school[26,6] <- 0
school[27,6] <- 0
school[28,6] <- 0
school[29,6] <- 0
school[30,6] <- 0
school[31,6] <- 0
school[32,6] <- 0
school[33,6] <- 0
school[34,6] <- 0
school[35,6] <- 5
school[36,6] <- 4
school[37,6] <- 5
school[38,6] <- 5
school[39,6] <- 5
school[40,6] <- 5
school[41,6] <- 5
school[42,6] <- 2
school[43,6] <- 5
school[44,6] <- 3
school[45,6] <- 5
school[46,6] <- 5
school[47,6] <- 2
```

```
school[48,6] <- 5
school[49,6] <- 5
school[50,6] <- 5
school[51,6] <- 0
school[52,6] <- 0
school[53,6] <- 4
school[54,6] <- 5
school[55,6] <- 4
school[56,6] <- 4
school[57,6] <- 4
school[58,6] <- 5
school[59,6] <- 4
school[60,6] <- 4
school[61,6] <- 5
school[62,6] <- 5
school[63,6] <- 5
school[64,6] <- 5
school[65,6] <- 3
school[66,6] <- 0
school[67,6] <- 5
school[68,6] <- 5
school[69,6] <- 5
school[70,6] <- 5
school[71,6] <- 5
school[72,6] <- 5
school[73,6] <- 5
school[74,6] <- 4
school[75,6] <- 5
school[76,6] <- 3
school[77,6] <- 0
school[78,6] <- 0
school[79,6] <- 0
school[80,6] <- 0
school[81,6] <- 0
school[82,6] <- 0
school[83,6] <- 0
school[84,6] <- 0
school[85,6] <- 0
```

```
school[86,6] <- 0
school[87,6] <- 5
school[88,6] <- 4
school[89,6] <- 5
school[90,6] <- 5
school[91,6] <- 5
school[92,6] <- 5
school[93,6] <- 5
school[94,6] <- 2
school[95,6] <- 5
school[96,6] <- 3
school[97,6] <- 5
school[98,6] <- 5
school[99,6] <- 2
school[100,6] <- 5
school[101,6] <- 5
school[102,6] <- 5
school[103,6] <- 5
school[104,6] <- 0
school[105,6] <- 0
school[106,6] <- 0
school[107,6] <- 5
school[108,6] <- 4
school[109,6] <- 3
school[110,6] <- 5
school[111,6] <- 5
school[112,6] <- 4
school[113,6] <- 4
school[114,6] <- 5
school[115,6] <- 5
school[116,6] <- 5
school[117,6] <- 5
school[118,6] <- 4
school[119,6] <- 0
school[120,6] <- 5
school[121,6] <- 5
school[122,6] <- 5
school[123,6] <- 5
```

```
school[124,6] <- 5
school[125,6] <- 5
school[126,6] <- 5
school[127,6] <- 4
school[128,6] <- 5
school[129,6] <- 0
school[130,6] <- 0
school[131,6] <- 0
school[132,6] <- 0
school[133,6] <- 0
school[134,6] <- 0
school[135,6] <- 0
school[136,6] <- 0
school[137,6] <- 0
school[138,6] <- 0
school[139,6] <- 0
school[140,6] <- 5
school[141,6] <- 4
school[142,6] <- 5
school[143,6] <- 5
school[144,6] <- 5
school[145,6] <- 5
school[146,6] <- 5
school[147,6] <- 2
school[148,6] <- 5
school[149,6] <- 3
school[150,6] <- 5
school[151,6] <- 5
school[152,6] <- 2
school[153,6] <- 5
school[154,6] <- 5
school[155,6] <- 5
school[156,6] <- 5
school[157,6] <- 0
school[158,6] <- 0
school[159,6] <- 5
school[160,6] <- 5
school[161,6] <- 2
```

```
school[162,6] <- 5
school[163,6] <- 5
school[164,6] <- 4
school[165,6] <- 4
school[166,6] <- 5
school[167,6] <- 5
school[168,6] <- 5
school[169,6] <- 5
school[170,6] <- 4
school[171,6] <- 0
school[172,6] <- 5
school[173,6] <- 5
school[174,6] <- 5
school[175,6] <- 5
school[176,6] <- 5
school[177,6] <- 5
school[178,6] <- 5
school[179,6] <- 4
school[180,6] <- 5
school[181,6] <- 0
school[182,6] <- 0
school[183,6] <- 0
school[184,6] <- 0
school[185,6] <- 0
school[186,6] <- 0
school[187,6] <- 0
school[188,6] <- 0
school[189,6] <- 0
school[190,6] <- 0
school[191,6] <- 0
school[192,6] <- 0
school[193,6] <- 4
school[194,6] <- 5
school[195,6] <- 5
school[196,6] <- 5
school[197,6] <- 5
school[198,6] <- 5
school[199,6] <- 2
```

```
school[200,6] <- 5
school[201,6] <- 4
school[202,6] <- 5
school[203,6] <- 5
school[204,6] <- 5
school[205,6] <- 2
school[206,6] <- 5
school[207,6] <- 5
school[208,6] <- 5
school[209,6] <- 0
school[210,6] <- 0
school[211,6] <- 5
school[212,6] <- 4
school[213,6] <- 4
school[214,6] <- 5
school[215,6] <- 5
school[216,6] <- 5
school[217,6] <- 3
school[218,6] <- 5
school[219,6] <- 5
school[220,6] <- 5
school[221,6] <- 5
school[222,6] <- 4
school[223,6] <- 0
school[224,6] <- 5
school[225,6] <- 5
school[226,6] <- 5
school[227,6] <- 5
school[228,6] <- 5
school[229,6] <- 5
school[230,6] <- 5
school[231,6] <- 4
school[232,6] <- 5
school[233,6] <- 0
school[234,6] <- 0
school[235,6] <- 0
school[236,6] <- 0
school[237,6] <- 0
```

```
school[238,6] <- 0
school[239,6] <- 0
school[240,6] <- 0
school[241,6] <- 0
school[242,6] <- 0
school[243,6] <- 0
school[244,6] <- 0
school[245,6] <- 4
school[246,6] <- 5
school[247,6] <- 5
school[248,6] <- 5
school[249,6] <- 5
school[250,6] <- 5
school[251,6] <- 3
school[252,6] <- 4
school[253,6] <- 5
school[254,6] <- 4
school[255,6] <- 5
school[256,6] <- 5
school[257,6] <- 2
school[258,6] <- 5
school[259,6] <- 5
school[260,6] <- 5
school[261,6] <- 0


school <- school %>%
  mutate(school = days_in_school/days_in_week) %>%
  select(year, weekofyr, school)

series <- series %>% left_join(school, by = c("year", "weekofyr"))
```

Time Series Vizualization

```
ggplot(series)+
  geom_line(aes(x=begin_date, y=assault_incid_c))+
```
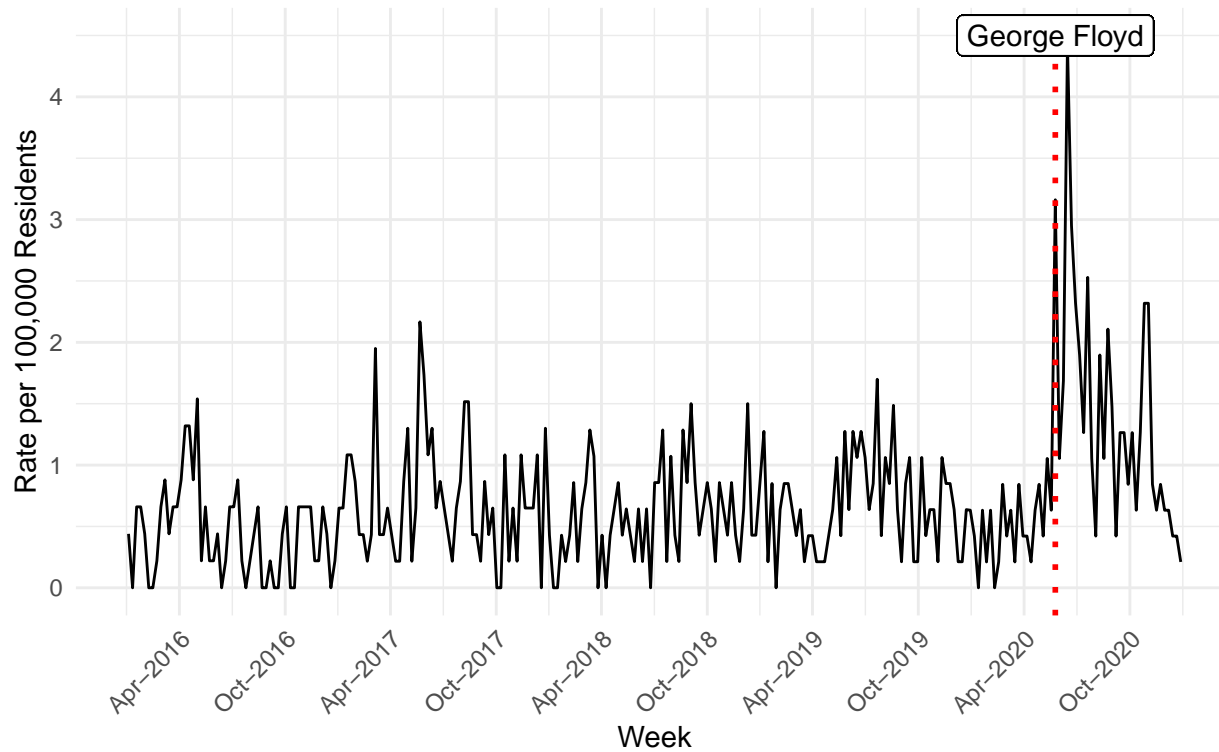
```r
scale_x_date(date_labels = "%b-%Y", date_breaks = "6 months")+
geom_vline(xintercept=series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-05-25"))],
           linetype="dotted", color="red", size=1)+
geom_label(aes(x=series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-05-25"))],
               y=4.5),
           label = "George Floyd", show.legend = FALSE)+
labs(title = "Figure 1: Weekly Firearm Assault Injuries, 2016-2020",
     subtitle = "MHA Hospital Data",
     x = "Week",
     y = "Rate per 100,000 Residents")+
theme_minimal()+
  theme(axis.text.x=element_text(angle=45, hjust=1))
```

Figure 1: Weekly Firearm Assault Injuries, 2016–2020
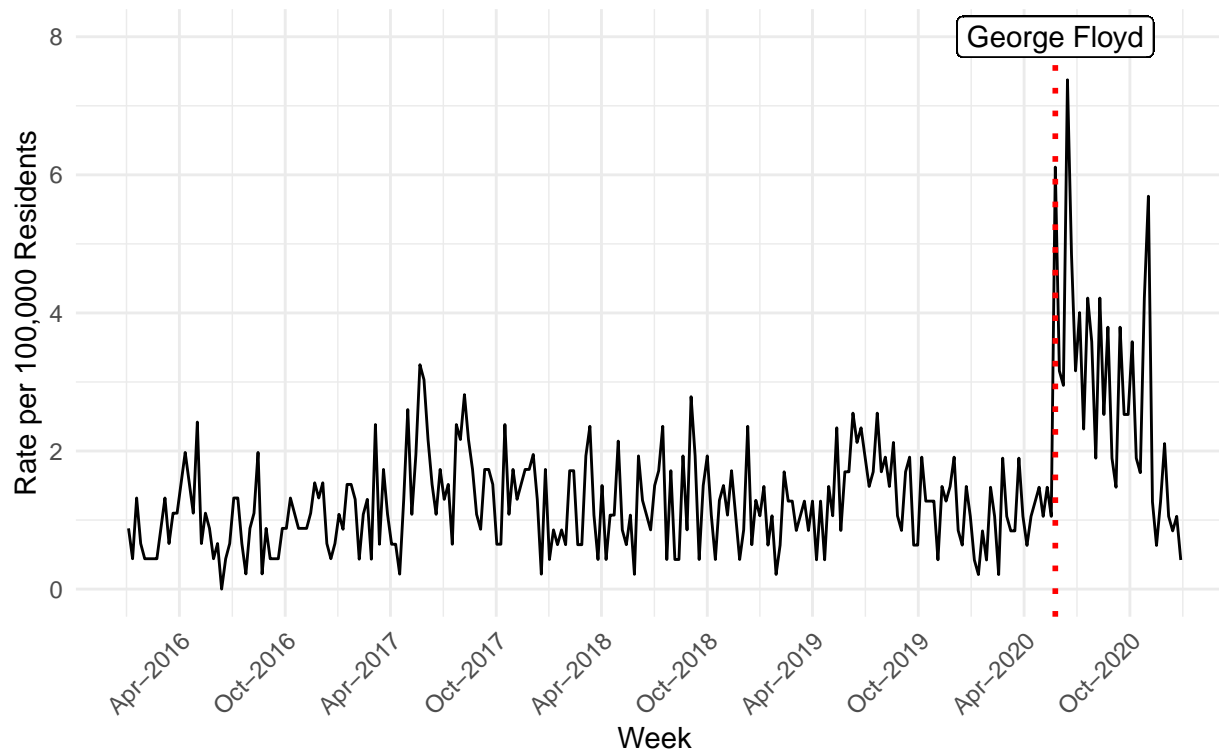MHA Hospital Data


```
ggplot(series)+
  geom_line(aes(x=begin_date, y=assault_unintent_incid_c))+
  scale_x_date(date_labels = "%b-%Y", date_breaks = "6 months")+
  geom_vline(xintercept=series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-05-25"))],
             linetype="dotted", color="red", size=1)+
  geom_label(aes(x=series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-05-25"))],
                 y=8),
             label = "George Floyd", show.legend = FALSE)+
  labs(title = "Figure A4: Weekly Firearm Assault+Unintentional Injuries, 2016-2020",
       subtitle = "MHA Hospital Data",
       x = "Week",
```

```
        y = "Rate per 100,000 Residents")+
  theme_minimal()+
    theme(axis.text.x=element_text(angle=45, hjust=1))
```

Figure A4: Weekly Firearm Assault+Unintentional Injuries, 2016–2020

MHA Hospital Data


```
ggplot(series)+
  geom_line(aes(x=begin_date, y=undeter_incid_c))+
  scale_x_date(date_labels = "%b-%Y", date_breaks = "6 months")+
  geom_vline(xintercept=series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-05-25"))],
             linetype="dotted", color="red", size=1)+
  geom_label(aes(x=series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-05-25"))],
                 y=.75),
```

```
            label = "George Floyd", show.legend = FALSE)+
labs(title = "Figure A7: Weekly Firearm Undetermined Injuries, 2016-2020",
     subtitle = "MHA Hospital Data",
     x = "Week",
     y = "Rate per 100,000 Residents")+
theme_minimal()+
  theme(axis.text.x=element_text(angle=45, hjust=1))
```

Figure A7: Weekly Firearm Undetermined Injuries, 2016–2020

MHA Hospital Data
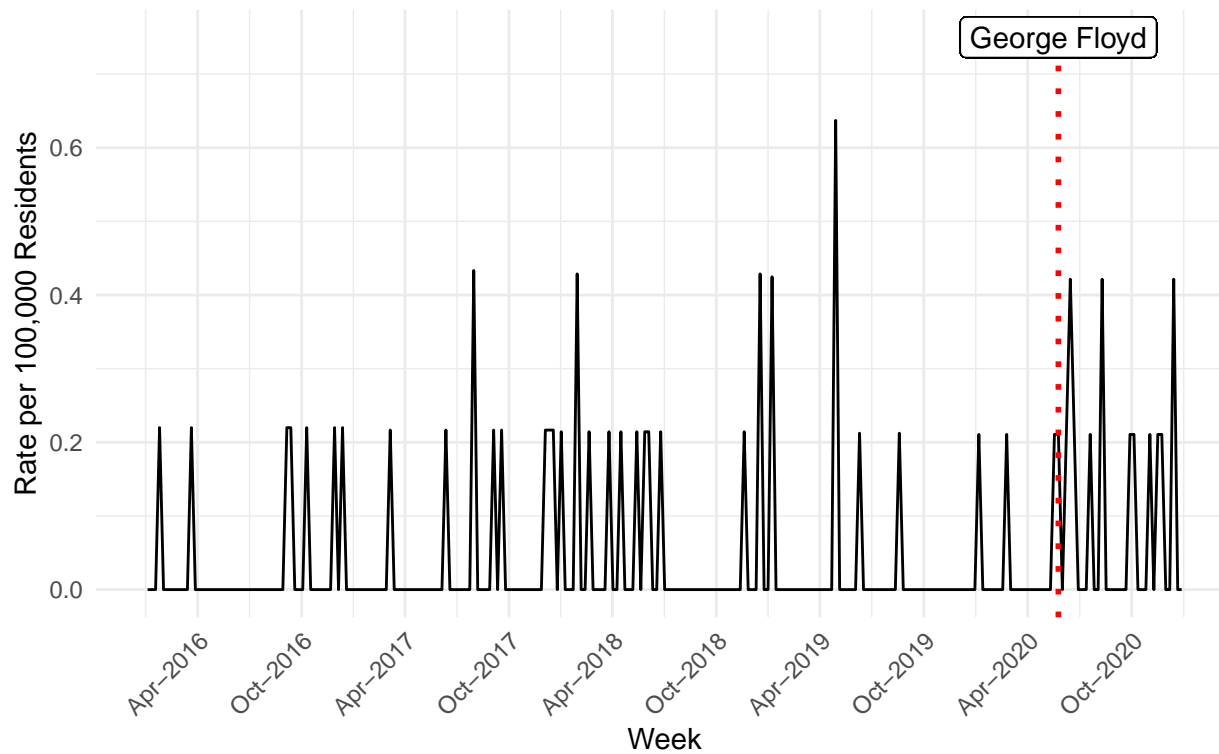

```
mean(series$assault_incid_c[series$post_floyd==0])
```

```
## [1] NaN
```

```
4.4/.6
```

```
## [1] 7.333333
```

Time Series Analysis

$$y_t = \beta_0 + \beta_1 Time_t + \beta_2 PostKilling_t + \beta_3 TimePost_t + \phi \mathbf{X}_t + \rho_1 y_{t-1} + \epsilon_t$$

```r
series <- series %>%
  mutate(t = 1:length(assault_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),
         months_post = factor(case_when(
           weeks_post <= 0 ~ "0 Months Post",
           weeks_post %in% c(1:4) ~ "1 Months Post",
           weeks_post %in% c(5:8) ~ "2 Months Post",
           weeks_post %in% c(9:12) ~ "3 Months Post",
           weeks_post %in% c(13:16) ~ "4 Months Post",
           weeks_post %in% c(17:20) ~ "5 Months Post",
           weeks_post %in% c(21:24) ~ "6 Months Post",
           weeks_post %in% c(25:31) ~ "7+ Months Post"),
           levels = c("0 Months Post","1 Months Post","2 Months Post",
                      "3 Months Post","4 Months Post","5 Months Post",
                      "6 Months Post","7+ Months Post")))

ts <- lm(assault_incid_c~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                         tmax_f+snow_in+precip_in+dark_before_12+school,
                         data = series)
summary(ts)
```

```
## 
## Call:
## lm(formula = assault_incid_c ~ t + state_of_emerg + stay_at_home +
##     post_floyd + t_post_floyd + tmax_f + snow_in + precip_in +
##     dark_before_12 + school, data = series)
## 
## Residuals:
##      Min      1Q   Median      3Q      Max
## -1.35968 -0.32342 -0.04226  0.23651  2.26161
## 
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)     0.6730083  0.3947942   1.705   0.0895 .
## t               0.0008298  0.0005033   1.649   0.1004
## state_of_emerg1 -0.4221236  0.2884605  -1.463   0.1446
## stay_at_home1   0.3270287  0.2967973   1.102   0.2716
## post_floyd1     1.9446701  0.3028230   6.422 6.73e-10 ***
## t_post_floyd   -0.0542385  0.0098753  -5.492 9.75e-08 ***
## tmax_f          0.0013252  0.0026799   0.494   0.6214
## snow_in        -0.0505587  0.0859528  -0.588   0.5569
## precip_in      -0.0890084  0.2808044  -0.317   0.7515
## dark_before_12 -0.0385454  0.0462303  -0.834   0.4052
## school          0.0004985  0.1047753   0.005   0.9962
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 
## Residual standard error: 0.4659 on 250 degrees of freedom
## Multiple R-squared:  0.3724, Adjusted R-squared:  0.3473
## F-statistic: 14.83 on 10 and 250 DF,  p-value: < 2.2e-16
```

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

Series: resid(ts)
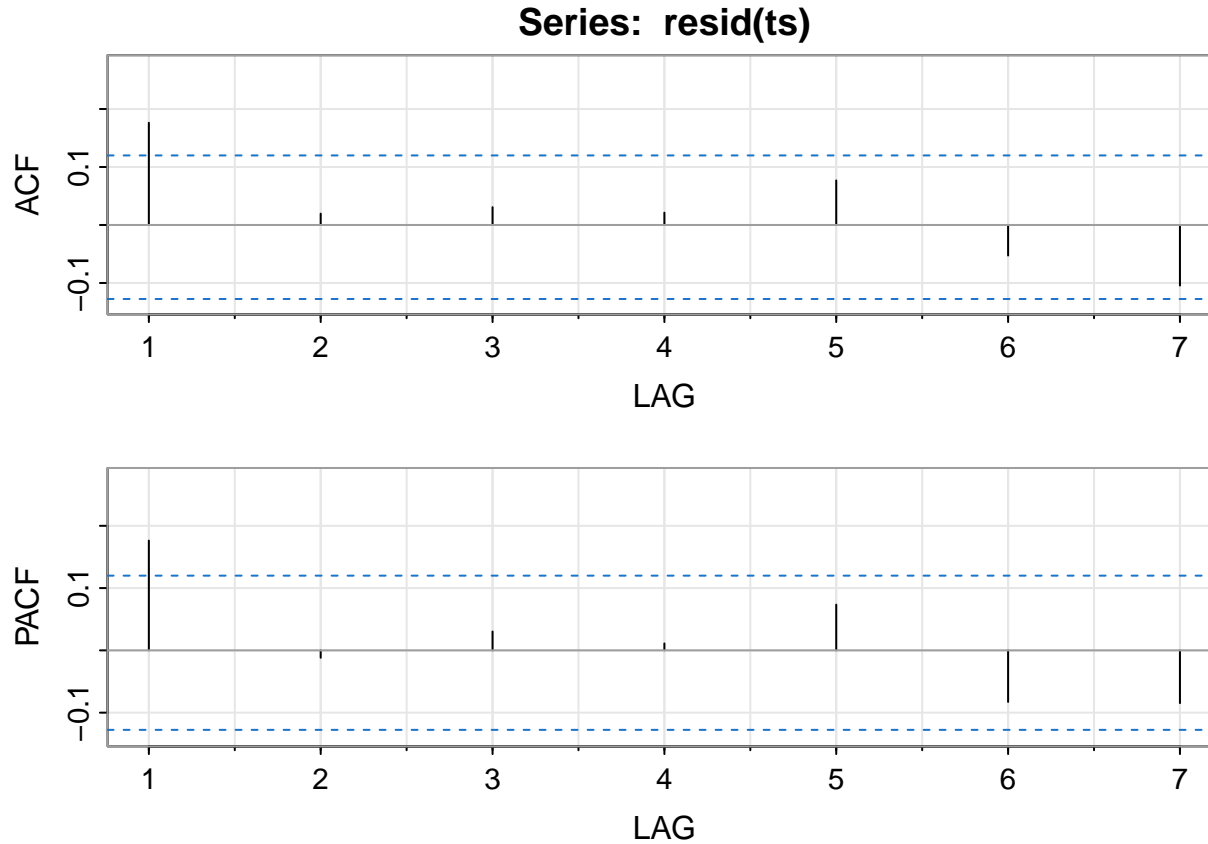

```
##        [,1]  [,2] [,3] [,4] [,5]  [,6]  [,7]
## ACF   0.18  0.02 0.03 0.02 0.08 -0.05 -0.10
## PACF  0.18 -0.01 0.03 0.01 0.07 -0.08 -0.08
```

```
ts_ar1<- lm(assault_incid_c~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                    tmax_f+snow_in+precip_in+dark_before_12+school+
                    dplyr::lag(assault_incid_c, 1), data = series)
summary(ts_ar1)
```
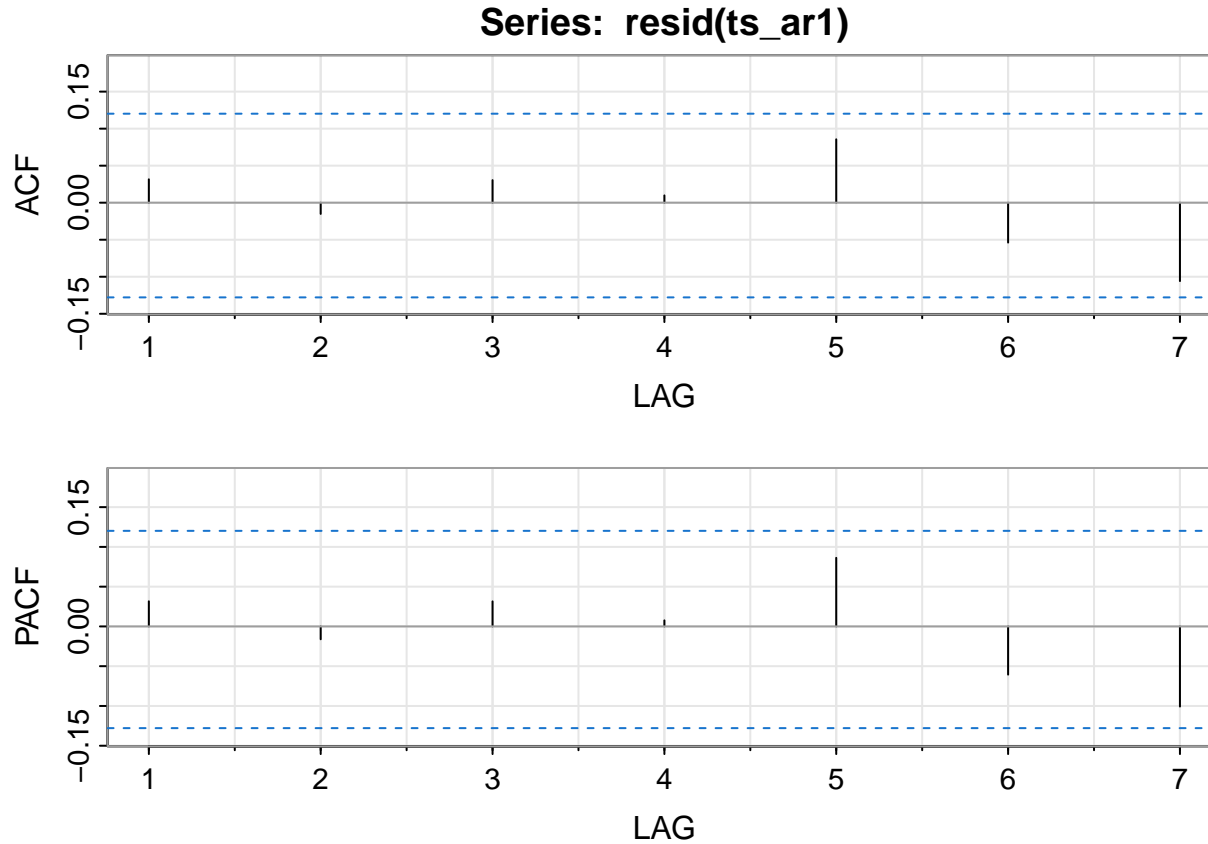
```
##
## Call:
## lm(formula = assault_incid_c ~ t + state_of_emerg + stay_at_home +
```

```
##       post_floyd + t_post_floyd + tmax_f + snow_in + precip_in +
##       dark_before_12 + school + dplyr::lag(assault_incid_c, 1),
##       data = series)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.35773 -0.32834 -0.00796  0.23712  2.32335
##
## Coefficients:
##                                Estimate Std. Error t value Pr(>|t|)
## (Intercept)                   0.5790022  0.3943385   1.468    0.143
## t                             0.0007124  0.0005068   1.406    0.161
## state_of_emerg1              -0.4628323  0.2871631  -1.612    0.108
## stay_at_home1                 0.4029897  0.2966860   1.358    0.176
## post_floyd1                   1.7814084  0.3090872   5.763 2.44e-08 ***
## t_post_floyd                 -0.0475773  0.0102296  -4.651 5.38e-06 ***
## tmax_f                        0.0010368  0.0026663   0.389    0.698
## snow_in                      -0.0485372  0.0853940  -0.568    0.570
## precip_in                    -0.0522940  0.2794156  -0.187    0.852
## dark_before_12               -0.0337543  0.0459955  -0.734    0.464
## school                        0.0130985  0.1042370   0.126    0.900
## dplyr::lag(assault_incid_c, 1) 0.1423092  0.0617438   2.305    0.022 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4628 on 248 degrees of freedom
##   (1 observation deleted due to missingness)
## Multiple R-squared:  0.385,  Adjusted R-squared:  0.3578
## F-statistic: 14.12 on 11 and 248 DF,  p-value: < 2.2e-16
```

```
acf2(resid(ts_ar1), max.lag = 7)
```

Series: resid(ts_ar1)


```
##        [,1]   [,2] [,3] [,4] [,5]  [,6]  [,7]
## ACF   0.03 -0.02 0.03 0.01 0.09 -0.05 -0.11
## PACF  0.03 -0.02 0.03 0.01 0.09 -0.06 -0.10
```

```
ts_pol <- lm(assault_incid_c~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                tmax_f+snow_in+precip_in+dark_before_12+school+
                uof_lag+stops_lag+shoot_lag,
                data = series)
summary(ts_pol)
```
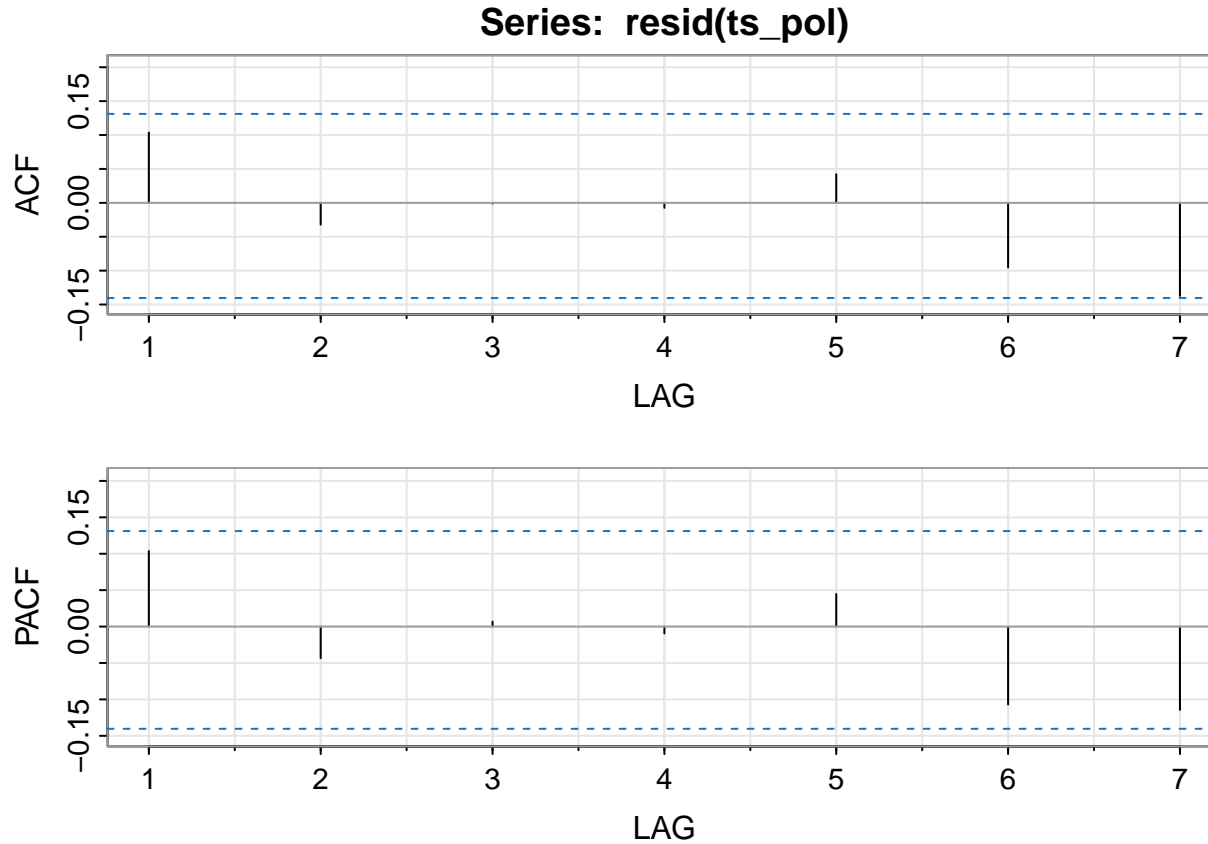
```
##
## Call:
```

```
## lm(formula = assault_incid_c ~ t + state_of_emerg + stay_at_home +
##     post_floyd + t_post_floyd + tmax_f + snow_in + precip_in +
##     dark_before_12 + school + uof_lag + stops_lag + shoot_lag,
##     data = series)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.36308 -0.31473 -0.03944  0.24767  2.18171
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)     9.947e-01  5.749e-01   1.730   0.0851 .
## t              -8.378e-04  9.741e-04  -0.860   0.3908
## state_of_emerg1 -3.893e-01  2.969e-01  -1.311   0.1912
## stay_at_home1   3.859e-01  3.040e-01   1.269   0.2058
## post_floyd1     1.839e+00  3.185e-01   5.774 2.87e-08 ***
## t_post_floyd   -5.015e-02  1.098e-02  -4.565 8.64e-06 ***
## tmax_f          3.010e-03  3.106e-03   0.969   0.3337
## snow_in        -7.787e-02  9.228e-02  -0.844   0.3997
## precip_in       1.861e-01  3.130e-01   0.595   0.5528
## dark_before_12 -2.323e-02  5.394e-02  -0.431   0.6671
## school         -3.614e-02  1.203e-01  -0.300   0.7642
## uof_lag         4.610e-02  7.035e-01   0.066   0.9478
## stops_lag      -1.349e-01  1.234e-01  -1.093   0.2755
## shoot_lag      -2.871e+01  2.053e+01  -1.399   0.1635
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4743 on 203 degrees of freedom
##   (44 observations deleted due to missingness)
## Multiple R-squared:  0.4043, Adjusted R-squared:  0.3662
## F-statistic:  10.6 on 13 and 203 DF,  p-value: < 2.2e-16
```

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

Series: resid(ts_pol)


```
##         [,1]  [,2] [,3]  [,4] [,5]  [,6]  [,7]
## ACF     0.1 -0.03 0.00 -0.01 0.04 -0.10 -0.14
## PACF    0.1 -0.04 0.01 -0.01 0.04 -0.11 -0.11
```

```
ts_b <- lm(assault_incid_c~t+state_of_emerg+stay_at_home+
               post_floyd+months_post+
                   tmax_f+snow_in+precip_in+dark_before_12+school,
                   data = series)


ts_b_pol <- lm(assault_incid_c~t+state_of_emerg+stay_at_home+
               post_floyd+months_post+
```

```
                        tmax_f+snow_in+precip_in+dark_before_12+school+
                        uof_lag+stops_lag+shoot_lag,
                        data = series)

ts_ar1_pol<- lm(assault_incid_c~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                        tmax_f+snow_in+precip_in+dark_before_12+school+
                    uof_lag+stops_lag+shoot_lag+
                        dplyr::lag(assault_incid_c, 1), data = series)


summary(ts_ar1_pol)
```
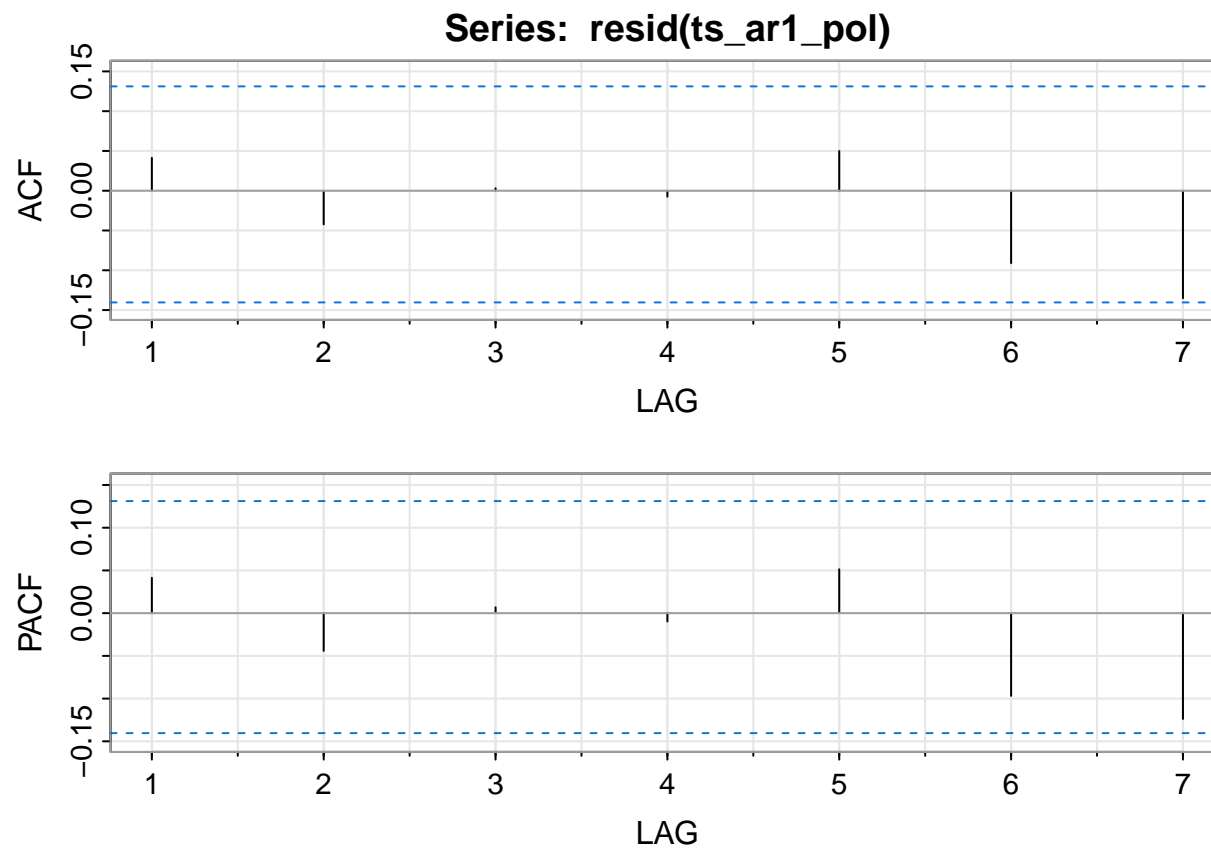
```
##
## Call:
## lm(formula = assault_incid_c ~ t + state_of_emerg + stay_at_home +
##     post_floyd + t_post_floyd + tmax_f + snow_in + precip_in +
##     dark_before_12 + school + uof_lag + stops_lag + shoot_lag +
##     dplyr::lag(assault_incid_c, 1), data = series)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.31636 -0.31029 -0.02695  0.22779  2.21257
##
## Coefficients:
##                                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)                    9.310e-01  5.792e-01   1.607    0.110
## t                             -7.609e-04  9.780e-04  -0.778    0.437
## state_of_emerg1               -4.111e-01  2.979e-01  -1.380    0.169
## stay_at_home1                  4.162e-01  3.059e-01   1.361    0.175
## post_floyd1                    1.775e+00  3.259e-01   5.448 1.48e-07 ***
## t_post_floyd                  -4.716e-02  1.145e-02  -4.120 5.53e-05 ***
## tmax_f                         2.663e-03  3.129e-03   0.851    0.396
## snow_in                       -7.622e-02  9.233e-02  -0.826    0.410
## precip_in                      2.017e-01  3.135e-01   0.643    0.521
## dark_before_12                -2.241e-02  5.396e-02  -0.415    0.678
## school                        -2.888e-02  1.206e-01  -0.239    0.811
## uof_lag                       -1.511e-02  7.068e-01  -0.021    0.983
## stops_lag                     -1.213e-01  1.243e-01  -0.976    0.330
## shoot_lag                     -2.738e+01  2.058e+01  -1.330    0.185
```

```
## dplyr::lag(assault_incid_c, 1)  6.459e-02  6.937e-02   0.931     0.353
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4744 on 202 degrees of freedom
##   (44 observations deleted due to missingness)
## Multiple R-squared:  0.4069, Adjusted R-squared:  0.3658
## F-statistic: 9.898 on 14 and 202 DF,  p-value: < 2.2e-16
```

```
acf2(resid(ts_ar1_pol), max.lag = 7)
```


Series: resid(ts_ar1_pol)

```
##      [,1]  [,2] [,3]  [,4] [,5]  [,6]  [,7]
```

```
## ACF   0.04 -0.04 0.00 -0.01 0.05 -0.09 -0.14
## PACF 0.04 -0.04 0.01 -0.01 0.05 -0.10 -0.12
```

```r
ts_ar1_u <- lm(assault_unintent_incid_c~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                      tmax_f+snow_in+precip_in+dark_before_12+school+
                      dplyr::lag(assault_unintent_incid_c, 1),
                   data = series)

ts_ar1_pol_u <- lm(assault_unintent_incid_c~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                      tmax_f+snow_in+precip_in+dark_before_12+school+
                   uof_lag+stops_lag+shoot_lag+
                      dplyr::lag(assault_unintent_incid_c, 1),
                   data = series)

ts_ar1_pol_d <- lm(undeter_incid_c~t+state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                      tmax_f+snow_in+precip_in+dark_before_12+school+
                   uof_lag+stops_lag+shoot_lag+
                      dplyr::lag(undeter_incid_c, 1), data = series)

ts_ar1_d <- lm(undeter_incid_c~t+state_of_emerg+stay_at_home+post_floyd+
                   t_post_floyd+
                      tmax_f+snow_in+precip_in+dark_before_12+school+
                      dplyr::lag(undeter_incid_c, 1), data = series)
```

ZCTA-Week Level Analysis

ZCTA-Level Maps

```r
#aggregate to zip-level over years
zip_level <- panel %>%
  group_by(zcta, period) %>%
  summarize(assault_tot = mean(assault_tot, na.rm = T),
            unintent_tot = mean(unintent_tot, na.rm = T),
            suicide_tot = mean(suicide_tot, na.rm = T),
            undeter_tot = mean(undeter_tot, na.rm = T),
            legal_tot = mean(legal_tot, na.rm = T),
            combined_tot = mean(combined_tot, na.rm = T),
            total_pop = mean(total_pop, na.rm = T)) %>%
```

```r
  mutate(assault_incid_c = (assault_tot/total_pop)*100000,
         unintent_incid_c = (unintent_tot/total_pop)*100000,
         suicide_incid_c = (suicide_tot/total_pop)*100000,
         undeter_incid_c = (undeter_tot/total_pop)*100000,
         legal_incid_c = (legal_tot/total_pop)*100000,
         combined_incid_c = (combined_tot/total_pop)*100000,
         assault_unintent_incid_c = ((assault_tot+unintent_tot)/total_pop)*100000) %>%
  ungroup() %>%
  left_join(zcta, by = "zcta")

mean(zip_level$assault_incid_c[zip_level$period=="Pre-Killing"], na.rm = T)
```

```
## [1] 0.6761851
```

```r
range(zip_level$assault_incid_c[zip_level$period=="Pre-Killing"], na.rm = T)
```

```
## [1] 0.000000 3.163689
```

```r
#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")

ggplot() +
  geom_sf(data = zip_level, aes(geometry = geometry, fill = assault_incid_c)) +
  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",
                  nudge_x = .1, nudge_y = -.1)+
  facet_wrap(~period)+
  scale_fill_distiller(palette = "Spectral")+
  labs(title = "Figure 2: Weekly Firearm Assault Injury Rates by ZCTA and Period",
       subtitle = "MHA Hospital Discharge Data",
       fill = "Incident Rate/100,000")+
  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"))
```

Figure 2: Weekly Firearm Assault Injury Rates by ZCTA and Period

MHA Hospital Discharge Data


```
ggplot() +
  geom_sf(data = zip_level, aes(geometry = geometry, fill = assault_unintent_incid_c)) +
```

```r
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",
                nudge_x = .1, nudge_y = -.1)+
facet_wrap(~period)+
scale_fill_distiller(palette = "Spectral")+
labs(title = "Figure A5: Weekly Firearm Assault+Unintentional Injury Rates by ZCTA and Period",
     subtitle = "MHA Hospital Discharge Data",
     fill = "Incident Rate/100,000")+
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"))
```
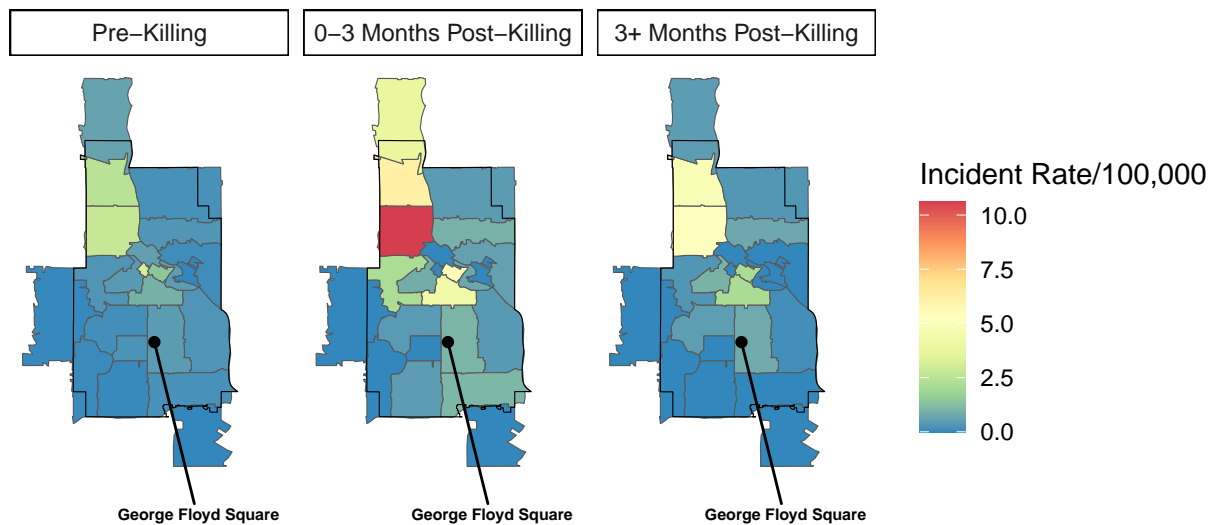
Figure A5: Weekly Firearm Assault+Unintentional Injury Rates by ZCTA and Per

MHA Hospital Discharge Data


```
ggplot() +
  geom_sf(data = zip_level, aes(geometry = geometry, fill = undeter_incid_c)) +
  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",
                  nudge_x = .1, nudge_y = -.1)+
  facet_wrap(~period)+
  scale_fill_distiller(palette = "Spectral")+
  labs(title = "Figure A8: Weekly Firearm Undetermined Injury Rates by ZCTA and Period",
```
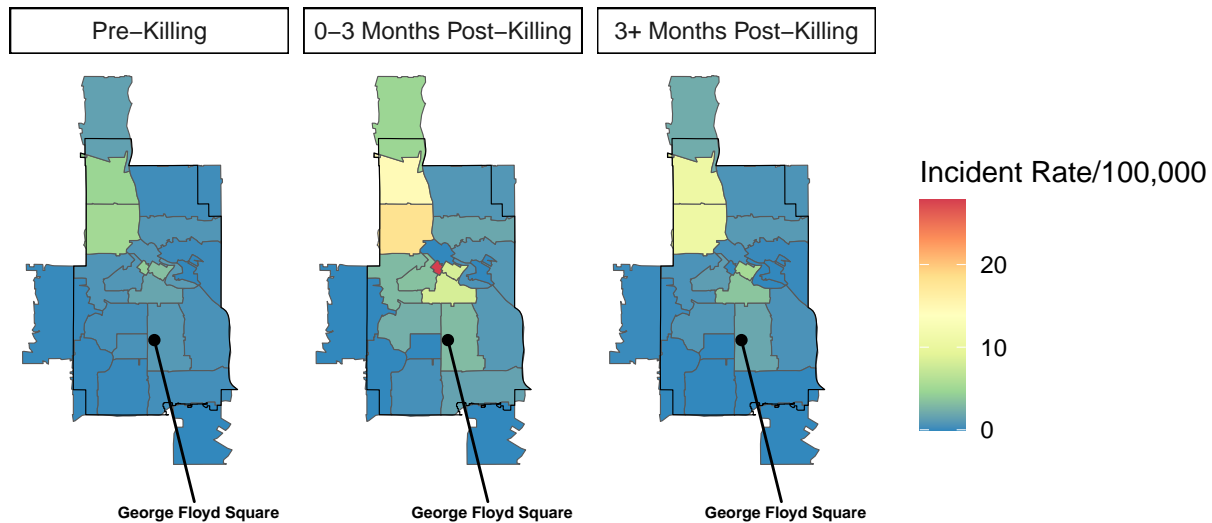
```
    subtitle = "MHA Hospital Discharge Data",
    fill = "Incident Rate/100,000")+
theme(axis.text.x = element_blank(),
    axis.text.y = element_blank(),
axis.line = element_blank(),
axis.ticks = element_blank(),
panel.border = element_blank(),
panel.grid = element_blank(),
axis.title = element_blank(),
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"))
```

Figure A8: Weekly Firearm Undetermined Injury Rates by ZCTA and Period
MHA Hospital Discharge Data
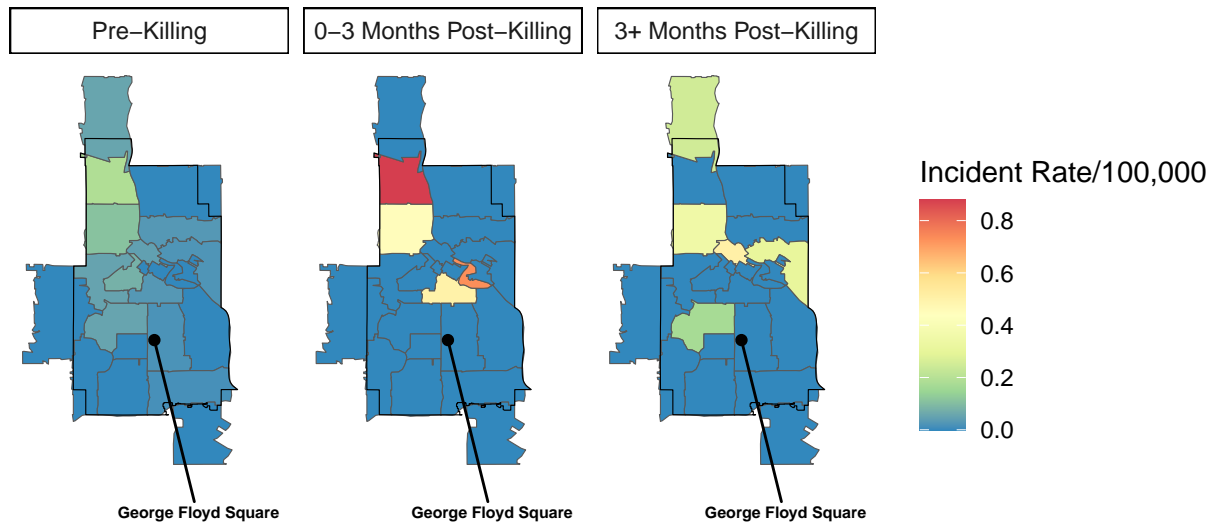
Panel Analysis

$$y_{ti} = \beta_{0i} + \beta_1 Time_t + \beta_2 PostKilling_t + \beta_3 TimePost_t + \phi \mathbf{X}_{ti} + \epsilon_{ti}$$

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

```
##
## Call:
## lm(formula = assault_incid_c ~ t + state_of_emerg + stay_at_home +
##     post_floyd + t_post_floyd + tmax_f + snow_in + precip_in +
##     dark_before_12 + school + as.factor(zcta), data = panel)
##
```

```
## Residuals:
##    Min     1Q  Median      3Q     Max
##  -4.394  -0.699  -0.261    0.049 264.008
##
## Coefficients:
##                         Estimate Std. Error t value Pr(>|t|)
## (Intercept)             0.538027   1.001434   0.537  0.59111
## t                       0.002743   0.001207   2.272  0.02315 *
## state_of_emerg         -0.646697   0.691035  -0.936  0.34939
## stay_at_home            0.242094   0.710960   0.341  0.73348
## post_floyd              1.329438   0.725402   1.833  0.06690 .
## t_post_floyd           -0.034865   0.023659  -1.474  0.14063
## tmax_f                  0.003187   0.006431   0.496  0.62021
## snow_in                -0.094586   0.205939  -0.459  0.64604
## precip_in              -0.257022   0.673047  -0.382  0.70257
## dark_before_12         -0.080475   0.110996  -0.725  0.46846
## school                 -0.245712   0.251084  -0.979  0.32782
## as.factor(zcta)55402   2.018846   0.468530   4.309 1.67e-05 ***
## as.factor(zcta)55403   0.017175   0.468530   0.037  0.97076
## as.factor(zcta)55404   0.773201   0.468530   1.650  0.09894 .
## as.factor(zcta)55405  -0.034397   0.468530  -0.073  0.94148
## as.factor(zcta)55406  -0.156014   0.468530  -0.333  0.73916
## as.factor(zcta)55407   0.058258   0.468530   0.124  0.90105
## as.factor(zcta)55408  -0.258652   0.468530  -0.552  0.58093
## as.factor(zcta)55409  -0.236436   0.468530  -0.505  0.61383
## as.factor(zcta)55410  -0.408970   0.468530  -0.873  0.38276
## as.factor(zcta)55411   2.925887   0.468530   6.245 4.54e-10 ***
## as.factor(zcta)55412   2.404515   0.468530   5.132 2.96e-07 ***
## as.factor(zcta)55413  -0.059222   0.468530  -0.126  0.89942
## as.factor(zcta)55414  -0.322758   0.468530  -0.689  0.49093
## as.factor(zcta)55415   1.241611   0.468530   2.650  0.00807 **
## as.factor(zcta)55416  -0.441445   0.468530  -0.942  0.34613
## as.factor(zcta)55417  -0.219008   0.468530  -0.467  0.64020
## as.factor(zcta)55418  -0.226440   0.468530  -0.483  0.62890
## as.factor(zcta)55419  -0.396449   0.468530  -0.846  0.39750
## as.factor(zcta)55430   0.344431   0.468530   0.735  0.46229
## as.factor(zcta)55450  -0.479877   0.473206  -1.014  0.31058
## as.factor(zcta)55454   0.008653   0.468530   0.018  0.98527
## as.factor(zcta)55455  -0.465239   0.468530  -0.993  0.32076
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.352 on 5960 degrees of freedom
##   (10 observations deleted due to missingness)
## Multiple R-squared:  0.03435,    Adjusted R-squared:  0.02917
## F-statistic: 6.626 on 32 and 5960 DF,  p-value: < 2.2e-16

##
## Call:
## lm(formula = assault_incid_c ~ t + state_of_emerg + stay_at_home +
##     post_floyd + t_post_floyd + tmax_f + snow_in + precip_in +
##     dark_before_12 + school + uof_lag + stops_lag + shoot_lag +
##     as.factor(zcta), data = panel)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
##  -5.718  -0.693  -0.254   0.067 262.095
##
## Coefficients:
##                        Estimate Std. Error t value Pr(>|t|)
## (Intercept)           0.5786260  1.0076414   0.574 0.565829
## t                     0.0020360  0.0012398   1.642 0.100608
## state_of_emerg       -0.5089870  0.6931282  -0.734 0.462775
## stay_at_home          0.1449090  0.7126787   0.203 0.838884
## post_floyd            1.2563182  0.7275699   1.727 0.084268 .
## t_post_floyd         -0.0314796  0.0237464  -1.326 0.185004
## tmax_f                0.0038097  0.0064758   0.588 0.556353
## snow_in              -0.1067380  0.2069463  -0.516 0.606030
## precip_in            -0.2122324  0.6767740  -0.314 0.753840
## dark_before_12       -0.0812715  0.1117160  -0.727 0.466959
## school               -0.2529111  0.2528312  -1.000 0.317199
## uof_lag              -0.1503532  0.0285759  -5.262 1.48e-07 ***
## stops_lag             0.0290076  0.0087517   3.315 0.000924 ***
## shoot_lag            -2.1208705  5.6098689  -0.378 0.705399
## as.factor(zcta)55402  2.5840636  0.6598364   3.916 9.10e-05 ***
## as.factor(zcta)55403  0.0056049  0.4708623   0.012 0.990503
## as.factor(zcta)55404  0.7506650  0.4708060   1.594 0.110894
## as.factor(zcta)55405 -0.0555791  0.4709667  -0.118 0.906063
```

```
## as.factor(zcta)55406 -0.1638176  0.4711649  -0.348 0.728088
## as.factor(zcta)55407  0.0429800  0.4710355   0.091 0.927300
## as.factor(zcta)55408 -0.2952230  0.4709003  -0.627 0.530727
## as.factor(zcta)55409 -0.2529967  0.4711037  -0.537 0.591267
## as.factor(zcta)55410 -0.4093065  0.4712669  -0.869 0.385143
## as.factor(zcta)55411  2.8757964  0.4706396   6.110 1.06e-09 ***
## as.factor(zcta)55412  2.3719080  0.4708322   5.038 4.85e-07 ***
## as.factor(zcta)55413 -0.1099430  0.4709178  -0.233 0.815408
## as.factor(zcta)55414 -0.3364465  0.4710881  -0.714 0.475138
## as.factor(zcta)55415  1.2405830  0.4705738   2.636 0.008403 **
## as.factor(zcta)55416 -0.4395507  0.4713632  -0.933 0.351111
## as.factor(zcta)55417 -0.2200773  0.4712824  -0.467 0.640535
## as.factor(zcta)55418 -0.2572088  0.4709934  -0.546 0.585019
## as.factor(zcta)55419 -0.4082088  0.4711659  -0.866 0.386317
## as.factor(zcta)55430  0.3487918  0.4712330   0.740 0.459227
## as.factor(zcta)55450 -0.7555500  0.5026241  -1.503 0.132838
## as.factor(zcta)55454 -0.0001769  0.4711057   0.000 0.999700
## as.factor(zcta)55455 -0.4588524  0.4711107  -0.974 0.330106
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## 
## Residual standard error: 5.363 on 5892 degrees of freedom
##   (75 observations deleted due to missingness)
## Multiple R-squared:  0.04109,    Adjusted R-squared:  0.03539
## F-statistic: 7.213 on 35 and 5892 DF,  p-value: < 2.2e-16
```

Series: resid(fe_full_model)
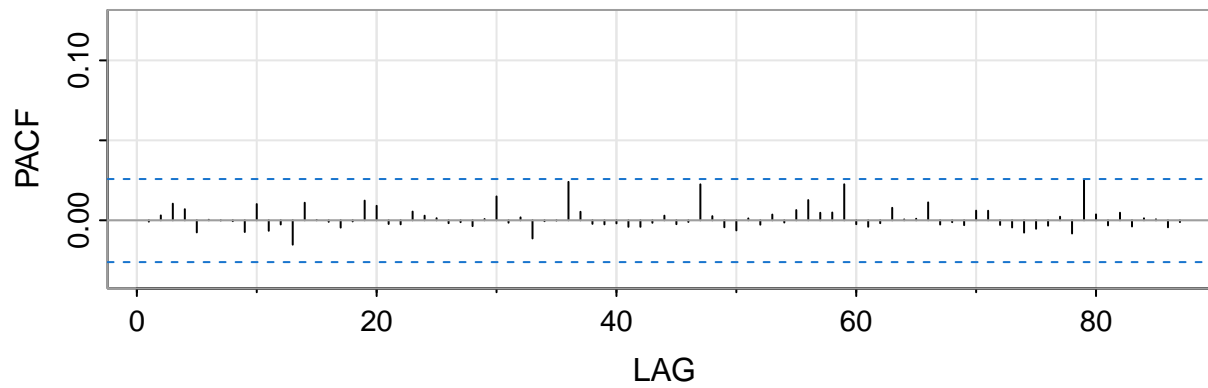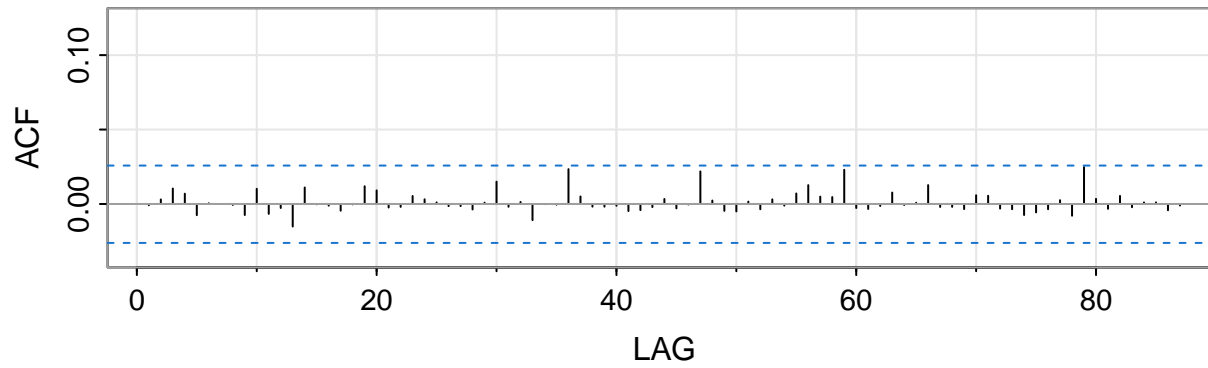

```
##      [,1] [,2] [,3] [,4]  [,5] [,6] [,7] [,8]  [,9] [,10] [,11] [,12] [,13]
## ACF     0    0 0.01 0.01 -0.01    0    0    0 -0.01  0.01 -0.01     0 -0.02
## PACF    0    0 0.01 0.01 -0.01    0    0    0 -0.01  0.01 -0.01     0 -0.02
##      [,14] [,15] [,16] [,17] [,18] [,19] [,20] [,21] [,22] [,23] [,24] [,25]
## ACF   0.01     0     0     0     0  0.01  0.01     0     0  0.01     0     0
## PACF  0.01     0     0     0     0  0.01  0.01     0     0  0.01     0     0
##      [,26] [,27] [,28] [,29] [,30] [,31] [,32] [,33] [,34] [,35] [,36] [,37]
## ACF      0     0     0     0  0.01     0     0 -0.01     0     0  0.02  0.01
## PACF     0     0     0     0  0.01     0     0 -0.01     0     0  0.02  0.01
##      [,38] [,39] [,40] [,41] [,42] [,43] [,44] [,45] [,46] [,47] [,48] [,49]
## ACF      0     0     0     0     0     0     0     0     0  0.02     0     0
```

```
## PACF     0     0     0     0     0     0     0     0     0  0.02     0     0
##       [,50] [,51] [,52] [,53] [,54] [,55] [,56] [,57] [,58] [,59] [,60] [,61]
## ACF   0.00     0     0     0     0  0.01  0.01     0     0  0.02     0     0
## PACF -0.01     0     0     0     0  0.01  0.01     0     0  0.02     0     0
##       [,62] [,63] [,64] [,65] [,66] [,67] [,68] [,69] [,70] [,71] [,72] [,73]
## ACF      0  0.01     0     0  0.01     0     0     0  0.01  0.01     0     0
## PACF     0  0.01     0     0  0.01     0     0     0  0.01  0.01     0     0
##       [,74] [,75] [,76] [,77] [,78] [,79] [,80] [,81] [,82] [,83] [,84] [,85]
## ACF  -0.01 -0.01     0     0 -0.01  0.02     0     0  0.01     0     0     0
## PACF -0.01 -0.01     0     0 -0.01  0.03     0     0  0.00     0     0     0
##       [,86] [,87]
## ACF      0     0
## PACF     0     0
##
##
## Call:
## lm(formula = assault_incid_c ~ t + state_of_emerg + stay_at_home +
##     post_floyd + t_post_floyd + tmax_f + snow_in + precip_in +
##     dark_before_12 + school + as.factor(zcta) + post_floyd:as.factor(zcta) +
##     t_post_floyd:as.factor(zcta), data = panel)
##
## Residuals:
##     Min     1Q  Median     3Q     Max
## -10.459  -0.637  -0.264   0.031 263.589
##
## Coefficients:
##                                Estimate Std. Error t value Pr(>|t|)
## (Intercept)                   6.734e-01  1.007e+00   0.669  0.50359
## t                             2.740e-03  1.205e-03   2.274  0.02302 *
## state_of_emerg               -6.464e-01  6.897e-01  -0.937  0.34870
## stay_at_home                  2.421e-01  7.096e-01   0.341  0.73299
## post_floyd                   -6.473e-01  1.975e+00  -0.328  0.74308
## t_post_floyd                  2.038e-02  1.028e-01   0.198  0.84285
## tmax_f                        3.200e-03  6.418e-03   0.499  0.61813
## snow_in                      -9.448e-02  2.055e-01  -0.460  0.64578
## precip_in                    -2.570e-01  6.717e-01  -0.383  0.70202
## dark_before_12               -8.022e-02  1.108e-01  -0.724  0.46902
## school                       -2.455e-01  2.506e-01  -0.979  0.32738
## as.factor(zcta)55402          2.301e+00  4.992e-01   4.609 4.13e-06 ***
```

```
## as.factor(zcta)55403                -1.105e-01  4.992e-01   -0.221   0.82481
## as.factor(zcta)55404                 4.278e-01  4.992e-01    0.857   0.39155
## as.factor(zcta)55405                -2.036e-01  4.992e-01   -0.408   0.68347
## as.factor(zcta)55406                -2.168e-01  4.992e-01   -0.434   0.66403
## as.factor(zcta)55407                -6.147e-02  4.992e-01   -0.123   0.90200
## as.factor(zcta)55408                -3.636e-01  4.992e-01   -0.728   0.46643
## as.factor(zcta)55409                -2.695e-01  4.992e-01   -0.540   0.58936
## as.factor(zcta)55410                -4.661e-01  4.992e-01   -0.934   0.35050
## as.factor(zcta)55411                 2.256e+00  4.992e-01    4.520 6.31e-06 ***
## as.factor(zcta)55412                 1.964e+00  4.992e-01    3.935 8.42e-05 ***
## as.factor(zcta)55413                -1.900e-01  4.992e-01   -0.381   0.70355
## as.factor(zcta)55414                -4.043e-01  4.992e-01   -0.810   0.41802
## as.factor(zcta)55415                 8.710e-01  4.992e-01    1.745   0.08110 .
## as.factor(zcta)55416                -5.031e-01  4.992e-01   -1.008   0.31357
## as.factor(zcta)55417                -3.153e-01  4.992e-01   -0.632   0.52769
## as.factor(zcta)55418                -3.157e-01  4.992e-01   -0.632   0.52713
## as.factor(zcta)55419                -4.831e-01  4.992e-01   -0.968   0.33325
## as.factor(zcta)55430                 1.214e-01  4.992e-01    0.243   0.80787
## as.factor(zcta)55450                -5.437e-01  5.049e-01   -1.077   0.28161
## as.factor(zcta)55454                -3.370e-02  4.992e-01   -0.068   0.94618
## as.factor(zcta)55455                -5.303e-01  4.992e-01   -1.062   0.28821
## post_floyd:as.factor(zcta)55402     -2.301e+00  2.657e+00   -0.866   0.38650
## post_floyd:as.factor(zcta)55403      2.798e-01  2.657e+00    0.105   0.91614
## post_floyd:as.factor(zcta)55404      4.714e+00  2.657e+00    1.774   0.07607 .
## post_floyd:as.factor(zcta)55405      2.556e+00  2.657e+00    0.962   0.33610
## post_floyd:as.factor(zcta)55406      8.601e-01  2.657e+00    0.324   0.74614
## post_floyd:as.factor(zcta)55407      9.488e-01  2.657e+00    0.357   0.72101
## post_floyd:as.factor(zcta)55408      9.903e-01  2.657e+00    0.373   0.70935
## post_floyd:as.factor(zcta)55409      2.695e-01  2.657e+00    0.101   0.91922
## post_floyd:as.factor(zcta)55410      4.661e-01  2.657e+00    0.175   0.86074
## post_floyd:as.factor(zcta)55411      1.170e+01  2.657e+00    4.404 1.08e-05 ***
## post_floyd:as.factor(zcta)55412      5.706e+00  2.657e+00    2.148   0.03179 *
## post_floyd:as.factor(zcta)55413      1.584e+00  2.657e+00    0.596   0.55096
## post_floyd:as.factor(zcta)55414      1.227e+00  2.657e+00    0.462   0.64429
## post_floyd:as.factor(zcta)55415      5.501e+00  2.657e+00    2.071   0.03844 *
## post_floyd:as.factor(zcta)55416      5.031e-01  2.657e+00    0.189   0.84981
## post_floyd:as.factor(zcta)55417      1.661e+00  2.657e+00    0.625   0.53180
## post_floyd:as.factor(zcta)55418      8.782e-01  2.657e+00    0.331   0.74101
## post_floyd:as.factor(zcta)55419      1.235e+00  2.657e+00    0.465   0.64212
```

```
## post_floyd:as.factor(zcta)55430     4.616e+00  2.657e+00   1.738  0.08234 .
## post_floyd:as.factor(zcta)55450     5.437e-01  2.658e+00   0.205  0.83792
## post_floyd:as.factor(zcta)55454     9.973e-01  2.657e+00   0.375  0.70740
## post_floyd:as.factor(zcta)55455     5.303e-01  2.657e+00   0.200  0.84182
## t_post_floyd:as.factor(zcta)55402   2.184e-15  1.446e-01   0.000  1.00000
## t_post_floyd:as.factor(zcta)55403   4.914e-02  1.446e-01   0.340  0.73406
## t_post_floyd:as.factor(zcta)55404  -1.224e-01  1.446e-01  -0.846  0.39762
## t_post_floyd:as.factor(zcta)55405  -7.588e-02  1.446e-01  -0.525  0.59987
## t_post_floyd:as.factor(zcta)55406  -2.348e-02  1.446e-01  -0.162  0.87104
## t_post_floyd:as.factor(zcta)55407   1.789e-03  1.446e-01   0.012  0.99013
## t_post_floyd:as.factor(zcta)55408  -8.664e-03  1.446e-01  -0.060  0.95224
## t_post_floyd:as.factor(zcta)55409   1.886e-15  1.446e-01   0.000  1.00000
## t_post_floyd:as.factor(zcta)55410   1.747e-15  1.446e-01   0.000  1.00000
## t_post_floyd:as.factor(zcta)55411  -4.026e-01  1.446e-01  -2.784  0.00539 **
## t_post_floyd:as.factor(zcta)55412  -1.365e-01  1.446e-01  -0.944  0.34532
## t_post_floyd:as.factor(zcta)55413  -3.342e-02  1.446e-01  -0.231  0.81730
## t_post_floyd:as.factor(zcta)55414  -3.622e-02  1.446e-01  -0.250  0.80226
## t_post_floyd:as.factor(zcta)55415  -1.599e-01  1.446e-01  -1.105  0.26906
## t_post_floyd:as.factor(zcta)55416   1.916e-15  1.446e-01   0.000  1.00000
## t_post_floyd:as.factor(zcta)55417  -5.652e-02  1.446e-01  -0.391  0.69601
## t_post_floyd:as.factor(zcta)55418  -9.677e-03  1.446e-01  -0.067  0.94666
## t_post_floyd:as.factor(zcta)55419  -3.408e-02  1.446e-01  -0.236  0.81374
## t_post_floyd:as.factor(zcta)55430  -1.805e-01  1.446e-01  -1.248  0.21218
## t_post_floyd:as.factor(zcta)55450   1.836e-15  1.446e-01   0.000  1.00000
## t_post_floyd:as.factor(zcta)55454  -4.205e-02  1.446e-01  -0.291  0.77125
## t_post_floyd:as.factor(zcta)55455   1.852e-15  1.446e-01   0.000  1.00000
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.342 on 5916 degrees of freedom
##   (10 observations deleted due to missingness)
## Multiple R-squared:  0.04522,    Adjusted R-squared:  0.03295
## F-statistic: 3.687 on 76 and 5916 DF,  p-value: < 2.2e-16

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

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


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

```
## rescaling

## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: assault_incid_c ~ t + state_of_emerg + stay_at_home + post_floyd +
##     t_post_floyd + tmax_f + snow_in + precip_in + dark_before_12 +
##     school + uof_lag + stops_lag + shoot_lag + (1 | zcta)
##    Data: panel
##
## REML criterion at convergence: 36813
##
## Scaled residuals:
##    Min    1Q Median    3Q    Max
## -1.114 -0.133 -0.055  0.003 48.937
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  zcta     (Intercept)  0.8496  0.9217
##  Residual             28.7706  5.3638
## Number of obs: 5928, groups:  zcta, 23
##
## Fixed effects:
##                   Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)       8.337e-01  9.728e-01  4.007e+03   0.857   0.3915
## t                 1.974e-03  1.240e-03  5.897e+03   1.593   0.1112
## state_of_emerg1  -5.055e-01  6.932e-01  5.891e+03  -0.729   0.4659
## stay_at_home1     1.565e-01  7.127e-01  5.891e+03   0.220   0.8262
## post_floyd1       1.277e+00  7.276e-01  5.892e+03   1.755   0.0793 .
## t_post_floyd     -3.179e-02  2.375e-02  5.891e+03  -1.339   0.1807
## tmax_f            3.600e-03  6.475e-03  5.893e+03   0.556   0.5783
## snow_in          -1.111e-01  2.069e-01  5.892e+03  -0.537   0.5914
## precip_in        -2.171e-01  6.768e-01  5.891e+03  -0.321   0.7484
## dark_before_12   -8.130e-02  1.117e-01  5.891e+03  -0.728   0.4668
## school           -2.598e-01  2.528e-01  5.892e+03  -1.027   0.3042
## uof_lag          -1.303e-01  2.715e-02  1.922e+03  -4.800 1.71e-06 ***
## stops_lag         3.526e-02  8.278e-03  1.690e+03   4.259 2.16e-05 ***
## shoot_lag        -1.953e+00  5.609e+00  5.897e+03  -0.348   0.7277
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

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

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

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

## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: assault_incid_c ~ t + state_of_emerg + stay_at_home + post_floyd +
##     t_post_floyd + tmax_f + snow_in + precip_in + dark_before_12 +
##     school + (1 | zcta)
##    Data: panel
##
## REML criterion at convergence: 37185
##
## Scaled residuals:
##    Min    1Q Median    3Q    Max
## -0.762 -0.135 -0.057 -0.001 49.365
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  zcta     (Intercept)  0.817   0.9039
##  Residual             28.647   5.3523
## Number of obs: 5993, groups:  zcta, 23
##
## Fixed effects:
##                  Estimate Std. Error       df t value Pr(>|t|)
## (Intercept)     8.004e-01  9.660e-01  4.194e+03   0.829   0.4074
## t               2.739e-03  1.207e-03  5.960e+03   2.269   0.0233 *
## state_of_emerg1 -6.463e-01  6.910e-01  5.960e+03  -0.935   0.3497
## stay_at_home1    2.421e-01  7.110e-01  5.960e+03   0.340   0.7335
## post_floyd1      1.330e+00  7.254e-01  5.960e+03   1.833   0.0669 .
## t_post_floyd    -3.488e-02  2.366e-02  5.960e+03  -1.474   0.1404
## tmax_f           3.203e-03  6.431e-03  5.960e+03   0.498   0.6185
## snow_in         -9.445e-02  2.059e-01  5.960e+03  -0.459   0.6465
## precip_in       -2.570e-01  6.730e-01  5.960e+03  -0.382   0.7026
## dark_before_12  -8.016e-02  1.110e-01  5.960e+03  -0.722   0.4702
```

```
## school        -2.454e-01  2.511e-01  5.960e+03  -0.977   0.3284
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##            (Intr) t      stt__1 sty__1 pst_f1 t_pst_ tmax_f snow_n prcp_n
## t          -0.101
## stat_f_mrg1 -0.085 -0.203
## stay_at_hm1  0.002 -0.009 -0.816
## post_floyd1  0.048 -0.027 -0.792  0.662
## t_post_flyd  0.210 -0.009 -0.168  0.170 -0.345
## tmax_f      -0.874  0.007  0.089 -0.019 -0.111 -0.091
## snow_in     -0.330 -0.060  0.069 -0.037 -0.043 -0.073  0.477
## precip_in   -0.005 -0.022 -0.034  0.042  0.030  0.059 -0.221 -0.221
## dark_bfr_12 -0.914 -0.062  0.114  0.020 -0.018 -0.264  0.749  0.202  0.038
## school      -0.122  0.041 -0.025 -0.063  0.057 -0.040  0.146  0.097  0.024
##            dr__12
## t
## stat_f_mrg1
## stay_at_hm1
## post_floyd1
## t_post_flyd
## tmax_f
## snow_in
## precip_in
## dark_bfr_12
## school      -0.101
##
## Warning: Some predictor variables are on very different scales: consider
## rescaling

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

## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: assault_unintent_incid_c ~ t + state_of_emerg + stay_at_home +
##     post_floyd + t_post_floyd + tmax_f + snow_in + precip_in +
##     dark_before_12 + school + uof_lag + stops_lag + shoot_lag +      (1 | zcta)
##    Data: panel
```

```
##
## REML criterion at convergence: 40977.8
##
## Scaled residuals:
##    Min      1Q Median     3Q    Max
## -1.157 -0.152 -0.061  0.017 44.654
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  zcta     (Intercept)  3.673   1.917
##  Residual             72.147   8.494
## Number of obs: 5748, groups:  zcta, 23
##
## Fixed effects:
##                   Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)     -2.363e-01  1.584e+00 2.573e+03  -0.149  0.88141
## t                3.957e-03  1.985e-03 5.716e+03   1.994  0.04625 *
## state_of_emerg1 -2.210e-02  1.106e+00 5.714e+03  -0.020  0.98406
## stay_at_home1   -8.436e-01  1.141e+00 5.714e+03  -0.739  0.45967
## post_floyd1      3.493e+00  1.166e+00 5.712e+03   2.996  0.00275 **
## t_post_floyd    -1.563e-01  3.848e-02 5.712e+03  -4.061 4.95e-05 ***
## tmax_f           1.611e-02  1.041e-02 5.712e+03   1.548  0.12177
## snow_in         -9.543e-02  3.340e-01 5.712e+03  -0.286  0.77508
## precip_in        2.776e-01  1.092e+00 5.711e+03   0.254  0.79944
## dark_before_12   4.583e-02  1.794e-01 5.711e+03   0.255  0.79842
## school          -5.687e-02  4.073e-01 5.712e+03  -0.140  0.88897
## uof_lag         -1.861e-01  4.380e-02 2.870e+03  -4.247 2.23e-05 ***
## stops_lag        2.158e-02  1.666e-02 1.511e+03   1.295  0.19552
## shoot_lag       -3.256e+00  8.883e+00 5.714e+03  -0.367  0.71399
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling

## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: assault_unintent_incid_c ~ t + state_of_emerg + stay_at_home +
##     post_floyd + t_post_floyd + tmax_f + snow_in + precip_in +
##     dark_before_12 + school + uof_lag + stops_lag + shoot_lag +      (1 | zcta)
```

```
##     Data: panel
##
## REML criterion at convergence: 40977.8
##
## Scaled residuals:
##    Min     1Q Median     3Q    Max
## -1.157 -0.152 -0.061  0.017 44.654
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  zcta     (Intercept)  3.673   1.917
##  Residual             72.147   8.494
## Number of obs: 5748, groups:  zcta, 23
##
## Fixed effects:
##                    Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)      -2.363e-01  1.584e+00  2.573e+03  -0.149  0.88141
## t                 3.957e-03  1.985e-03  5.716e+03   1.994  0.04625 *
## state_of_emerg1  -2.210e-02  1.106e+00  5.714e+03  -0.020  0.98406
## stay_at_home1    -8.436e-01  1.141e+00  5.714e+03  -0.739  0.45967
## post_floyd1       3.493e+00  1.166e+00  5.712e+03   2.996  0.00275 **
## t_post_floyd     -1.563e-01  3.848e-02  5.712e+03  -4.061 4.95e-05 ***
## tmax_f            1.611e-02  1.041e-02  5.712e+03   1.548  0.12177
## snow_in          -9.543e-02  3.340e-01  5.712e+03  -0.286  0.77508
## precip_in         2.776e-01  1.092e+00  5.711e+03   0.254  0.79944
## dark_before_12    4.583e-02  1.794e-01  5.711e+03   0.255  0.79842
## school           -5.687e-02  4.073e-01  5.712e+03  -0.140  0.88897
## uof_lag          -1.861e-01  4.380e-02  2.870e+03  -4.247 2.23e-05 ***
## stops_lag         2.158e-02  1.666e-02  1.511e+03   1.295  0.19552
## shoot_lag        -3.256e+00  8.883e+00  5.714e+03  -0.367  0.71399
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling

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


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

```
## rescaling

## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: undeter_incid_c ~ t + state_of_emerg + stay_at_home + post_floyd +
##     t_post_floyd + tmax_f + snow_in + precip_in + dark_before_12 +
##     school + uof_lag + stops_lag + shoot_lag + (1 | zcta)
##    Data: panel
##
## REML criterion at convergence: 7336.8
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -0.5577 -0.1281 -0.0593 -0.0162 23.2781
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  zcta     (Intercept) 0.002157 0.04645
##  Residual             0.197542 0.44446
## Number of obs: 5928, groups:  zcta, 23
##
## Fixed effects:
##                   Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)      9.610e-03  7.961e-02 5.508e+03   0.121   0.9039
## t               -5.648e-06  1.027e-04 5.903e+03  -0.055   0.9561
## state_of_emerg1 -4.804e-02  5.744e-02 5.893e+03  -0.836   0.4030
## stay_at_home1    3.869e-02  5.905e-02 5.893e+03   0.655   0.5124
## post_floyd1      1.383e-01  6.028e-02 5.895e+03   2.295   0.0218 *
## t_post_floyd    -2.081e-03  1.968e-03 5.893e+03  -1.058   0.2903
## tmax_f          -4.372e-05  5.365e-04 5.896e+03  -0.081   0.9351
## snow_in         -1.041e-02  1.715e-02 5.894e+03  -0.607   0.5440
## precip_in       -2.835e-02  5.608e-02 5.893e+03  -0.506   0.6132
## dark_before_12   4.194e-03  9.257e-03 5.893e+03   0.453   0.6506
## school           1.466e-02  2.095e-02 5.894e+03   0.700   0.4839
## uof_lag         -3.610e-04  2.146e-03 9.104e+02  -0.168   0.8664
## stops_lag       -8.672e-05  6.511e-04 7.687e+02  -0.133   0.8941
## shoot_lag       -1.599e-01  4.646e-01 5.904e+03  -0.344   0.7307
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

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

## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: undeter_incid_c ~ t + state_of_emerg + stay_at_home + post_floyd +
##     t_post_floyd + tmax_f + snow_in + precip_in + dark_before_12 +
##     school + (1 | zcta)
##    Data: panel
##
## REML criterion at convergence: 7328.3
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -0.5589 -0.1276 -0.0583 -0.0152 23.4128
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  zcta     (Intercept) 0.002112 0.04596
##  Residual             0.195321 0.44195
## Number of obs: 5993, groups:  zcta, 23
##
## Fixed effects:
##                   Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)      8.815e-03  7.882e-02  5.574e+03   0.112   0.9109
## t                1.349e-06  9.970e-05  5.960e+03   0.014   0.9892
## state_of_emerg1 -4.875e-02  5.706e-02  5.960e+03  -0.854   0.3930
## stay_at_home1    3.887e-02  5.871e-02  5.960e+03   0.662   0.5079
## post_floyd1      1.378e-01  5.990e-02  5.960e+03   2.300   0.0215 *
## t_post_floyd    -2.040e-03  1.954e-03  5.960e+03  -1.044   0.2965
## tmax_f          -3.604e-05  5.310e-04  5.960e+03  -0.068   0.9459
## snow_in         -1.032e-02  1.700e-02  5.960e+03  -0.607   0.5440
## precip_in       -2.848e-02  5.557e-02  5.960e+03  -0.512   0.6083
## dark_before_12   3.992e-03  9.165e-03  5.960e+03   0.436   0.6632
## school           1.457e-02  2.073e-02  5.960e+03   0.703   0.4823
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
```

```
##              (Intr) t       stt__1 sty__1 pst_f1 t_pst_ tmax_f snow_n prcp_n
## t           -0.102
## stat_f_mrg1 -0.086 -0.203
## stay_at_hm1  0.002 -0.009 -0.816
## post_floyd1  0.049 -0.027 -0.792  0.662
## t_post_flyd  0.213 -0.009 -0.168  0.170 -0.345
## tmax_f      -0.884  0.007  0.089 -0.019 -0.111 -0.091
## snow_in     -0.333 -0.060  0.069 -0.037 -0.043 -0.073  0.477
## precip_in   -0.005 -0.022 -0.034  0.042  0.030  0.059 -0.221 -0.221
## dark_bfr_12 -0.925 -0.062  0.114  0.020 -0.018 -0.264  0.749  0.202  0.038
## school      -0.123  0.041 -0.025 -0.063  0.057 -0.040  0.146  0.097  0.024
##              dr__12
## t
## stat_f_mrg1
## stay_at_hm1
## post_floyd1
## t_post_flyd
## tmax_f
## snow_in
## precip_in
## dark_bfr_12
## school      -0.101

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


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

## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: assault_incid_c ~ t + state_of_emerg + stay_at_home + post_floyd +
##     t_post_floyd + tmax_f + snow_in + precip_in + dark_before_12 +
##     school + uof_lag + stops_lag + shoot_lag + med_hh_inc + black_pop +
##     post_floyd:black_pop + (1 | zcta)
##    Data: panel
##
## REML criterion at convergence: 34344.1
##
## Scaled residuals:
```

```
##     Min     1Q Median    3Q    Max
## -1.471 -0.137 -0.062 -0.002 47.025
##
## Random effects:
##  Groups    Name        Variance Std.Dev.
##  zcta     (Intercept)  0.254    0.504
##  Residual              31.102   5.577
## Number of obs: 5460, groups:  zcta, 21
##
## Fixed effects:
##                         Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)           -4.120e-01  1.211e+00 2.232e+02  -0.340  0.73395
## t                      9.744e-04  1.414e-03 1.354e+03   0.689  0.49075
## state_of_emerg1       -4.385e-01  7.544e-01 5.425e+03  -0.581  0.56106
## stay_at_home1          1.891e-01  7.755e-01 5.424e+03   0.244  0.80736
## post_floyd1            2.816e-01  8.450e-01 5.430e+03   0.333  0.73898
## t_post_floyd          -3.573e-02  2.582e-02 5.425e+03  -1.384  0.16649
## tmax_f                 4.552e-03  7.013e-03 5.440e+03   0.649  0.51631
## snow_in               -9.885e-02  2.245e-01 5.423e+03  -0.440  0.65978
## precip_in             -2.404e-01  7.336e-01 5.424e+03  -0.328  0.74318
## dark_before_12        -7.093e-02  1.210e-01 5.442e+03  -0.586  0.55778
## school                -2.927e-01  2.738e-01 5.425e+03  -1.069  0.28519
## uof_lag               -1.228e-01  2.686e-02 9.139e+02  -4.571 5.52e-06 ***
## stops_lag              7.648e-02  1.077e-02 1.688e+02   7.099 3.34e-11 ***
## shoot_lag             -1.668e+00  5.830e+00 5.435e+03  -0.286  0.77483
## med_hh_inc             7.638e-06  7.044e-06 1.736e+01   1.084  0.29304
## black_pop              3.780e-02  1.226e-02 1.806e+01   3.084  0.00639 **
## post_floyd1:black_pop  6.296e-02  1.575e-02 5.442e+03   3.997 6.51e-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

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

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

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

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

## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: assault_unintent_incid_c ~ t + state_of_emerg + stay_at_home +
##     post_floyd + t_post_floyd + tmax_f + snow_in + precip_in +
##     dark_before_12 + school + uof_lag + stops_lag + shoot_lag +
##     med_hh_inc + black_pop + post_floyd:black_pop + (1 | zcta)
##     Data: panel
##
## REML criterion at convergence: 39207.8
##
## Scaled residuals:
##     Min      1Q Median     3Q    Max
## -1.203 -0.150 -0.068  0.009 43.692
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  zcta     (Intercept)  2.10    1.449
##  Residual             75.77    8.704
## Number of obs: 5460, groups:  zcta, 21
##
## Fixed effects:
##                       Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)          -1.599e+00  2.225e+00  6.872e+01  -0.719 0.474803
## t                     3.496e-03  2.355e-03  3.514e+02   1.484 0.138679
## state_of_emerg1       3.914e-02  1.178e+00  5.420e+03   0.033 0.973485
## stay_at_home1        -8.765e-01  1.210e+00  5.417e+03  -0.724 0.469014
## post_floyd1           1.812e+00  1.319e+00  5.427e+03   1.373 0.169773
## t_post_floyd         -1.630e-01  4.030e-02  5.420e+03  -4.043 5.34e-05 ***
## tmax_f                1.721e-02  1.096e-02  5.439e+03   1.570 0.116457
## snow_in              -1.032e-01  3.505e-01  5.417e+03  -0.295 0.768359
## precip_in             2.819e-01  1.145e+00  5.419e+03   0.246 0.805529
## dark_before_12        5.949e-02  1.892e-01  5.430e+03   0.314 0.753238
## school               -6.942e-02  4.275e-01  5.418e+03  -0.162 0.870989
```

```
## uof_lag                  -1.689e-01  4.416e-02  1.243e+03  -3.824 0.000138 ***
## stops_lag                 4.168e-02  1.895e-02  3.129e+02   2.199 0.028607 *
## shoot_lag                -2.942e+00  9.103e+00  5.423e+03  -0.323 0.746606
## med_hh_inc                4.629e-06  1.705e-05  1.561e+01   0.272 0.789553
## black_pop                 5.525e-02  2.953e-02  1.572e+01   1.871 0.080110 .
## post_floyd1:black_pop     1.002e-01  2.462e-02  5.442e+03   4.069 4.78e-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

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

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

## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: undeter_incid_c ~ t + state_of_emerg + stay_at_home + post_floyd +
##     t_post_floyd + tmax_f + snow_in + precip_in + dark_before_12 +
##     school + uof_lag + stops_lag + shoot_lag + med_hh_inc + black_pop +
##     post_floyd:black_pop + (1 | zcta)
##    Data: panel
##
## REML criterion at convergence: 7236.2
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -0.8875 -0.1175 -0.0614 -0.0213 22.3794
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  zcta     (Intercept) 0.001376 0.0371
##  Residual             0.213833 0.4624
## Number of obs: 5460, groups:  zcta, 21
##
## Fixed effects:
##                         Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)            8.182e-03 9.848e-02 3.090e+02   0.083    0.934
```

```
## t                       1.295e-05  1.164e-04  1.782e+03   0.111   0.911
## state_of_emerg1        -5.219e-02  6.255e-02  5.427e+03  -0.834   0.404
## stay_at_home1           4.218e-02  6.430e-02  5.427e+03   0.656   0.512
## post_floyd1             5.446e-02  7.006e-02  5.432e+03   0.777   0.437
## t_post_floyd           -2.275e-03  2.141e-03  5.427e+03  -1.062   0.288
## tmax_f                 -6.159e-05  5.814e-04  5.440e+03  -0.106   0.916
## snow_in                -1.150e-02  1.862e-02  5.426e+03  -0.618   0.537
## precip_in              -3.110e-02  6.083e-02  5.426e+03  -0.511   0.609
## dark_before_12          4.268e-03  1.003e-02  5.441e+03   0.425   0.671
## school                  1.602e-02  2.271e-02  5.428e+03   0.705   0.481
## uof_lag                -4.872e-04  2.206e-03  1.006e+03  -0.221   0.825
## stops_lag              -2.437e-04  8.723e-04  1.790e+02  -0.279   0.780
## shoot_lag              -1.429e-01  4.834e-01  5.437e+03  -0.296   0.768
## med_hh_inc             -3.118e-07  5.427e-07  1.966e+01  -0.575   0.572
## black_pop               1.216e-03  9.460e-04  2.061e+01   1.285   0.213
## post_floyd1:black_pop   5.149e-03  1.306e-03  5.442e+03   3.943 8.16e-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

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

Figure 3: Post−Killing X Percent Black Interaction Plot
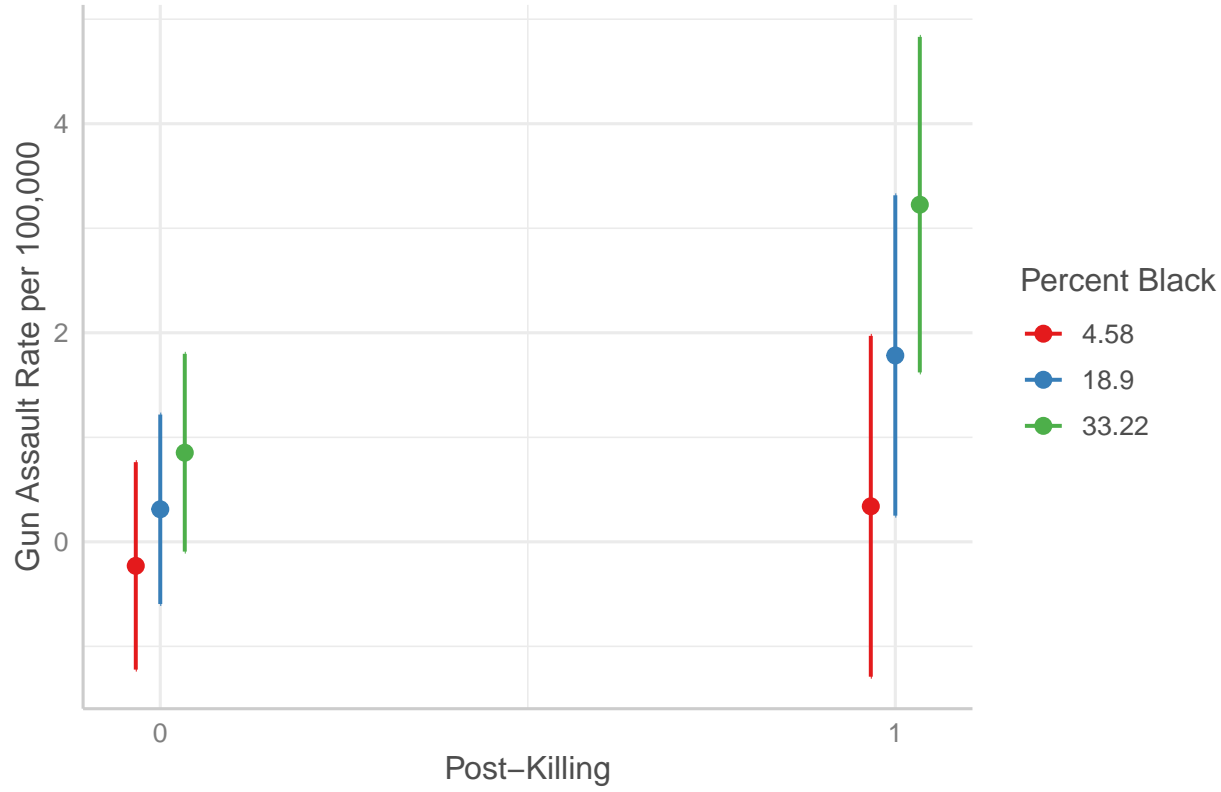
Figure A6: Post−Killing X Percent B
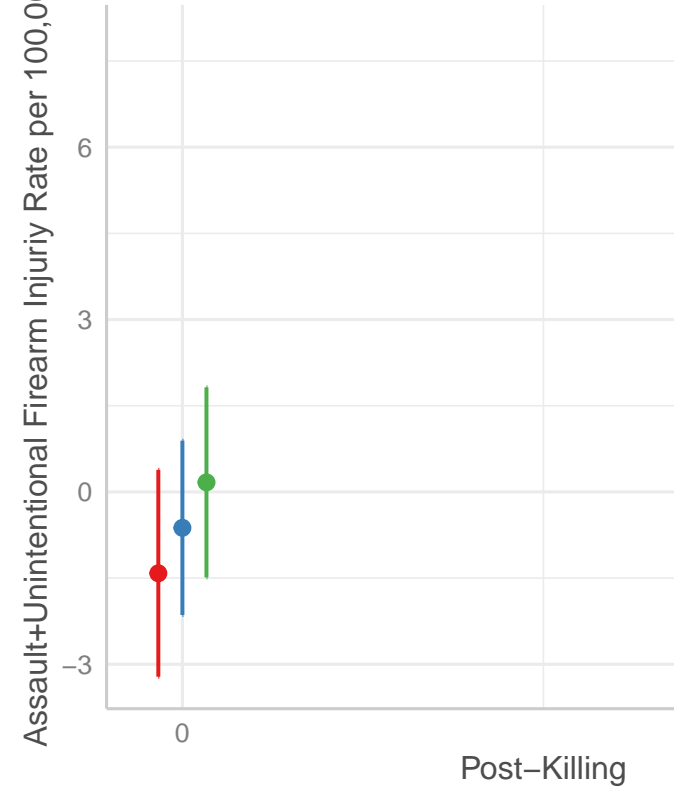
Figure A9: Post–Killing X Percent Black Interaction Plot
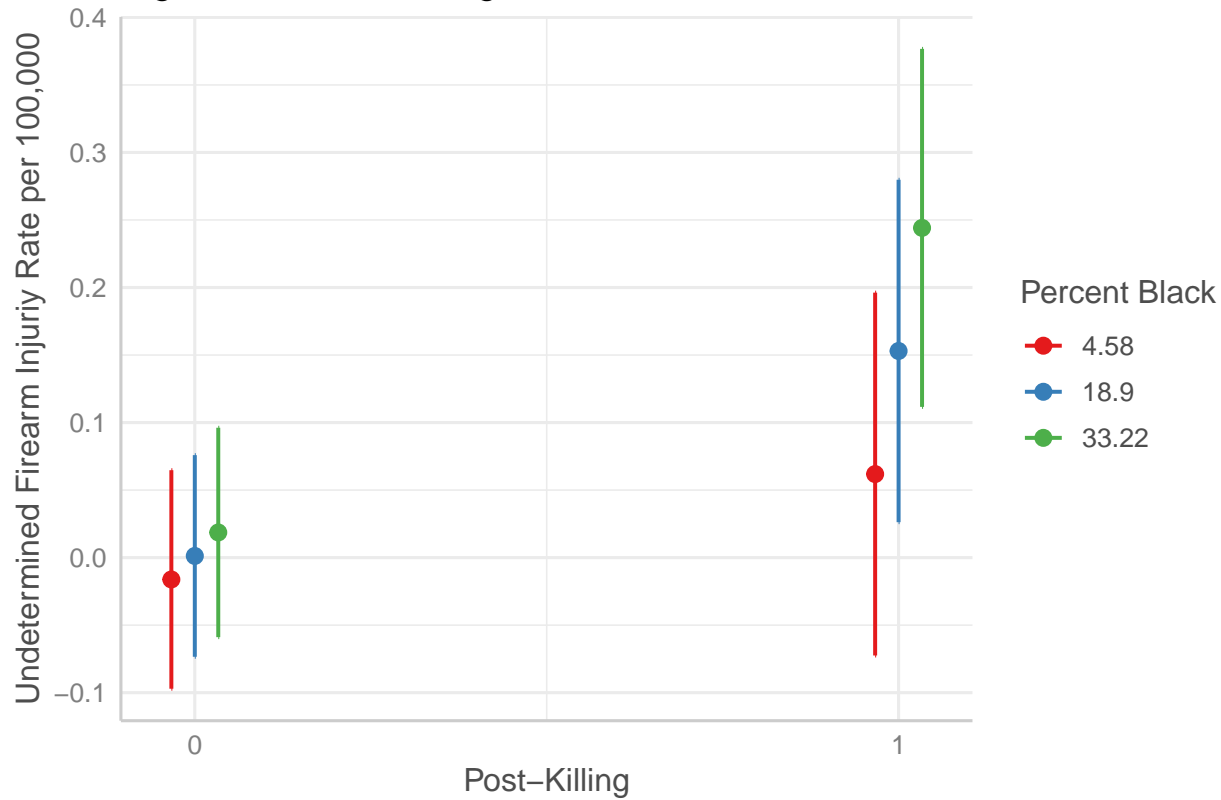
```
class(re_base_nopol) <- "lmerMod"
class(re_base) <- "lmerMod"
class(re_int) <- "lmerMod"

stargazer(ts_ar1, ts_ar1_pol, re_base_nopol, re_base, re_int,
          title = "Interrupted Time Series Models of Firearm Assault Injuries",
          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 OIS t-1",
                               "AR(1)",
```

```
                                "Median HH Income",
                                "Percent Black",
                                "Post-Killing X Percent Black"),
          header = F,
          dep.var.caption = "Firearm Assault Injuries",
          dep.var.labels = "Rate per 100,000",
          model.names = FALSE,
          column.labels = c("AR(1) TSR","AR(1) TSR",
                            "RE HLM","RE HLM", "RE HLM +Int."),
          report = "vcs",
          ci=TRUE,
          ci.level=0.95,
          ci.separator = "|",
          notes = "95\\% Confidence Intervals in parentheses",
          single.row = F,
          font.size="scriptsize",
          no.space = T,
          column.sep.width = "0.1pt",
          omit = c("tmax_f", "snow_in","precip_in","dark_before_12","school"),
          omit.stat = c("adj.rsq"),
          #star.cutoffs = c(.05, .01, .001), star.char = c("*","**","***"),
          add.lines = list(c("SD(ZCTA)", "","", .904, .922, .504),
                          c("SD(Residual)", "","", 5.352, 5.364, 5.577)),
          notes.label = "Models include controls for seasonality.",
          notes.append = F)


#maps of post_floyd and post_floyd_3 coefficients by zip - colored divergently
coef <- broom::tidy(fe_int_model$coefficients) %>%
  filter(str_detect(names, "post_floyd")) %>%
  mutate(period = ifelse(str_detect(names, "post_floyd_3"), "3+ Months Post-Killing", "0-3 Months Post-Killing"),
        main_effect = ifelse(period=="3+ Months Post-Killing", round(0.3399083,2), round(-0.5604477,2)),
        zcta = as.numeric(str_sub(names, -5)),
        zcta = as.numeric(ifelse(is.na(zcta), "55401", zcta)),
        interaction_effect = ifelse(zcta=="55401", 0, round(x,2)),
        coef = main_effect+interaction_effect) %>%
  select(zcta, period, coef, main_effect, interaction_effect) %>%
  arrange(zcta, period)

#creating period rows in other spatial layers
```

Table 2: Interrupted Time Series Models of Firearm Assault Injuries

	Firearm Assault Injuries				
	Rate per 100,000				
	AR(1) TSR	AR(1) TSR	RE HLM	RE HLM	RE HLM +Int.
	(1)	(2)	(3)	(4)	(5)
T	0.001	−0.001	0.003	0.002	0.001
	(−0.0003|0.002)	(−0.003|0.001)	(0.0004|0.005)	(−0.0005|0.004)	(−0.002|0.004)
COVID - State of Emergency	−0.463	−0.411	−0.646	−0.506	−0.439
	(−1.026|0.100)	(−0.995|0.173)	(−2.001|0.708)	(−1.864|0.853)	(−1.917|1.040)
COVID - Stay at Home	0.403	0.416	0.242	0.156	0.189
	(−0.179|0.984)	(−0.183|1.016)	(−1.151|1.636)	(−1.240|1.553)	(−1.331|1.709)
Post-Killing	1.781	1.775	1.330	1.277	0.282
	(1.176|2.387)	(1.137|2.414)	(−0.092|2.751)	(−0.149|2.703)	(−1.375|1.938)
T Post-Killing	−0.048	−0.047	−0.035	−0.032	−0.036
	(−0.068|−0.028)	(−0.070|−0.025)	(−0.081|0.011)	(−0.078|0.015)	(−0.086|0.015)
MPD Use of Force t-1		−0.015		−0.130	−0.123
		(−1.400|1.370)		(−0.184|−0.077)	(−0.175|−0.070)
MPD Stops t-1		−0.121		0.035	0.076
		(−0.365|0.122)		(0.019|0.051)	(0.055|0.098)
MPD OIS t-1		−27.382		−1.953	−1.668
		(−67.727|12.964)		(−12.946|9.040)	(−13.095|9.759)
AR(1)	0.142	0.065			
	(0.021|0.263)	(−0.071|0.201)			
Median HH Income					0.00001
					(−0.00001|0.00002)
Percent Black					0.038
					(0.014|0.062)
Post-Killing X Percent Black					0.063
					(0.032|0.094)
Constant	0.579	0.931	0.800	0.834	−0.412
	(−0.194|1.352)	(−0.204|2.066)	(−1.093|2.694)	(−1.073|2.740)	(−2.785|1.961)
SD(ZCTA)			0.904	0.922	0.504
SD(Residual)			5.352	5.364	5.577
Observations	260	217	5,993	5,928	5,460
R^2	0.385	0.407			
Log Likelihood			−18,592.500	−18,406.520	−17,172.070
Akaike Inf. Crit.			37,210.990	36,845.050	34,382.150
Bayesian Inf. Crit.			37,298.070	36,952.040	34,507.640
Residual Std. Error	0.463 (df = 248)	0.474 (df = 202)			
F Statistic	14.117*** (df = 11; 248)	9.898*** (df = 14; 202)			

Models include controls for seasonality. 95% Confidence Intervals in parentheses

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```r
coef_zip_level <- zip_level %>%
  filter(period!="Pre-Killing") %>%
  left_join(coef, by = c("zcta", "period"))
coef_gfs <- gfs
coef_gfs[2,] <- gfs[1,]
coef_gfs$period <- c("3+ Months Post-Killing", "0-3 Months Post-Killing")
coef_mpls <- mpls
coef_mpls[2,] <- mpls[1,]
coef_mpls$period <- c("3+ Months Post-Killing", "0-3 Months Post-Killing")


ggplot() +
  geom_sf(data = coef_zip_level, aes(geometry = geometry, fill = coef)) +
  geom_sf(data = mpls, aes(geometry = geometry), color = "black", alpha = 0)+
  geom_sf(data = coef_gfs, aes(geometry = geometry), color = "black")+
  geom_text_repel(data = gfs, aes(x=lon, y=lat, label = name),
                  size = 2,
                  fontface = "bold",
                  nudge_x = 1, nudge_y = -1)+
  scale_fill_gradient2(trans="reverse")+
  facet_wrap(~period)+
  labs(title = "Figure 3: Treatment Effects by ZCTA",
       fill = "Coef.")+
  theme(axis.text = 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"))+
  guides(fill = guide_colorbar(reverse = TRUE))
```

MPD Murders: Time Series

```r
#pre-pims
mpd_2016 <- read_csv("Data/Police_Incidents_2016.csv")
mpd_2017 <- read_csv("Data/Police_Incidents_2017.csv")
mpd_2018a <- read_csv("Data/Police_Incidents_2018.csv")


#pims
mpd_2018b <- read_csv("Data/Police_Incidents_2018_PIMS.csv")
mpd_2019 <- read_csv("Data/Police_Incidents_2019.csv")
mpd_2020 <- read_csv("Data/Police_Incidents_2020.csv")
mpd_2021 <- read_csv("Data/Police_Incidents_2021.csv")

pre_pims_base <- mpd_2016 %>%
  rbind(mpd_2017) %>%
  rbind(mpd_2018a) %>%
  rename(reportedDate = ReportedDate,
         centerLong = Long,
         centerLat = Lat) %>%
  select(FID, centerLong, centerLat, Offense, reportedDate) %>%
  rename(OBJECTID = FID,
         X = centerLong,
         Y = centerLat,
         offense = Offense)

post_pims_base <- mpd_2018b %>%
  rbind(mpd_2019) %>%
  rbind(mpd_2020) %>%
  rbind(mpd_2021) %>%
  select(OBJECTID, X, Y, offense, reportedDate)

mpd <- pre_pims_base %>%
  rbind(post_pims_base)

mpd_series <- mpd %>%
  mutate(date=ymd_hms(reportedDate),
         year=isoyear(date),
          week=isoweek(date)) %>%
```

```
  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(offense=="MURDR" & zcta %in% zcta_universe) %>%
  group_by(year, week, .drop=F) %>%
  tally(name = "murder") %>%
  arrange(year, week) %>%
  filter(year <= 2021 & year >= 2016) %>%
  ungroup() %>%
  complete(year, week = 1:52, fill = list(murder = 0)) %>%
  select(year, week, murder)

mpls_pops_year <- series %>%
  group_by(year) %>%
  summarize(total_pop = mean(total_pop, na.rm = T)) %>%
  add_row(year = 2021, total_pop = 603465)


mpd_series <- mpd_series %>%
  left_join(mpls_pops_year, by = "year") %>%
  mutate(murder_rate = (murder/total_pop)*100000,
         begin_date = ISOweek2date(paste(year, paste0("W", sprintf("%02d", week)), 1,sep = "-")),
         end_date = begin_date+weeks(1)-days(1))


mpd_series <- mpd_series %>%
  mutate(csma = forecast::ma(murder_rate, order=5,centre=TRUE),
         tsma = TTR::SMA(murder_rate, n=5))

#build in covariates to MPD series

weather_murder <- read_csv("Data/dnr_weather_2.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)`) %>%
```

```r
  filter(year >= 2016 & year <= 2021) %>%
  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))

sun_series_murder <- getSunlightTimes(date = seq(min(mpd_series$begin_date),
                                      max(mpd_series$begin_date),
                                      "days"),
                                      lat = 44.97775   ,
                                      lon = -93.26501,
                                      keep = "sunset",
                                      tz = "UTC") %>%
  mutate(sunset = sunset-hours(6),
         midnight = as.POSIXlt(date+days(1), format = '%Y-%m-%d %H:%M:%S'),
         dark = as.numeric(midnight-sunset),
         year = year(date),
         week = isoweek(date)) %>%
  group_by(year, week) %>%
  summarize(dark_before_12 = mean(dark, na.rm = T))

school_murder <- mpd_series %>%
  select(year, week, begin_date, end_date) %>%
  mutate(days_in_week = as.numeric((end_date-begin_date))+1,
         days_in_school_murder = NA_integer_)

school_murder[1,6] <- 5
school_murder[2,6] <- 4
school_murder[3,6] <- 3
school_murder[4,6] <- 5
school_murder[5,6] <- 5
school_murder[6,6] <- 4
school_murder[7,6] <- 4
school_murder[8,6] <- 5
school_murder[9,6] <- 5
school_murder[10,6] <- 4
school_murder[11,6] <- 4
```

```
school_murder[12,6] <- 5
school_murder[13,6] <- 0
school_murder[14,6] <- 5
school_murder[15,6] <- 5
school_murder[16,6] <- 5
school_murder[17,6] <- 5
school_murder[18,6] <- 5
school_murder[19,6] <- 5
school_murder[20,6] <- 5
school_murder[21,6] <- 5
school_murder[22,6] <- 4
school_murder[23,6] <- 2
school_murder[24,6] <- 0
school_murder[25,6] <- 0
school_murder[26,6] <- 0
school_murder[27,6] <- 0
school_murder[28,6] <- 0
school_murder[29,6] <- 0
school_murder[30,6] <- 0
school_murder[31,6] <- 0
school_murder[32,6] <- 0
school_murder[33,6] <- 0
school_murder[34,6] <- 0
school_murder[35,6] <- 5
school_murder[36,6] <- 4
school_murder[37,6] <- 5
school_murder[38,6] <- 5
school_murder[39,6] <- 5
school_murder[40,6] <- 5
school_murder[41,6] <- 5
school_murder[42,6] <- 2
school_murder[43,6] <- 5
school_murder[44,6] <- 3
school_murder[45,6] <- 5
school_murder[46,6] <- 5
school_murder[47,6] <- 2
school_murder[48,6] <- 5
school_murder[49,6] <- 5
```

```r
school_murder[50,6] <- 5
school_murder[51,6] <- 0
school_murder[52,6] <- 0
school_murder[53,6] <- 4
school_murder[54,6] <- 5
school_murder[55,6] <- 4
school_murder[56,6] <- 4
school_murder[57,6] <- 4
school_murder[58,6] <- 5
school_murder[59,6] <- 4
school_murder[60,6] <- 4
school_murder[61,6] <- 5
school_murder[62,6] <- 5
school_murder[63,6] <- 5
school_murder[64,6] <- 5
school_murder[65,6] <- 3
school_murder[66,6] <- 0
school_murder[67,6] <- 5
school_murder[68,6] <- 5
school_murder[69,6] <- 5
school_murder[70,6] <- 5
school_murder[71,6] <- 5
school_murder[72,6] <- 5
school_murder[73,6] <- 5
school_murder[74,6] <- 4
school_murder[75,6] <- 5
school_murder[76,6] <- 3
school_murder[77,6] <- 0
school_murder[78,6] <- 0
school_murder[79,6] <- 0
school_murder[80,6] <- 0
school_murder[81,6] <- 0
school_murder[82,6] <- 0
school_murder[83,6] <- 0
school_murder[84,6] <- 0
school_murder[85,6] <- 0
school_murder[86,6] <- 0
school_murder[87,6] <- 5
```

```
school_murder[88,6] <- 4
school_murder[89,6] <- 5
school_murder[90,6] <- 5
school_murder[91,6] <- 5
school_murder[92,6] <- 5
school_murder[93,6] <- 5
school_murder[94,6] <- 2
school_murder[95,6] <- 5
school_murder[96,6] <- 3
school_murder[97,6] <- 5
school_murder[98,6] <- 5
school_murder[99,6] <- 2
school_murder[100,6] <- 5
school_murder[101,6] <- 5
school_murder[102,6] <- 5
school_murder[103,6] <- 5
school_murder[104,6] <- 0
school_murder[105,6] <- 0
school_murder[106,6] <- 0
school_murder[107,6] <- 5
school_murder[108,6] <- 4
school_murder[109,6] <- 3
school_murder[110,6] <- 5
school_murder[111,6] <- 5
school_murder[112,6] <- 4
school_murder[113,6] <- 4
school_murder[114,6] <- 5
school_murder[115,6] <- 5
school_murder[116,6] <- 5
school_murder[117,6] <- 5
school_murder[118,6] <- 4
school_murder[119,6] <- 0
school_murder[120,6] <- 5
school_murder[121,6] <- 5
school_murder[122,6] <- 5
school_murder[123,6] <- 5
school_murder[124,6] <- 5
school_murder[125,6] <- 5
```

```
school_murder[126,6] <- 5
school_murder[127,6] <- 4
school_murder[128,6] <- 5
school_murder[129,6] <- 0
school_murder[130,6] <- 0
school_murder[131,6] <- 0
school_murder[132,6] <- 0
school_murder[133,6] <- 0
school_murder[134,6] <- 0
school_murder[135,6] <- 0
school_murder[136,6] <- 0
school_murder[137,6] <- 0
school_murder[138,6] <- 0
school_murder[139,6] <- 0
school_murder[140,6] <- 5
school_murder[141,6] <- 4
school_murder[142,6] <- 5
school_murder[143,6] <- 5
school_murder[144,6] <- 5
school_murder[145,6] <- 5
school_murder[146,6] <- 5
school_murder[147,6] <- 2
school_murder[148,6] <- 5
school_murder[149,6] <- 3
school_murder[150,6] <- 5
school_murder[151,6] <- 5
school_murder[152,6] <- 2
school_murder[153,6] <- 5
school_murder[154,6] <- 5
school_murder[155,6] <- 5
school_murder[156,6] <- 5
school_murder[157,6] <- 0
school_murder[158,6] <- 0
school_murder[159,6] <- 5
school_murder[160,6] <- 5
school_murder[161,6] <- 2
school_murder[162,6] <- 5
school_murder[163,6] <- 5
```

```r
school_murder[164,6] <- 4
school_murder[165,6] <- 4
school_murder[166,6] <- 5
school_murder[167,6] <- 5
school_murder[168,6] <- 5
school_murder[169,6] <- 5
school_murder[170,6] <- 4
school_murder[171,6] <- 0
school_murder[172,6] <- 5
school_murder[173,6] <- 5
school_murder[174,6] <- 5
school_murder[175,6] <- 5
school_murder[176,6] <- 5
school_murder[177,6] <- 5
school_murder[178,6] <- 5
school_murder[179,6] <- 4
school_murder[180,6] <- 5
school_murder[181,6] <- 0
school_murder[182,6] <- 0
school_murder[183,6] <- 0
school_murder[184,6] <- 0
school_murder[185,6] <- 0
school_murder[186,6] <- 0
school_murder[187,6] <- 0
school_murder[188,6] <- 0
school_murder[189,6] <- 0
school_murder[190,6] <- 0
school_murder[191,6] <- 0
school_murder[192,6] <- 0
school_murder[193,6] <- 4
school_murder[194,6] <- 5
school_murder[195,6] <- 5
school_murder[196,6] <- 5
school_murder[197,6] <- 5
school_murder[198,6] <- 5
school_murder[199,6] <- 2
school_murder[200,6] <- 5
school_murder[201,6] <- 4
```

```
school_murder[202,6] <- 5
school_murder[203,6] <- 5
school_murder[204,6] <- 5
school_murder[205,6] <- 2
school_murder[206,6] <- 5
school_murder[207,6] <- 5
school_murder[208,6] <- 5
school_murder[209,6] <- 0
school_murder[210,6] <- 0
school_murder[211,6] <- 5
school_murder[212,6] <- 4
school_murder[213,6] <- 4
school_murder[214,6] <- 5
school_murder[215,6] <- 5
school_murder[216,6] <- 5
school_murder[217,6] <- 3
school_murder[218,6] <- 5
school_murder[219,6] <- 5
school_murder[220,6] <- 5
school_murder[221,6] <- 5
school_murder[222,6] <- 4
school_murder[223,6] <- 0
school_murder[224,6] <- 5
school_murder[225,6] <- 5
school_murder[226,6] <- 5
school_murder[227,6] <- 5
school_murder[228,6] <- 5
school_murder[229,6] <- 5
school_murder[230,6] <- 5
school_murder[231,6] <- 4
school_murder[232,6] <- 5
school_murder[233,6] <- 0
school_murder[234,6] <- 0
school_murder[235,6] <- 0
school_murder[236,6] <- 0
school_murder[237,6] <- 0
school_murder[238,6] <- 0
school_murder[239,6] <- 0
```

```
school_murder[240,6] <- 0
school_murder[241,6] <- 0
school_murder[242,6] <- 0
school_murder[243,6] <- 0
school_murder[244,6] <- 0
school_murder[245,6] <- 4
school_murder[246,6] <- 5
school_murder[247,6] <- 5
school_murder[248,6] <- 5
school_murder[249,6] <- 5
school_murder[250,6] <- 5
school_murder[251,6] <- 3
school_murder[252,6] <- 4
school_murder[253,6] <- 5
school_murder[254,6] <- 4
school_murder[255,6] <- 5
school_murder[256,6] <- 5
school_murder[257,6] <- 2
school_murder[258,6] <- 5
school_murder[259,6] <- 5
school_murder[260,6] <- 5
school_murder[261,6] <- 5
school_murder[262,6] <- 5
school_murder[263,6] <- 4
school_murder[264,6] <- 4
school_murder[265,6] <- 4
school_murder[266,6] <- 5
school_murder[267,6] <- 5
school_murder[268,6] <- 3
school_murder[269,6] <- 5
school_murder[270,6] <- 5
school_murder[271,6] <- 5
school_murder[272,6] <- 5
school_murder[273,6] <- 4
school_murder[274,6] <- 0
school_murder[275,6] <- 5
school_murder[276,6] <- 5
school_murder[277,6] <- 5
```

```
school_murder[278,6] <- 5
school_murder[279,6] <- 5
school_murder[280,6] <- 5
school_murder[281,6] <- 5
school_murder[282,6] <- 4
school_murder[283,6] <- 0
school_murder[284,6] <- 0
school_murder[285,6] <- 0
school_murder[286,6] <- 0
school_murder[287,6] <- 0
school_murder[288,6] <- 0
school_murder[289,6] <- 0
school_murder[290,6] <- 0
school_murder[291,6] <- 0
school_murder[292,6] <- 0
school_murder[293,6] <- 0
school_murder[294,6] <- 0
school_murder[295,6] <- 0
school_murder[296,6] <- 3
school_murder[297,6] <- 5
school_murder[298,6] <- 5
school_murder[299,6] <- 5
school_murder[300,6] <- 5
school_murder[301,6] <- 5
school_murder[302,6] <- 3
school_murder[303,6] <- 5
school_murder[304,6] <- 4
school_murder[305,6] <- 5
school_murder[306,6] <- 5
school_murder[307,6] <- 2
school_murder[308,6] <- 5
school_murder[309,6] <- 5
school_murder[310,6] <- 5
school_murder[311,6] <- 0
school_murder[312,6] <- 0
school_murder[313,6] <- 0

school_murder <- school_murder %>%
```

```r
  mutate(school = days_in_school_murder/days_in_week) %>%
  select(year, week, school)


mpd_series <- mpd_series %>%
  left_join(uof, by=c("year", "week"="week")) %>%
  left_join(stop, by=c("year", "week"="week")) %>%
  left_join(ois, by=c("year", "week"="week")) %>%
  left_join(weather_murder, by=c("year", "week"="week")) %>%
  left_join(sun_series_murder, by = c("year", "week"="week")) %>%
  left_join(school_murder, by=c("year", "week"="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,
           use_of_force_rate = (use_of_force/total_pop)*1000,
           police_stop_rate = (police_stops/total_pop)*1000,
           t = 1:length(murder_rate),
         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))


ggplot(mpd_series)+
  geom_line(aes(x=begin_date, y=murder_rate))+
  scale_x_date(date_labels = "%b-%Y", date_breaks = "6 months")+
  geom_vline(xintercept=mpd_series$begin_date[mpd_series$year==2020 & mpd_series$week==isoweek(date("2020-05-25"))],
             linetype="dotted", color="red", size=1)+
  geom_label(aes(x=mpd_series$begin_date[mpd_series$year==2020 & mpd_series$week==isoweek(date("2020-05-25"))],
                 y=1.5),
             label = "George Floyd", show.legend = FALSE)+
  labs(title = "Figure A1: Weekly Murder Rate, 2016-2021",
```

```
    subtitle = "MPD Data",
    x = "Week",
    y = "Rate per 1,000 Residents",
    color = NULL)+
theme_minimal()+
theme(axis.text.x=element_text(angle=45, hjust=1)) +
geom_line(aes(x=begin_date, y=csma, color = "CSMA(5)"))+
#geom_line(aes(x=begin_date, y=tsma, color = "TSMA(5)"))+
#geom_ma(aes(x = begin_date, y = murder_rate, color = "MA4"), ma_fun = SMA, n = 4)
scale_color_manual(values = c("blue", "green"))
```

Figure A1: Weekly Murder Rate, 2016–2021

MPD Data
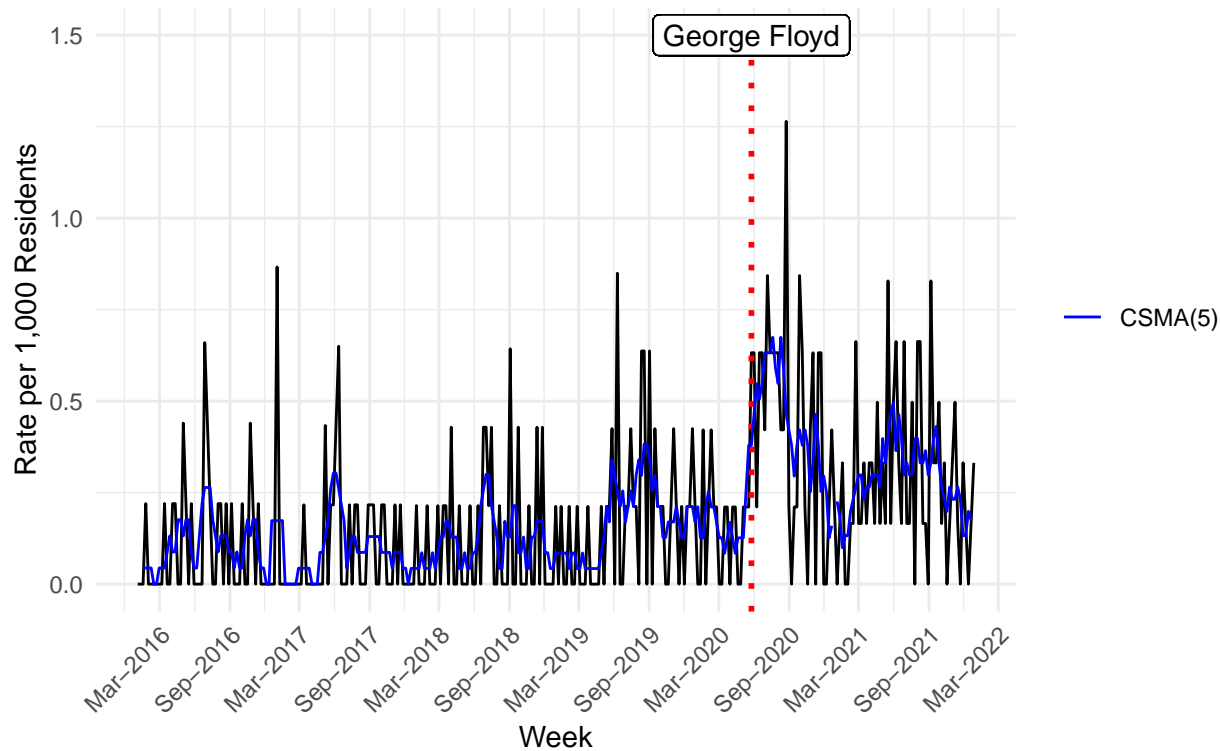
```
mean(mpd_series$murder_rate[mpd_series$post_floyd==0])
```

```
## [1] 0.124684
```

```
mean(mpd_series$murder_rate[mpd_series$post_floyd==1])
```

```
## [1] 0.3436705
```

```
t.test(murder_rate~post_floyd, data = mpd_series, var.equal=F)
```

```
##
##  Welch Two Sample t-test
##
## data:  murder_rate by post_floyd
## t = -7.0569, df = 111.37, p-value = 1.535e-10
## alternative hypothesis: true difference in means between group 0 and group 1 is not equal to 0
## 95 percent confidence interval:
##  -0.2804754 -0.1574975
## sample estimates:
## mean in group 0 mean in group 1
##       0.1246840       0.3436705
```

```r
# murder time series models AR(1)
ts_ar1_pol_m<- lm(murder_rate~t+
                    state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                      tmax_f+snow_in+precip_in+dark_before_12+school+
                  uof_lag+stops_lag+shoot_lag+
                      dplyr::lag(murder_rate, 1), data = mpd_series)


summary(ts_ar1_pol_m)
```

```
##
## Call:
## lm(formula = murder_rate ~ t + state_of_emerg + stay_at_home +
##     post_floyd + t_post_floyd + tmax_f + snow_in + precip_in +
##     dark_before_12 + school + uof_lag + stops_lag + shoot_lag +
##     dplyr::lag(murder_rate, 1), data = mpd_series)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
```

```
## -0.44203 -0.13930 -0.03273  0.10442  0.86331
##
## Coefficients:
##                            Estimate Std. Error t value Pr(>|t|)
## (Intercept)               0.0375003  0.1995187   0.188  0.85106
## t                         0.0005974  0.0003924   1.523  0.12913
## state_of_emerg1          -0.0436354  0.1214237  -0.359  0.71962
## stay_at_home1            -0.0276275  0.1246543  -0.222  0.82478
## post_floyd1               0.2831971  0.1232375   2.298  0.02238 *
## t_post_floyd             -0.0042185  0.0009803  -4.303  2.4e-05 ***
## tmax_f                    0.0030664  0.0011011   2.785  0.00576 **
## snow_in                   0.0090765  0.0352209   0.258  0.79685
## precip_in                -0.1058142  0.1163379  -0.910  0.36393
## dark_before_12           -0.0069101  0.0183843  -0.376  0.70733
## school                    0.0016746  0.0447600   0.037  0.97019
## uof_lag                   0.1588913  0.2575319   0.617  0.53780
## stops_lag                -0.0541703  0.0476538  -1.137  0.25672
## shoot_lag                 5.0560172  8.3311809   0.607  0.54447
## dplyr::lag(murder_rate, 1) -0.1388226 0.0625145  -2.221  0.02726 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1972 on 254 degrees of freedom
##   (44 observations deleted due to missingness)
## Multiple R-squared:  0.3148, Adjusted R-squared:  0.277
## F-statistic: 8.334 on 14 and 254 DF,  p-value: 1.052e-14
```

```r
ts_ar1_m<- lm(murder_rate~t+
                  state_of_emerg+stay_at_home+post_floyd+t_post_floyd+
                     tmax_f+snow_in+precip_in+dark_before_12+school+
                     dplyr::lag(murder_rate, 1), data = mpd_series)



summary(ts_ar1_pol_m)
```

```
##
## Call:
## lm(formula = murder_rate ~ t + state_of_emerg + stay_at_home +
##     post_floyd + t_post_floyd + tmax_f + snow_in + precip_in +
##     dark_before_12 + school + uof_lag + stops_lag + shoot_lag +
```

```
##      dplyr::lag(murder_rate, 1), data = mpd_series)
##
## Residuals:
##      Min      1Q   Median      3Q      Max
## -0.44203 -0.13930 -0.03273  0.10442  0.86331
##
## Coefficients:
##                           Estimate Std. Error t value Pr(>|t|)
## (Intercept)              0.0375003  0.1995187   0.188  0.85106
## t                        0.0005974  0.0003924   1.523  0.12913
## state_of_emerg1         -0.0436354  0.1214237  -0.359  0.71962
## stay_at_home1           -0.0276275  0.1246543  -0.222  0.82478
## post_floyd1              0.2831971  0.1232375   2.298  0.02238 *
## t_post_floyd            -0.0042185  0.0009803  -4.303  2.4e-05 ***
## tmax_f                   0.0030664  0.0011011   2.785  0.00576 **
## snow_in                  0.0090765  0.0352209   0.258  0.79685
## precip_in               -0.1058142  0.1163379  -0.910  0.36393
## dark_before_12          -0.0069101  0.0183843  -0.376  0.70733
## school                   0.0016746  0.0447600   0.037  0.97019
## uof_lag                  0.1588913  0.2575319   0.617  0.53780
## stops_lag               -0.0541703  0.0476538  -1.137  0.25672
## shoot_lag                5.0560172  8.3311809   0.607  0.54447
## dplyr::lag(murder_rate, 1) -0.1388226  0.0625145  -2.221  0.02726 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.1972 on 254 degrees of freedom
##   (44 observations deleted due to missingness)
## Multiple R-squared:  0.3148, Adjusted R-squared:  0.277
## F-statistic: 8.334 on 14 and 254 DF,  p-value: 1.052e-14
```

MPD Murders: Panel

```
# creation of mpd panel

mpd_panel <- mpd %>%
  mutate(date=ymd_hms(reportedDate),
         year=isoyear(date),
```

```r
                week=isoweek(date)) %>%
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)) %>%
filter(offense=="MURDR" & zcta %in% zcta_universe) %>%
group_by(year, zcta, week, .drop=F) %>%
tally(name = "murder") %>%
arrange(year, week, zcta) %>%
filter(year <= 2021 & year >= 2016) %>%
ungroup() %>%
complete(year, zcta = zcta_universe, week = 1:52, fill = list(murder = 0)) %>%
select(year, week, zcta, murder) %>%
mutate(begin_date = ISOweek2date(paste(year,
                                        paste0("W",
                                               sprintf("%02d", week)),
                                        1,sep = "-")),
        end_date = begin_date+weeks(1)-days(1),
        stay_at_home = as.numeric(begin_date >= as.Date("2020-03-28") &               begin_date <= as.Date("2020-05-28")),
        state_of_emerg = 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),
        post_floyd = as.numeric(begin_date >= as.Date("2020-05-25")),
        post_floyd_3 = as.numeric(begin_date >= as.Date("2020-05-25")+months(3)),
        period = factor(case_when(
          post_floyd==0 & post_floyd_3==0 ~ "Pre-Killing",
          post_floyd>=1 & post_floyd_3==0 ~ "0-3 Months Post-Killing",
          post_floyd>=1 & post_floyd_3>=1 ~ "3+ Months Post-Killing"),
          levels = c("Pre-Killing", "0-3 Months Post-Killing", "3+ Months Post-Killing"))) %>%
left_join(acs, by = c("zcta", "year")) %>%
mutate(murder_rate = murder/total_pop*100000) %>%
left_join(weather_murder, by = c("year","week")) %>%
left_join(sun_series_murder, by = c("year","week")) %>%
left_join(school_murder, by = c("year","week")) %>%
left_join(uof_spatial, by = c("year", "week", "zcta")) %>%
```

```r
  left_join(stop_spatial, by = c("year", "week", "zcta")) %>%
  left_join(ois_spatial, by = c("year", "week", "zcta")) %>%
  mutate(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,
          uof_lag = dplyr::lag(uof_rate, 1),
         stops_lag = dplyr::lag(stops_rate, 1),
         shoot_lag = dplyr::lag(ois_rate, 1),
         t = row_number())


mpd_zip_level <- mpd_panel %>%
  group_by(zcta, period) %>%
  summarize(murder_tot = mean(murder, na.rm = T),
            total_pop = mean(total_pop, na.rm = T)) %>%
  mutate(murder_rate = (murder_tot/total_pop)*100000) %>%
  ungroup() %>%
  left_join(zcta, by = "zcta")
```

```
## `summarise()` has grouped output by 'zcta'. You can override using the
## `.groups` argument.
```

```r
ggplot() +
  geom_sf(data = mpd_zip_level, aes(geometry = geometry, fill = murder_rate)) +
  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",
                  nudge_x = .1, nudge_y = -.1)+
  facet_wrap(~period)+
  scale_fill_distiller(palette = "Spectral")+
  labs(title = "Figure A2: Weekly Murder Rates by ZCTA and Period",
       subtitle = "MPD Data",
       fill = "Murder Rate/100,000")+
  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"))
```

Figure A2: Weekly Murder Rates by ZCTA and Period
MPD Data
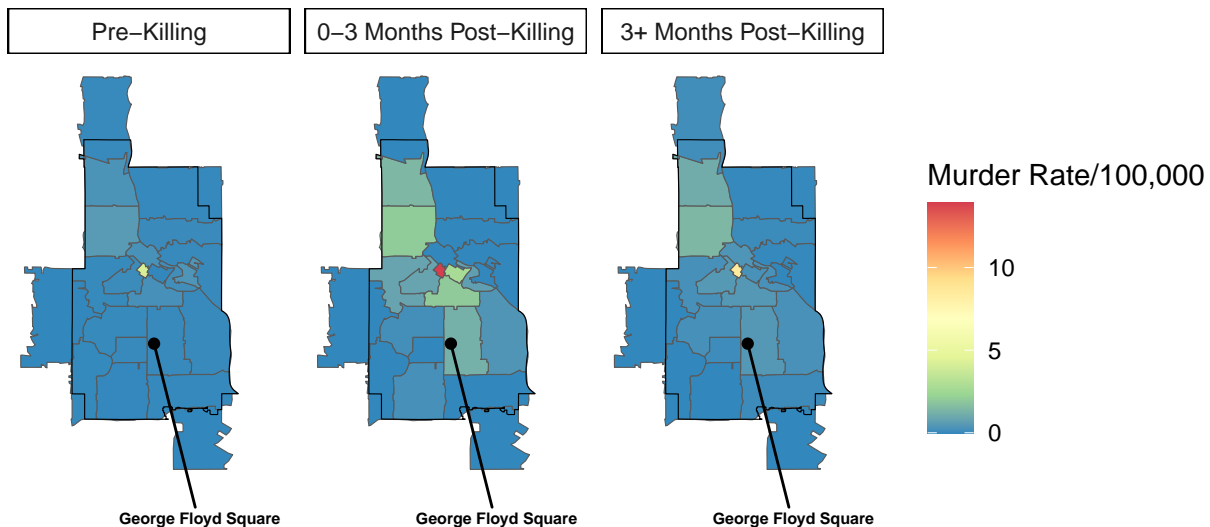

```
mpd_panel <- mpd_panel %>%
  mutate(state_of_emerg = as.factor(state_of_emerg),
```

```
        stay_at_home = as.factor(stay_at_home),
        post_floyd = as.factor(post_floyd),
        post_floyd_3 = as.factor(post_floyd_3))

#RE base model
re_base_m <- lmer(murder_rate~t+state_of_emerg+stay_at_home+
                post_floyd+t_post_floyd+
              tmax_f+snow_in+precip_in+dark_before_12+school+
              uof_lag+stops_lag+shoot_lag+
              (1|zcta), data = mpd_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_base_m)
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: murder_rate ~ t + state_of_emerg + stay_at_home + post_floyd +
##      t_post_floyd + tmax_f + snow_in + precip_in + dark_before_12 +
##      school + uof_lag + stops_lag + shoot_lag + (1 | zcta)
##    Data: mpd_panel
##
## REML criterion at convergence: 37566.2
##
## Scaled residuals:
##    Min     1Q Median     3Q    Max
## -0.944 -0.074 -0.025  0.015 33.225
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  zcta     (Intercept)  0.5856  0.7653
##  Residual             32.7659  5.7241
## Number of obs: 5926, groups:  zcta, 23
##
## Fixed effects:
```

```
##                   Estimate Std. Error          df t value Pr(>|t|)
## (Intercept)      3.064e-01  1.064e+00  4.566e+03    0.288 0.773346
## t                1.067e-04  5.727e-05  5.572e+03    1.864 0.062431 .
## state_of_emerg1 -3.317e-01  7.412e-01  5.885e+03   -0.448 0.654502
## stay_at_home1   -3.308e-01  7.615e-01  5.874e+03   -0.434 0.664029
## post_floyd1      8.477e-01  7.781e-01  5.877e+03    1.089 0.276007
## t_post_floyd    -3.229e-02  2.663e-02  5.874e+03   -1.213 0.225315
## tmax_f           5.859e-03  7.024e-03  5.885e+03    0.834 0.404219
## snow_in         -3.405e-02  2.213e-01  5.875e+03   -0.154 0.877687
## precip_in       -7.429e-01  7.223e-01  5.873e+03   -1.028 0.303802
## dark_before_12  -1.088e-01  1.198e-01  5.875e+03   -0.909 0.363582
## school           1.284e-01  2.730e-01  5.877e+03    0.470 0.638140
## uof_lag         -9.484e-02  2.835e-02  8.849e+02   -3.346 0.000855 ***
## stops_lag        1.990e-02  8.472e-03  8.345e+02    2.349 0.019036 *
## shoot_lag        2.313e+00  5.985e+00  5.887e+03    0.387 0.699131
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation matrix not shown by default, as p = 14 > 12.
## Use print(x, correlation=TRUE)  or
##     vcov(x)        if you need it
##
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
```

```
re_base_nopol_m <- lmer(murder_rate~t+state_of_emerg+stay_at_home+
               post_floyd+t_post_floyd+
             tmax_f+snow_in+precip_in+dark_before_12+school+
              (1|zcta), data = mpd_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_base_nopol_m)
```

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

```
## Formula: murder_rate ~ t + state_of_emerg + stay_at_home + post_floyd +
##     t_post_floyd + tmax_f + snow_in + precip_in + dark_before_12 +
##     school + (1 | zcta)
##    Data: mpd_panel
##
## REML criterion at convergence: 37590.7
##
## Scaled residuals:
##    Min    1Q Median    3Q    Max
## -0.712 -0.076 -0.026  0.012 33.273
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  zcta     (Intercept)  0.4733  0.688
##  Residual             32.8428  5.731
## Number of obs: 5929, groups:  zcta, 23
##
## Fixed effects:
##                   Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)      2.369e-01  1.062e+00 5.315e+03   0.223   0.8235
## t                1.280e-04  5.689e-05 5.612e+03   2.251   0.0245 *
## state_of_emerg1 -4.280e-01  7.416e-01 5.904e+03  -0.577   0.5638
## stay_at_home1   -2.623e-01  7.621e-01 5.896e+03  -0.344   0.7308
## post_floyd1      8.870e-01  7.786e-01 5.896e+03   1.139   0.2547
## t_post_floyd    -3.328e-02  2.659e-02 5.896e+03  -1.252   0.2107
## tmax_f           5.708e-03  7.025e-03 5.899e+03   0.812   0.4166
## snow_in         -2.804e-02  2.214e-01 5.897e+03  -0.127   0.8992
## precip_in       -7.552e-01  7.230e-01 5.896e+03  -1.045   0.2963
## dark_before_12  -1.024e-01  1.199e-01 5.897e+03  -0.854   0.3930
## school           1.244e-01  2.730e-01 5.896e+03   0.456   0.6487
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##            (Intr) t      stt__1 sty__1 pst_f1 t_pst_ tmax_f snow_n prcp_n
## t          -0.246
## stat_f_mrg1 -0.056 -0.209
## stay_at_hm1  0.006 -0.001 -0.817
## post_floyd1  0.043 -0.025 -0.786  0.656
```

```
## t_post_flyd  0.225   0.012 -0.177   0.176 -0.349
## tmax_f       -0.886   0.139   0.065 -0.025 -0.105 -0.119
## snow_in      -0.321 -0.057   0.072 -0.041 -0.039 -0.089   0.469
## precip_in    -0.007   0.004 -0.040   0.043   0.027   0.065 -0.218 -0.224
## dark_bfr_12 -0.925   0.088   0.086   0.016 -0.016 -0.273   0.754   0.197   0.036
## school      -0.138   0.035 -0.017 -0.069   0.067 -0.082   0.164   0.107   0.020
##               dr__12
## t
## stat_f_mrg1
## stay_at_hm1
## post_floyd1
## t_post_flyd
## tmax_f
## snow_in
## precip_in
## dark_bfr_12
## school       -0.084
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
```

```r
re_int_m <- lmer(murder_rate~t+state_of_emerg+stay_at_home+
                   post_floyd+t_post_floyd+
                 tmax_f+snow_in+precip_in+dark_before_12+school+
                   uof_lag+stops_lag+shoot_lag+
                   med_hh_inc+
                   black_pop+
                 post_floyd:black_pop+
                   (1|zcta), data = mpd_panel)
```

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

```
## boundary (singular) fit: see help('isSingular')
```

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

```r
summary(re_int_m)
```

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

```
## Formula: murder_rate ~ t + state_of_emerg + stay_at_home + post_floyd +
##     t_post_floyd + tmax_f + snow_in + precip_in + dark_before_12 +
##     school + uof_lag + stops_lag + shoot_lag + med_hh_inc + black_pop +
##     post_floyd:black_pop + (1 | zcta)
##     Data: mpd_panel
##
## REML criterion at convergence: 34801.3
##
## Scaled residuals:
##    Min    1Q Median    3Q    Max
## -1.272 -0.076 -0.026  0.012 33.094
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  zcta     (Intercept)  0.00    0.00
##  Residual             33.99    5.83
## Number of obs: 5458, groups:  zcta, 21
##
## Fixed effects:
##                        Estimate Std. Error        df t value Pr(>|t|)
## (Intercept)           4.613e-01  1.163e+00 5.441e+03   0.397   0.6917
## t                     1.028e-04  6.101e-05 5.441e+03   1.684   0.0922 .
## state_of_emerg1      -2.644e-01  7.894e-01 5.441e+03  -0.335   0.7377
## stay_at_home1        -3.333e-01  8.117e-01 5.441e+03  -0.411   0.6814
## post_floyd1           8.087e-01  8.863e-01 5.441e+03   0.912   0.3616
## t_post_floyd         -3.959e-02  2.836e-02 5.441e+03  -1.396   0.1628
## tmax_f                4.631e-03  7.442e-03 5.441e+03   0.622   0.5338
## snow_in              -2.778e-02  2.352e-01 5.441e+03  -0.118   0.9060
## precip_in            -8.566e-01  7.670e-01 5.441e+03  -1.117   0.2641
## dark_before_12       -1.319e-01  1.269e-01 5.441e+03  -1.040   0.2985
## school                1.999e-01  2.896e-01 5.441e+03   0.690   0.4902
## uof_lag              -3.625e-02  2.632e-02 5.441e+03  -1.377   0.1686
## stops_lag             7.362e-02  9.324e-03 5.441e+03   7.895 3.48e-15 ***
## shoot_lag             2.586e+00  6.090e+00 5.441e+03   0.425   0.6712
## med_hh_inc           -2.748e-06  4.308e-06 5.441e+03  -0.638   0.5235
## black_pop             4.717e-04  7.637e-03 5.441e+03   0.062   0.9507
## post_floyd1:black_pop 1.518e-02  1.667e-02 5.441e+03   0.911   0.3625
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
## 
## Correlation matrix not shown by default, as p = 17 > 12.
## Use print(x, correlation=TRUE)   or
##     vcov(x)        if you need it

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

```
plot_model(re_int_m,
          terms = c("post_floyd", "black_pop", "t[245.5]", "t_post_floyd[15.5]"),
          type = "pred",
          ci.lvl = 0.95,
          mdrt.values = "meansd",
          title = "Figure A3: Post-Killing X Percent Black Interaction Plot",
          axis.title = c("Post-Killing","Murder Rate per 100,000"))+
  theme_sjplot()+
  ggplot2::labs(colour = "Percent Black")
```

Figure A3: Post−Killing X Percent Black Interaction Plot
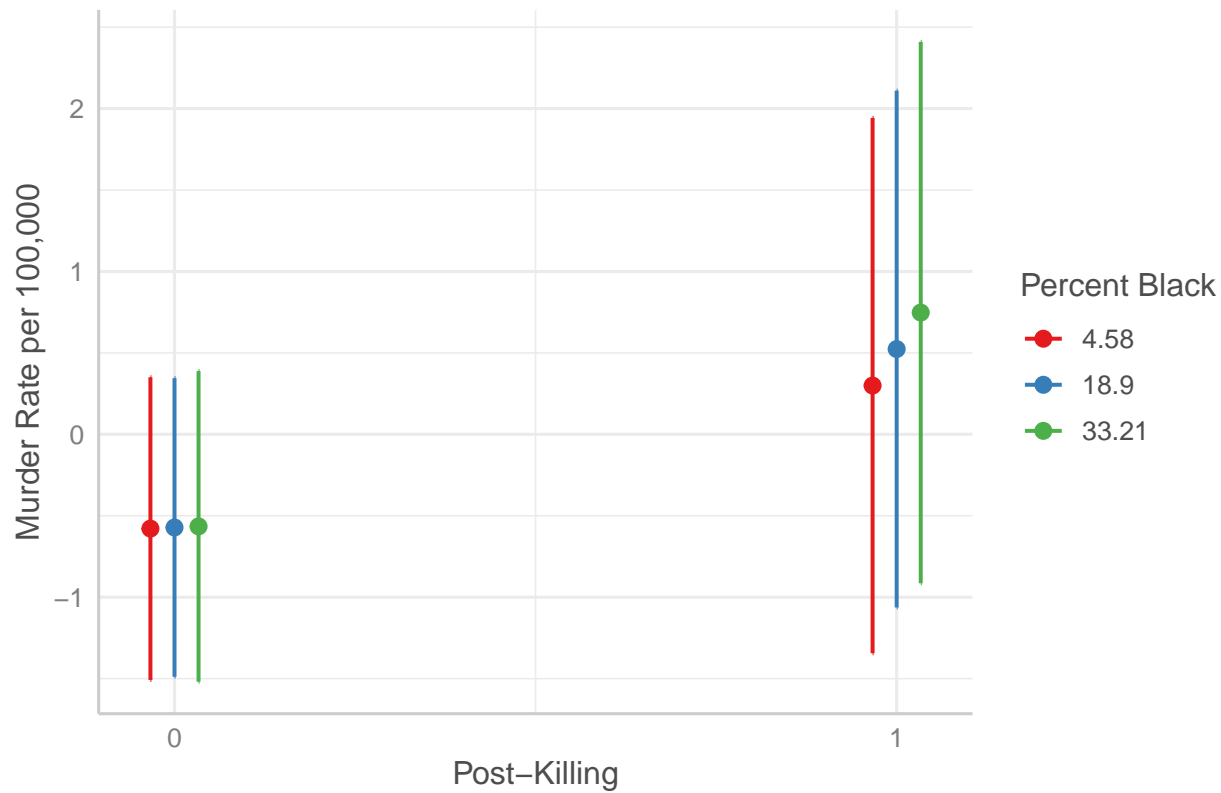
Appendix Tables

```
class(re_base_nopol_m) <- "lmerMod"
class(re_base_m) <- "lmerMod"
class(re_int_m) <- "lmerMod"

stargazer(ts_ar1_m, ts_ar1_pol_m, re_base_nopol_m, re_base_m, re_int_m,
        title = "Interrupted Time Series Models of the Murder Rate",
        covariate.labels = c("T","COVID - State of Emergency",
```

```r
                           "COVID - Stay at Home",
                           "Post-Killing", "T Post-Killing",
                           "MPD Use of Force t-1", "MPD Stops t-1",
                           "MPD OIS t-1",
                            "AR(1)",
                           "Median HH Income",
                           "Percent Black",
                           "Post-Killing X Percent Black"),
          header = F,
          dep.var.caption = "Murder Rate",
          dep.var.labels = "Rate per 100,000",
          model.names = FALSE,
          column.labels = c("AR(1) TSR","AR(1) TSR",
                            "RE HLM","RE HLM", "RE HLM +Int."),
          report = "vcs",
          ci=TRUE,
          ci.level=0.95,
          ci.separator = "|",
          notes = "95\\% Confidence Intervals in parentheses",
          single.row = F,
          font.size="scriptsize",
          no.space = T,
          column.sep.width = "0.01pt",
          omit = c("tmax_f", "snow_in","precip_in","dark_before_12","school"),
          omit.stat = c("adj.rsq"),
          #star.cutoffs = c(.05, .01, .001), star.char = c("*","**","***"),
          add.lines = list(c("SD(ZCTA)", "","", .904, .922, .504),
                          c("SD(Residual)", "","", 5.352, 5.364, 5.577)),
          notes.label = "Models include controls for seasonality.",
          notes.append = F)

class(re_base_u) <- "lmerMod"
class(re_base_u_nopol) <- "lmerMod"
class(re_int_u) <- "lmerMod"

stargazer(ts_ar1_u, ts_ar1_pol_u, re_base_u_nopol,re_base_u, re_int_u,
         title = "Interrupted Time Series Models of Firearm Assault+Unintentional Injuries",
         covariate.labels = c("T","COVID - State of Emergency",
                             "COVID - Stay at Home",
```

Table A1: Interrupted Time Series Models of the Murder Rate

	Murder Rate				
	Rate per 100,000				
	AR(1) TSR	AR(1) TSR	RE HLM	RE HLM	RE HLM +Int.
	(1)	(2)	(3)	(4)	(5)
T	0.001	0.001	0.0001	0.0001	0.0001
	(0.0002|0.001)	(−0.0002|0.001)	(0.00002|0.0002)	(−0.00001|0.0002)	(−0.00002|0.0002)
COVID - State of Emergency	−0.025	−0.044	−0.428	−0.332	−0.264
	(−0.255|0.205)	(−0.282|0.194)	(−1.881|1.025)	(−1.785|1.121)	(−1.812|1.283)
COVID - Stay at Home	−0.038	−0.028	−0.262	−0.331	−0.333
	(−0.275|0.199)	(−0.272|0.217)	(−1.756|1.231)	(−1.823|1.162)	(−1.924|1.258)
Post-Killing	0.309	0.283	0.887	0.848	0.809
	(0.078|0.541)	(0.042|0.525)	(−0.639|2.413)	(−0.677|2.373)	(−0.928|2.546)
T Post-Killing	−0.004	−0.004	−0.033	−0.032	−0.040
	(−0.006|−0.002)	(−0.006|−0.002)	(−0.085|0.019)	(−0.084|0.020)	(−0.095|0.016)
MPD Use of Force t-1		0.159		−0.095	−0.036
		(−0.346|0.664)		(−0.150|−0.039)	(−0.088|0.015)
MPD Stops t-1		−0.054		0.020	0.074
		(−0.148|0.039)		(0.003|0.037)	(0.055|0.092)
MPD OIS t-1		5.056		2.313	2.586
		(−11.273|21.385)		(−9.418|14.045)	(−9.350|14.521)
AR(1)	−0.107	−0.139			
	(−0.220|0.006)	(−0.261|−0.016)			
Median HH Income					−0.00000
					(−0.00001|0.00001)
Percent Black					0.0005
					(−0.014|0.015)
Post-Killing X Percent Black					0.015
					(−0.017|0.048)
Constant	−0.028	0.038	0.237	0.306	0.461
	(−0.303|0.247)	(−0.354|0.429)	(−1.845|2.319)	(−1.779|2.392)	(−1.819|2.741)
SD(ZCTA)			0.904	0.922	0.504
SD(Residual)			5.352	5.364	5.577
Observations	312	269	5,929	5,926	5,458
R^2	0.297	0.315			
Log Likelihood			−18,795.350	−18,783.110	−17,400.650
Akaike Inf. Crit.			37,616.700	37,598.210	34,839.310
Bayesian Inf. Crit.			37,703.640	37,705.210	34,964.800
Residual Std. Error	0.192 (df = 300)	0.197 (df = 254)			
F Statistic	11.538*** (df = 11; 300)	8.334*** (df = 14; 254)			

Models include controls for seasonality.   95% Confidence Intervals in parentheses

```r
                              "Post-Killing", "T Post-Killing",
                              "MPD Use of Force t-1", "MPD Stops t-1",
                              "MPD OIS t-1",
                               "AR(1)",
                              "Median HH Income",
                              "Percent Black",
                              "Post-Killing X Percent Black"),
          header = F,
          dep.var.caption = "Firearm Assault+Unintentional Injuries",
          dep.var.labels = "Rate per 100,000",
          model.names = FALSE,
          column.labels = c("AR(1) TSR","AR(1) TSR",
                            "RE HLM","RE HLM", "RE HLM +Int."),
          report = "vcs",
          ci=TRUE,
          ci.level=0.95,
          ci.separator = "|",
          notes = "95\\% Confidence Intervals in parentheses",
          single.row = F,
          font.size="scriptsize",
          no.space = T,
          column.sep.width = "0.01pt",
          omit = c("tmax_f", "snow_in","precip_in","dark_before_12","school"),
          omit.stat = c("adj.rsq"),
          #star.cutoffs = c(.05, .01, .001), star.char = c("*","**","***"),
          add.lines = list(c("SD(ZCTA)", "","", 1.779, 1.916, 1.449),
                          c("SD(Residual)", "","", 8.493, 8.494, 8.704)),
          notes.label = "Models include controls for seasonality.",
          notes.append = F)

class(re_base_d_nopol) <- "lmerMod"
class(re_base_d) <- "lmerMod"
class(re_int_d) <- "lmerMod"


stargazer(ts_ar1_d, ts_ar1_pol_d, re_base_d_nopol, re_base_d, re_int_d,
      title = "Interrupted Time Series Models of Firearm Undetermined Injuries",
      covariate.labels = c("T","COVID - State of Emergency",
                      "COVID - Stay at Home",
                          "Post-Killing", "T Post-Killing",
```

Table A2: Interrupted Time Series Models of Firearm Assault+Unintentional Injuries

	Firearm Assault+Unintentional Injuries				
	Rate per 100,000				
	AR(1) TSR	AR(1) TSR	RE HLM	RE HLM	RE HLM +Int.
	(1)	(2)	(3)	(4)	(5)
T	0.002	−0.002	0.005	0.004	0.003
	(0.0001|0.003)	(−0.005|0.001)	(0.001|0.009)	(0.0001|0.008)	(−0.001|0.008)
COVID - State of Emergency	−0.608	−0.464	−0.178	−0.022	0.039
	(−1.486|0.270)	(−1.380|0.452)	(−2.343|1.987)	(−2.190|2.146)	(−2.269|2.347)
COVID - Stay at Home	0.445	0.451	−0.726	−0.844	−0.877
	(−0.464|1.354)	(−0.490|1.393)	(−2.962|1.509)	(−3.080|1.393)	(−3.249|1.496)
Post-Killing	3.394	3.341	3.606	3.493	1.812
	(2.443|4.345)	(2.337|4.344)	(1.323|5.890)	(1.208|5.778)	(−0.774|4.397)
T Post-Killing	−0.097	−0.092	−0.160	−0.156	−0.163
	(−0.128|−0.065)	(−0.127|−0.057)	(−0.235|−0.085)	(−0.232|−0.081)	(−0.242|−0.084)
MPD Use of Force t-1		−0.083		−0.186	−0.169
		(−2.252|2.086)		(−0.272|−0.100)	(−0.255|−0.082)
MPD Stops t-1		−0.265		0.022	0.042
		(−0.649|0.118)		(−0.011|0.054)	(0.005|0.079)
MPD OIS t-1		−10.263		−3.256	−2.942
		(−73.259|52.733)		(−20.666|14.155)	(−20.783|14.900)
AR(1)	0.045	−0.038			
	(−0.075|0.165)	(−0.173|0.096)			
Median HH Income					0.00000
					(−0.00003|0.00004)
Percent Black					0.055
					(−0.003|0.113)
Post-Killing X Percent Black					0.100
					(0.052|0.148)
Constant	0.411	1.290	−0.280	−0.236	−1.599
	(−0.787|1.609)	(−0.483|3.063)	(−3.369|2.809)	(−3.340|2.867)	(−5.960|2.762)
SD(ZCTA)			1.779	1.916	1.449
SD(Residual)			8.493	8.494	8.704
Observations	260	217	5,770	5,748	5,460
R^2	0.491	0.513			
Log Likelihood			−20,564.490	−20,488.920	−19,603.880
Akaike Inf. Crit.			41,154.970	41,009.850	39,245.760
Bayesian Inf. Crit.			41,241.560	41,116.350	39,371.260
Residual Std. Error	0.721 (df = 248)	0.742 (df = 202)			
F Statistic	21.786*** (df = 11; 248)	15.216*** (df = 14; 202)			

Models include controls for seasonality.   95% Confidence Intervals in parentheses

```
                              "MPD Use of Force t-1", "MPD Stops t-1",
                              "MPD OIS t-1",
                               "AR(1)",
                              "Median HH Income",
                              "Percent Black",
                              "Post-Killing X Percent Black"),
          header = F,
          dep.var.caption = "Firearm Undetermined Injuries",
          dep.var.labels = "Rate per 100,000",
          model.names = FALSE,
          column.labels = c("AR(1) TSR","AR(1) TSR",
                            "RE HLM","RE HLM", "RE HLM +Int."),
          report = "vcs",
          ci=TRUE,
          ci.level=0.95,
          ci.separator = "|",
          notes = "95\\% Confidence Intervals in parentheses",
          single.row = F,
          font.size="scriptsize",
          no.space = T,
          column.sep.width = "0.1pt",
          omit = c("tmax_f", "snow_in","precip_in","dark_before_12","school"),
          omit.stat = c("adj.rsq"),
          #star.cutoffs = c(.05, .01, .001), star.char = c("*","**","***"),
          add.lines = list(c("SD(ZCTA)", "","", .046, .046, .037),
                            c("SD(Residual)", "","", .442, .444, .462)),
          notes.label = "Models include controls for seasonality.",
          notes.append = F)
```

```
class(re_base_b_nopol) <- "lmerMod"
class(re_base_b) <- "lmerMod"
class(re_int_b) <- "lmerMod"


stargazer(ts_b, ts_b_pol, re_base_b_nopol, re_base_b, re_int_b,
      title = "Interrupted Time Series Models of Firearm Assault Injuries",
      covariate.labels = c("T","COVID - State of Emergency",
                      "COVID - Stay at Home",
                            "Post-Killing",
                      "1 Month Post","2 Months Post","3 Months Post",
```

Table A3: Interrupted Time Series Models of Firearm Undetermined Injuries

	Firearm Undetermined Injuries				
		Rate per 100,000			
	AR(1) TSR	AR(1) TSR	RE HLM	RE HLM	RE HLM +Int.
	(1)	(2)	(3)	(4)	(5)
T	0.00002	−0.0001	0.00000	−0.00001	0.00001
	(−0.0002|0.0002)	(−0.001|0.0003)	(−0.0002|0.0002)	(−0.0002|0.0002)	(−0.0002|0.0002)
COVID - State of Emergency	−0.065	−0.065	−0.049	−0.048	−0.052
	(−0.192|0.062)	(−0.200|0.071)	(−0.161|0.063)	(−0.161|0.065)	(−0.175|0.070)
COVID - Stay at Home	0.050	0.054	0.039	0.039	0.042
	(−0.080|0.181)	(−0.084|0.193)	(−0.076|0.154)	(−0.077|0.154)	(−0.084|0.168)
Post-Killing	0.164	0.170	0.138	0.138	0.054
	(0.029|0.299)	(0.023|0.316)	(0.020|0.255)	(0.020|0.257)	(−0.083|0.192)
T Post-Killing	−0.002	−0.002	−0.002	−0.002	−0.002
	(−0.006|0.002)	(−0.007|0.003)	(−0.006|0.002)	(−0.006|0.002)	(−0.006|0.002)
MPD Use of Force t-1		0.099		−0.0004	−0.0005
		(−0.221|0.420)		(−0.005|0.004)	(−0.005|0.004)
MPD Stops t-1		−0.007		−0.0001	−0.0002
		(−0.064|0.049)		(−0.001|0.001)	(−0.002|0.001)
MPD OIS t-1		−3.299		−0.160	−0.143
		(−12.654|6.055)		(−1.071|0.751)	(−1.090|0.805)
AR(1)	−0.058	−0.085			
	(−0.183|0.067)	(−0.224|0.053)			
Median HH Income					−0.00000
					(−0.00000|0.00000)
Percent Black					0.001
					(−0.001|0.003)
Post-Killing X Percent Black					0.005
					(0.003|0.008)
Constant	0.075	0.194	0.009	0.010	0.008
	(−0.098|0.249)	(−0.071|0.459)	(−0.146|0.163)	(−0.146|0.166)	(−0.185|0.201)
SD(ZCTA)			0.046	0.046	0.037
SD(Residual)			0.442	0.444	0.462
Observations	260	217	5,993	5,928	5,460
R^2	0.057	0.068			
Log Likelihood			−3,664.154	−3,668.384	−3,618.111
Akaike Inf. Crit.			7,354.308	7,368.767	7,274.223
Bayesian Inf. Crit.			7,441.387	7,475.766	7,399.722
Residual Std. Error	0.104 (df = 248)	0.110 (df = 202)			
F Statistic	1.373 (df = 11; 248)	1.051 (df = 14; 202)			

Models include controls for seasonality.   95% Confidence Intervals in parentheses

```
                    "4 Months Post","5 Months Post","6 Months Post",
                    "7+ Months Post",
                             "MPD Use of Force t-1", "MPD Stops t-1",
                             "MPD OIS t-1",
                              "AR(1)",
                             "Median HH Income",
                             "Percent Black",
                             "Post-Killing X Percent Black"),
         header = F,
         dep.var.caption = "Firearm Assault Injuries",
         dep.var.labels = "Rate per 100,000",
         model.names = FALSE,
         column.labels = c("AR(1) TSR","AR(1) TSR",
                     "RE HLM","RE HLM", "RE HLM +Int."),
         report = "vcs",
         ci=TRUE,
         ci.level=0.95,
         ci.separator = "|",
         notes = "95\\% Confidence Intervals in parentheses",
         single.row = F,
         font.size="scriptsize",
         no.space = T,
         column.sep.width = "0.1pt",
         omit = c("tmax_f", "snow_in","precip_in","dark_before_12","school"),
         omit.stat = c("adj.rsq"),
         #star.cutoffs = c(.05, .01, .001), star.char = c("*","**","***"),
         add.lines = list(c("SD(ZCTA)", "","", .817, .922, .504),
                     c("SD(Residual)", "","", 5.353, 5.364, 5.578)),
         notes.label = "Models include controls for seasonality.",
         notes.append = F)
```

Table A4: Interrupted Time Series Models of Firearm Assault Injuries

	Firearm Assault Injuries				
	Rate per 100,000				
	AR(1) TSR	AR(1) TSR	RE HLM	RE HLM	RE HLM +Int.
	(1)	(2)	(3)	(4)	(5)
T	0.001	−0.001	0.003	0.002	0.001
	(−0.0001|0.002)	(−0.003|0.001)	(0.0004|0.005)	(−0.0004|0.004)	(−0.002|0.004)
COVID - State of Emergency	−0.148	−0.063	−0.520	−0.352	−0.313
	(−0.786|0.490)	(−0.706|0.580)	(−2.114|1.074)	(−1.951|1.246)	(−2.052|1.427)
COVID - Stay at Home	−0.016	−0.032	0.081	−0.037	0.028
	(−0.712|0.681)	(−0.732|0.669)	(−1.659|1.821)	(−1.781|1.707)	(−1.869|1.926)
Post-Killing	2.545	2.556	1.611	1.617	0.563
	(1.614|3.477)	(1.619|3.493)	(−0.716|3.938)	(−0.715|3.950)	(−2.040|3.166)
1 Month Post	−0.699	−0.853	−0.013	−0.067	0.052
	(−1.906|0.509)	(−2.080|0.374)	(−3.029|3.003)	(−3.090|2.956)	(−3.237|3.342)
2 Months Post	−1.241	−1.538	−0.902	−1.059	−0.972
	(−2.454|−0.028)	(−2.785|−0.292)	(−3.931|2.127)	(−4.096|1.977)	(−4.276|2.331)
3 Months Post	−2.128	−2.355	−1.248	−1.331	−1.338
	(−3.345|−0.911)	(−3.596|−1.114)	(−4.288|1.791)	(−4.377|1.715)	(−4.652|1.977)
4 Months Post	−1.871	−2.021	−1.176	−1.145	−1.156
	(−3.085|−0.656)	(−3.252|−0.790)	(−4.210|1.858)	(−4.185|1.896)	(−4.464|2.153)
5 Months Post	−2.121	−2.111	−1.372	−1.353	−1.401
	(−3.334|−0.907)	(−3.339|−0.884)	(−4.402|1.658)	(−4.391|1.684)	(−4.706|1.903)
6 Months Post	−1.330	−1.337	−0.249	−0.304	−0.179
	(−2.548|−0.111)	(−2.566|−0.108)	(−3.292|2.794)	(−3.355|2.746)	(−3.498|3.140)
7+ Months Post	−2.489	−2.485	−1.527	−1.524	−1.566
	(−3.672|−1.307)	(−3.674|−1.295)	(−4.480|1.426)	(−4.484|1.435)	(−4.786|1.654)
MPD Use of Force t-1		−0.732		−0.130	−0.123
		(−2.145|0.680)		(−0.184|−0.077)	(−0.175|−0.070)
MPD Stops t-1		−0.182		0.035	0.077
		(−0.415|0.050)		(0.019|0.051)	(0.055|0.098)
MPD OIS t-1		−30.131		−2.053	−1.773
		(−68.210|7.948)		(−13.048|8.942)	(−13.202|9.657)
AR(1)					0.00001
					(−0.00001|0.00002)
Median HH Income					0.038
					(0.014|0.062)
Percent Black					0.063
					(0.032|0.094)
Post-Killing X Percent Black	0.722	1.263	0.878	0.924	−0.320
	(−0.029|1.474)	(0.178|2.348)	(−1.039|2.794)	(−1.006|2.854)	(−2.715|2.076)
SD(ZCTA)			0.817	0.922	0.504
SD(Residual)			5.353	5.364	5.578
Observations	261	217	5,993	5,928	5,460
R²	0.436	0.485			
Log Likelihood			−18,582.870	−18,396.930	−17,161.870
Akaike Inf. Crit.			37,203.730	36,837.860	34,373.740
Bayesian Inf. Crit.			37,331.000	36,984.990	34,538.870
Residual Std. Error	0.447 (df = 244)	0.448 (df = 197)			
F Statistic	11.808*** (df = 16; 244)	9.761*** (df = 19; 197)			

Models include controls for seasonality. 95% Confidence Intervals in parentheses