Gun Series

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Base Panel Construction - ZCTA-Week Level

Hospital Data - ZCTA-Week level

```
hosp_zcta <- read_csv("Data/Restricted MHA Data/minnepop_1620_agg_zipfull_updated.csv") %>%
  arrange(zipcode, year, weekofyr) %>%
  select(-c(`_chk`, zippop_tag)) %>%
  filter(!(year==2016 & weekofyr==53)) %>%
  mutate(across(-c(zipcode, year, weekofyr),
                ~ifelse(is.na(.x),0,.x))) #fill NAs with 0
```

ZCTAs and ACS 5-Year Estimates

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

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

acs <- map_dfr(
  year,
  ~ get_acs(geography = "zcta",
              variables = c("B01001_001E", "B03003_003E",
                            "B02001_003E", "B02001_002E",
                            "B02001_004E", "B02001_008E",
                            "B02001_005E", "B02001_006E",
                            "B02001_007E", "B11001_003E",
```

```
                            "B17001_002E", "B01002_001E",
                            "B09010_002E", "B06009_005E",
                            "B01001_002E", "B99233_005E",
                            "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))

#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))
```

```
##   |                                                                              |
```

```
#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
```

```r
#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

```r
#Minneapolis Police Department - Use of Force Dashboard
uof_spatial <- read_csv("Data/Police_Use_Of_Force.csv")  %>%
  mutate(date=ymd_hms(ResponseDate),
```

```
        year=isoyear(date),
        week=isoweek(date)) %>%
  select(OBJECTID, year, week, X, Y, Race) %>%
  st_as_sf(coords = c("X", "Y"), crs = "NAD83", remove=F) %>%
  mutate(intersection = as.integer(st_intersects(geometry, zcta)),
        zcta = ifelse(is.na(intersection), NA, zcta$zcta[intersection])) %>%
  st_drop_geometry() %>%
  filter(!is.na(zcta) & year >= 2016 & year <= 2021 & zcta %in% zcta_universe) %>%
  group_by(year, week, zcta, Race, .drop=F) %>%
  tally(name = "use_of_force") %>%
  filter(!is.na(Race) & Race!="not recorded") %>%
  ungroup() %>%
  complete(year, week, zcta=zcta_universe, Race, fill = list(use_of_force = 0)) %>%
  arrange(year, week, zcta, Race) %>%
  mutate(race = str_to_lower(Race)) %>%
  select(-Race) %>%
  pivot_wider(names_from = race,
              values_from = use_of_force,
              values_fill = 0,
              names_glue = "{race}_{.value}") %>%
  mutate(total_use_of_force = asian_use_of_force+black_use_of_force+`native american_use_of_force`+
           `other / mixed race_use_of_force`+`pacific islander_use_of_force`+unknown_use_of_force+
            white_use_of_force)

#MPD Stop Dashboard
stop_spatial <- read_csv("Data/Police_Stop_Data.csv") %>%
  mutate(date=ymd_hms(responseDate),
        year=isoyear(date),
        week=isoweek(date)) %>%
  select(OBJECTID, year, week, lat, long, race) %>%
  st_as_sf(coords = c("long", "lat"), crs = "NAD83", remove=F) %>%
  mutate(intersection = as.integer(st_intersects(geometry, zcta)),
        zcta = ifelse(is.na(intersection), NA, zcta$zcta[intersection])) %>%
  st_drop_geometry() %>%
  filter(!is.na(zcta) & year >= 2016& year <= 2021 & zcta %in% zcta_universe) %>%
  group_by(year, week, zcta, race, .drop=F) %>%
  tally(name = "police_stops") %>%
   filter(!is.na(race) & race!="not recorded") %>%
```

```r
  ungroup() %>%
  complete(year, week, zcta=zcta_universe, race, fill = list(police_stops = 0)) %>%
  mutate(race = str_to_lower(race)) %>%
  arrange(year, week, zcta, race) %>%
  pivot_wider(names_from = race,
              values_from = police_stops,
              values_fill = 0,
              names_glue = "{race}_{.value}") %>%
  mutate(total_police_stops = asian_police_stops+black_police_stops+
         `east african_police_stops`+latino_police_stops+`native american_police_stops`+
           other_police_stops+unknown_police_stops+white_police_stops)

#Officer Involved Shootings - MPD
ois_spatial <- read_csv("Data/Police_Officer_Involved_Shootings.csv") %>%
  mutate(date=ymd_hms(IncidentDate),
         year=isoyear(date),
         week=isoweek(date)) %>%
  select(OBJECTID, year, week, CenterLatitude, CenterLongitude, SubjectOfForceRace) %>%
  rename(race = SubjectOfForceRace,
         lat = CenterLatitude,
         long = CenterLongitude) %>%
  st_as_sf(coords = c("long", "lat"), crs = "NAD83", remove=F) %>%
  mutate(intersection = as.integer(st_intersects(geometry, zcta)),
         zcta = ifelse(is.na(intersection), NA, zcta$zcta[intersection])) %>%
  st_drop_geometry() %>%
  filter(!is.na(zcta) & year >= 2016 & year <= 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)

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") %>%
  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")
```

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


#creating date variable
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")
```

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

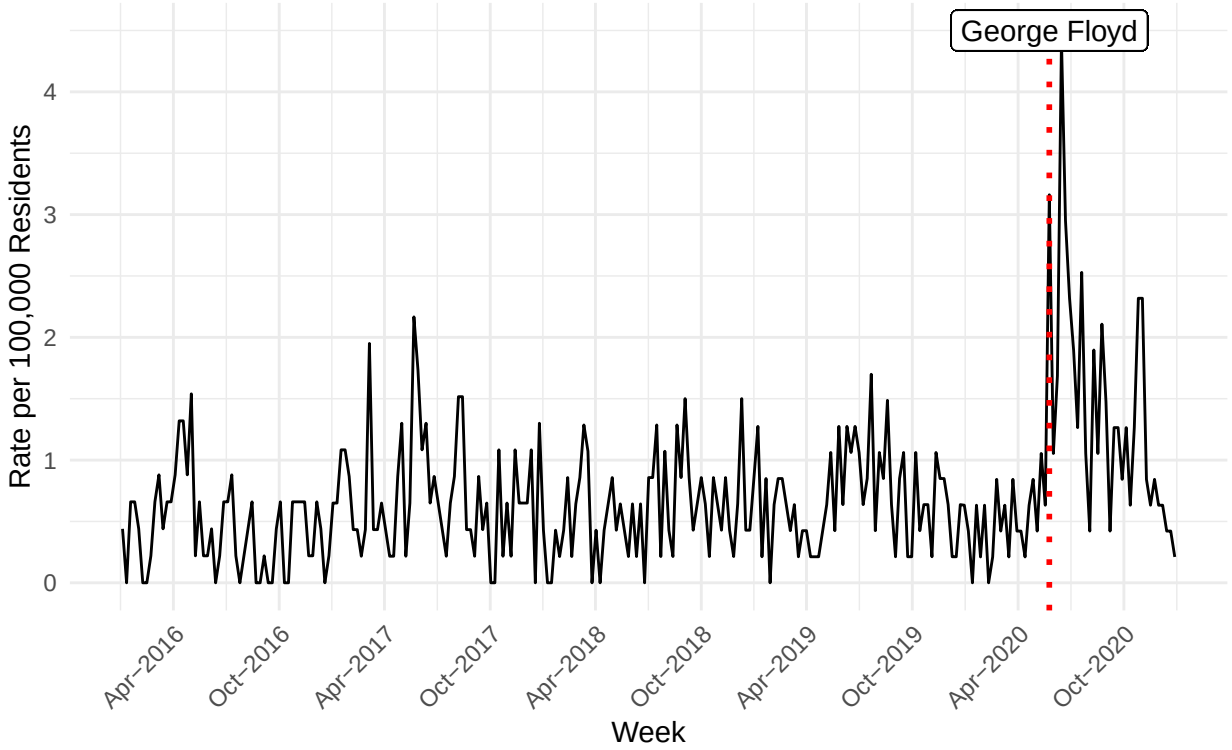
```
school[235,6] <- 0
school[236,6] <- 0
school[237,6] <- 0
school[238,6] <- 0
school[239,6] <- 0
school[240,6] <- 0
school[241,6] <- 0
school[242,6] <- 0
school[243,6] <- 0
school[244,6] <- 0
school[245,6] <- 4
school[246,6] <- 5
school[247,6] <- 5
school[248,6] <- 5
school[249,6] <- 5
school[250,6] <- 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))+
  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

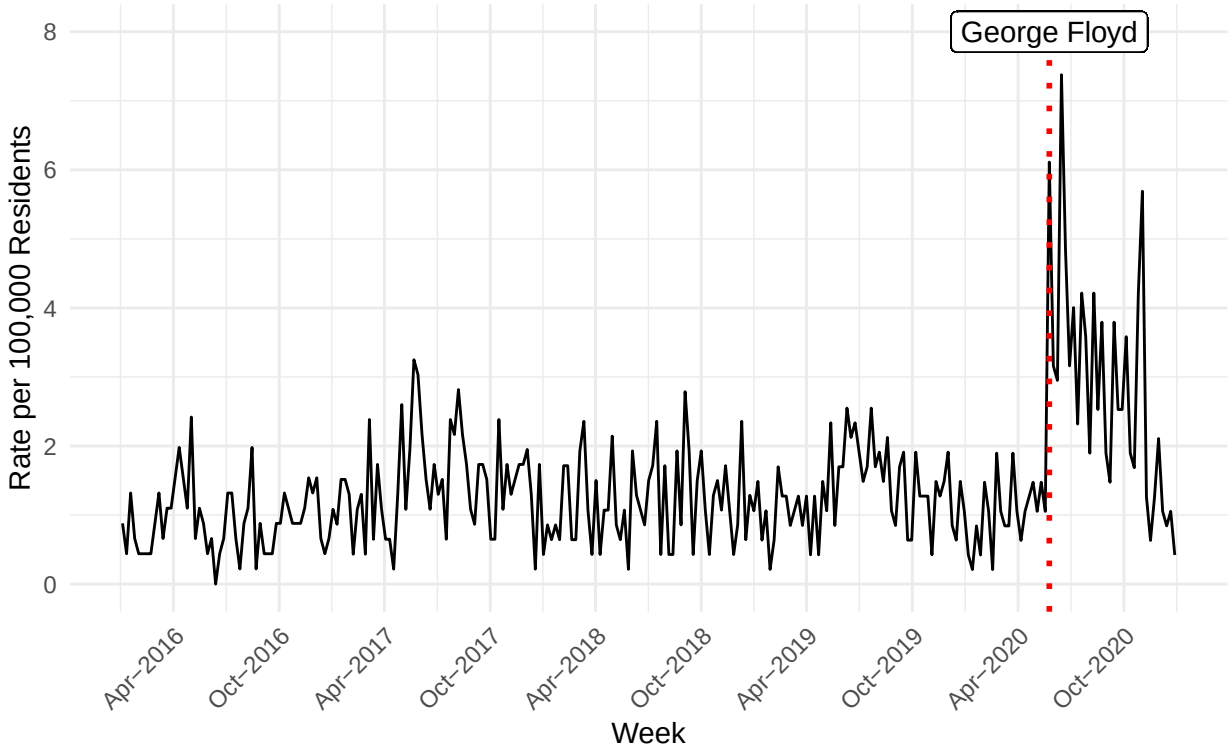



```
ggplot(series)+
  geom_line(aes(x=begin_date, y=assault_unintent_incid_c))+
  scale_x_date(date_labels = "%b-%Y", date_breaks = "6 months")+
  geom_vline(xintercept=series$begin_date[series$year==2020 & series$weekofyr==isoweek(date("2020-05-25"))],
             linetype="dotted", color="red", size=1)+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

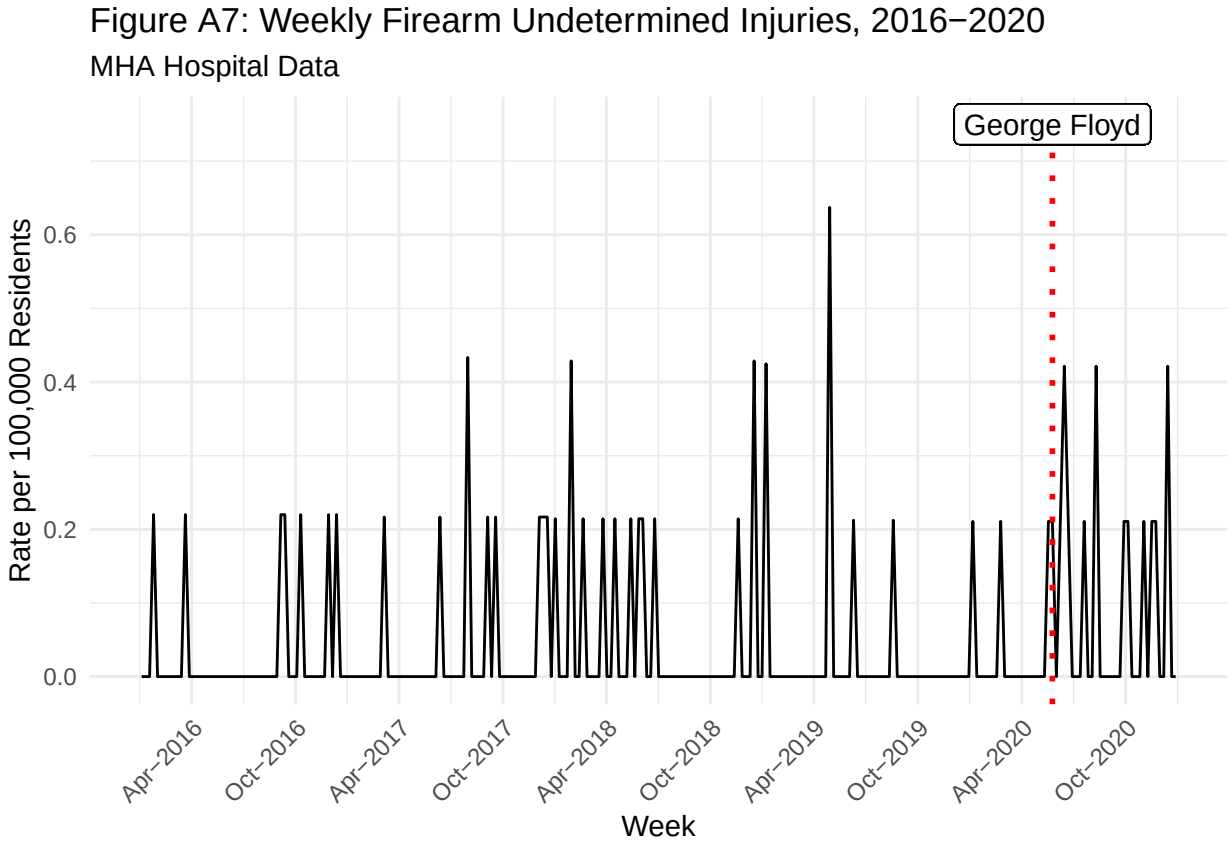
Figure A4: Weekly Firearm Assault+Unintentional Injuries, 2016−2020

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))
```




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

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

```r
4.4/.6
```

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

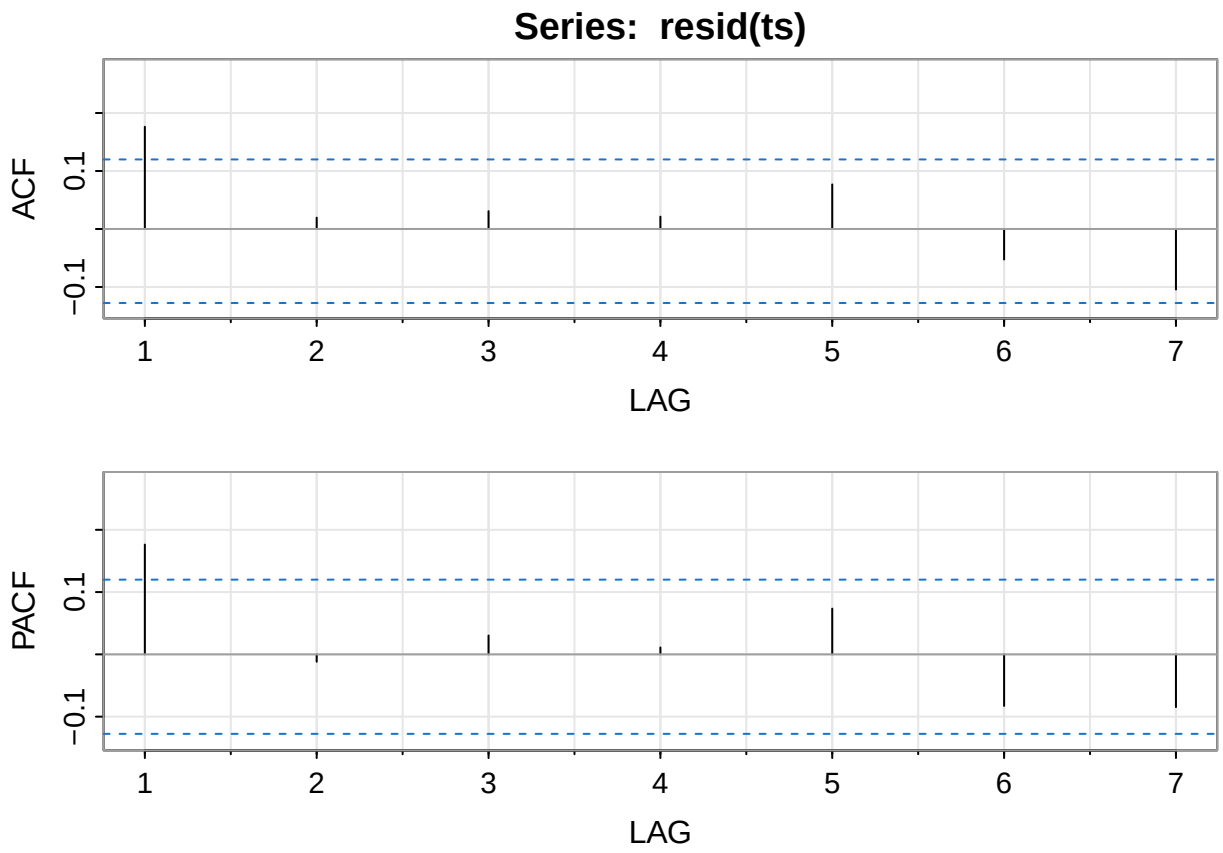
Time Series Analysis

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

```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
```

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



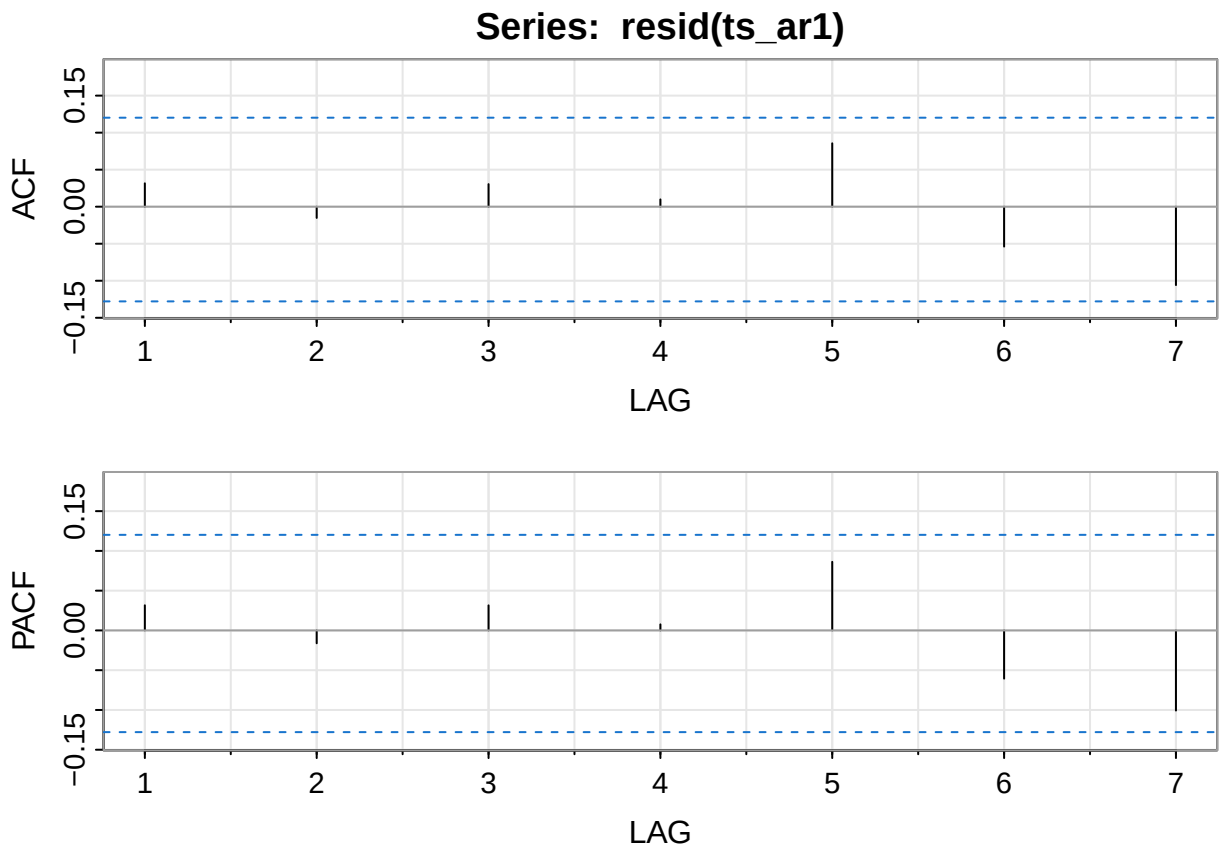

```
##      [,1]  [,2] [,3] [,4] [,5]  [,6]  [,7]
## ACF  0.18  0.02 0.03 0.02 0.08 -0.05 -0.10
## PACF 0.18 -0.01 0.03 0.01 0.07 -0.08 -0.08
```

```
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)
```



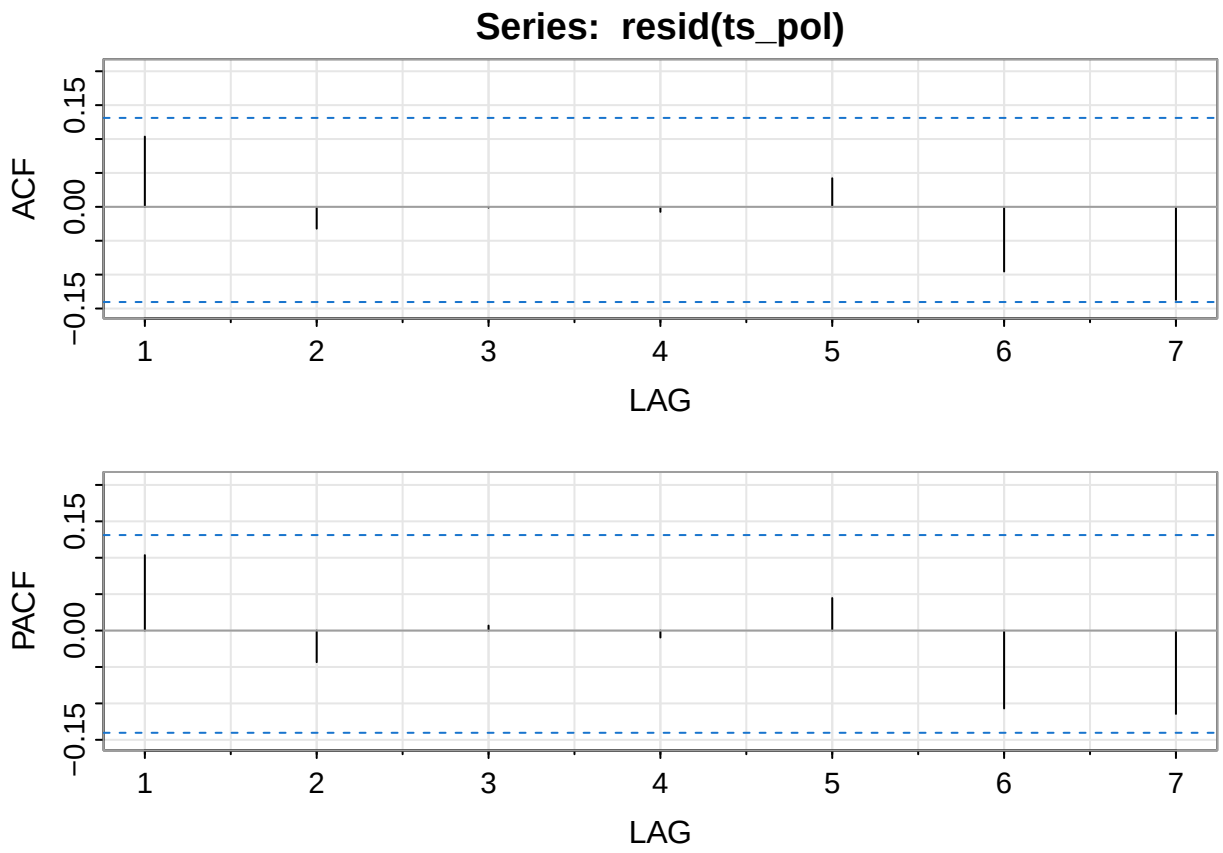

```
##      [,1]  [,2] [,3] [,4] [,5]  [,6]  [,7]
## ACF  0.03 -0.02 0.03 0.01 0.09 -0.05 -0.11
## PACF 0.03 -0.02 0.03 0.01 0.09 -0.06 -0.10
```

```
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)
```




```
##      [,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
```

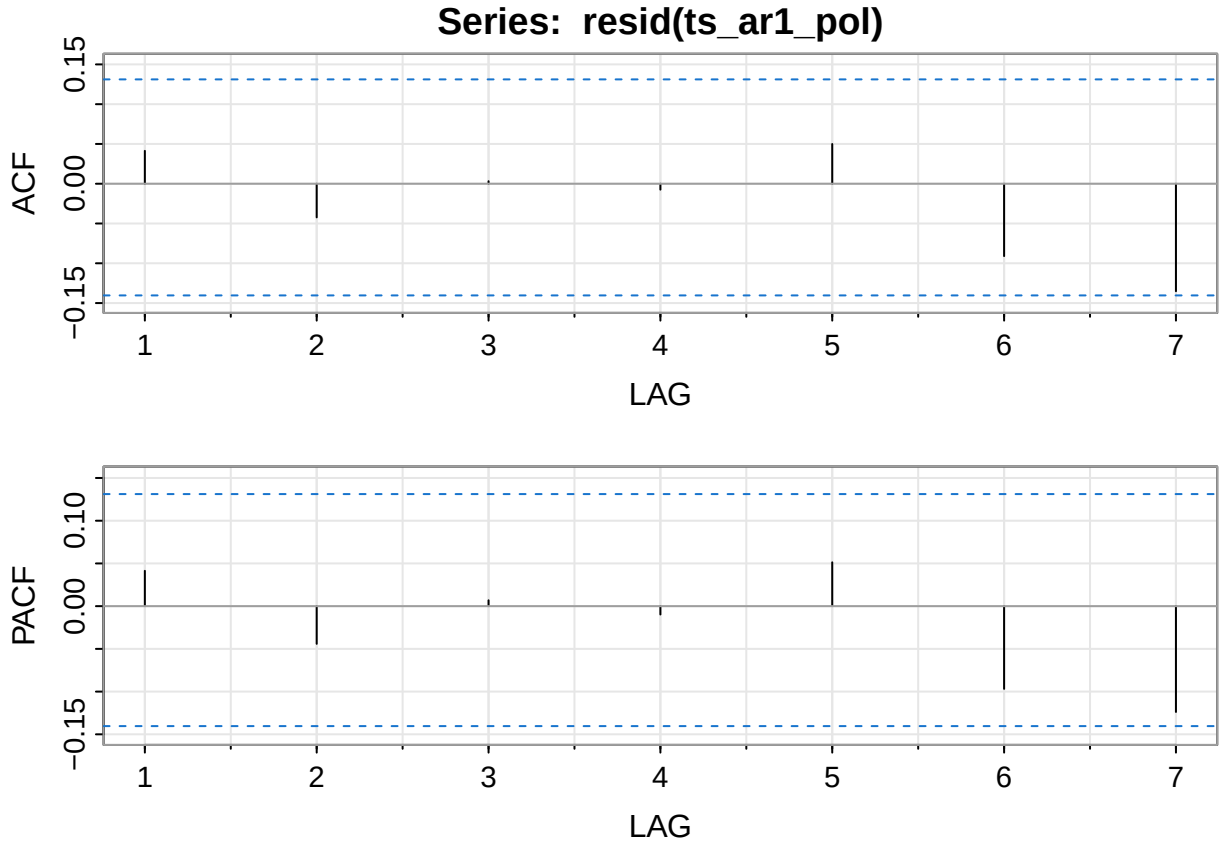
```
ts_b <- lm(assault_incid_c~t+state_of_emerg+stay_at_home+
                  post_floyd+months_post+
                        tmax_f+snow_in+precip_in+dark_before_12+school,
                        data = series)

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)
```




```
##      [,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
```

```
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

```
#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)) %>%
```

```
  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
```

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

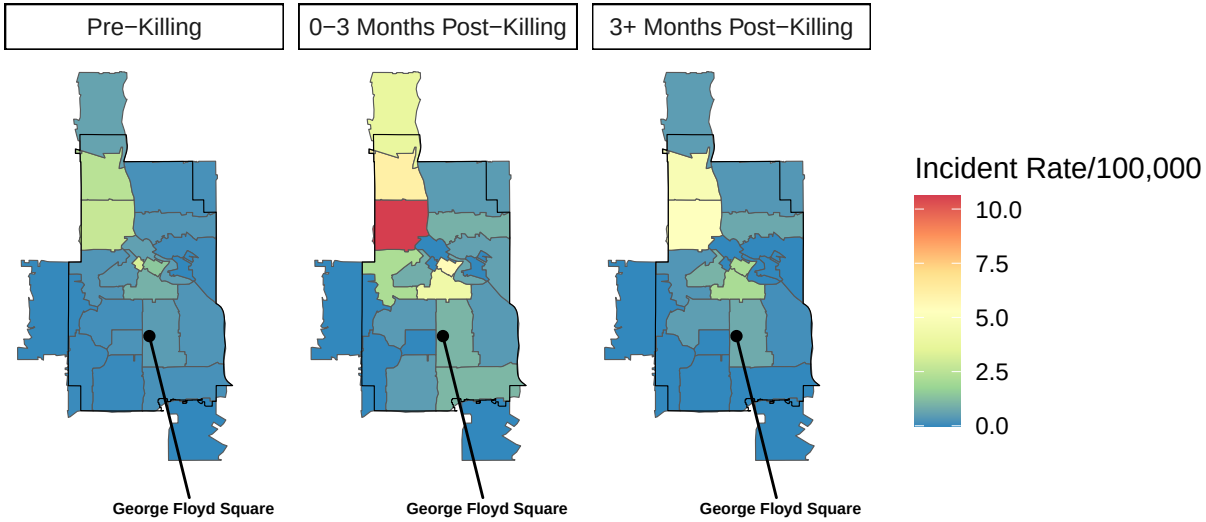
```
## [1] 0.000000 3.163689
```

```
#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

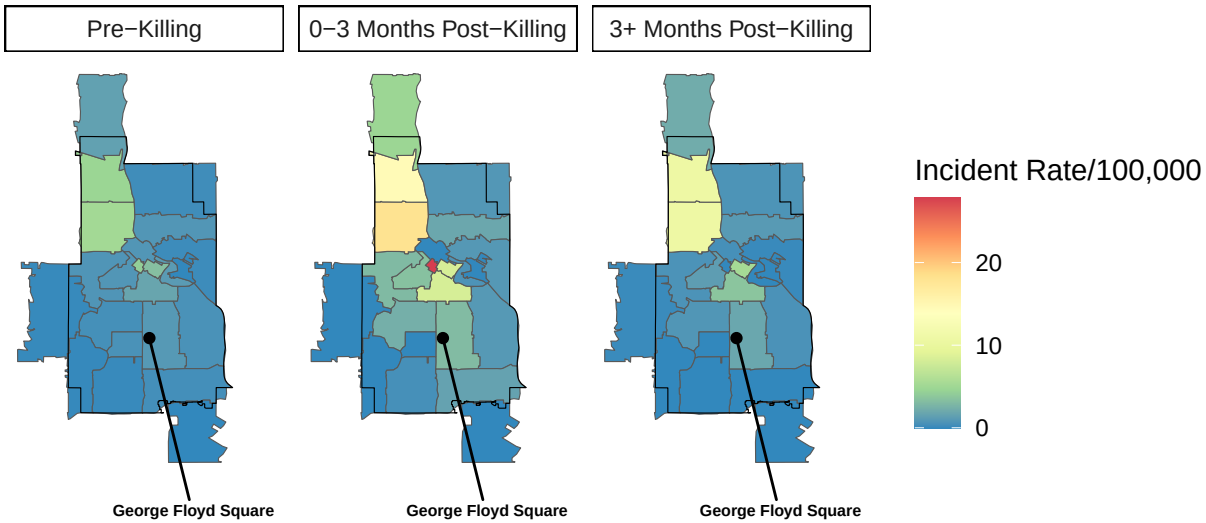



```
ggplot() +
  geom_sf(data = zip_level, aes(geometry = geometry, fill = assault_unintent_incid_c)) +
```

```
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

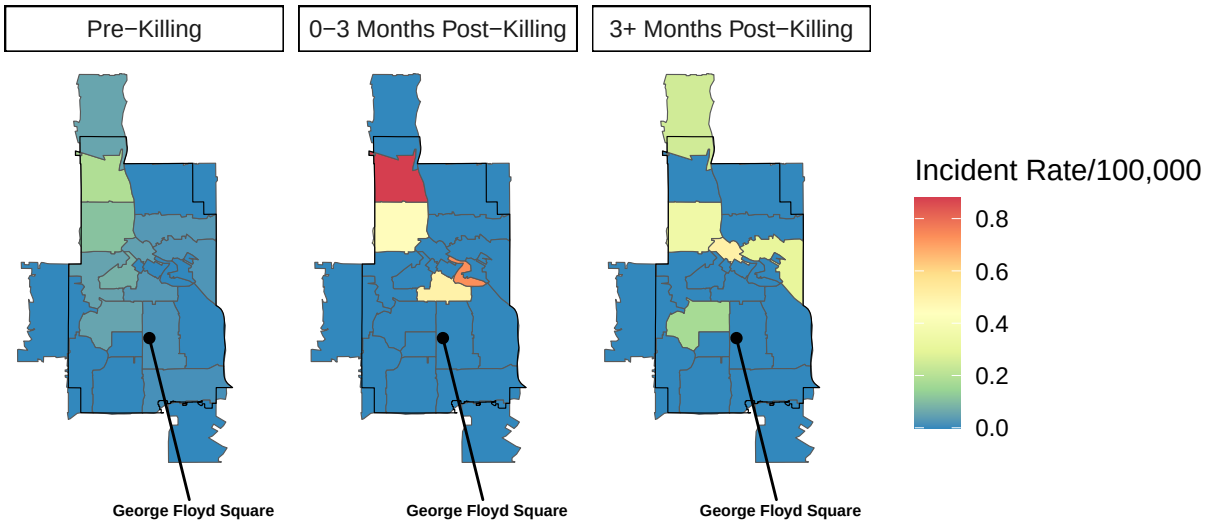



```
ggplot() +
  geom_sf(data = zip_level, aes(geometry = geometry, fill = undeter_incid_c)) +
  geom_sf(data = mpls, aes(geometry = geometry), color = "black", alpha = 0)+
  geom_sf(data = gfs, aes(geometry = geometry), color = "black")+
  geom_text_repel(data = gfs, aes(x=lon, y=lat, label = name),
                  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

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

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

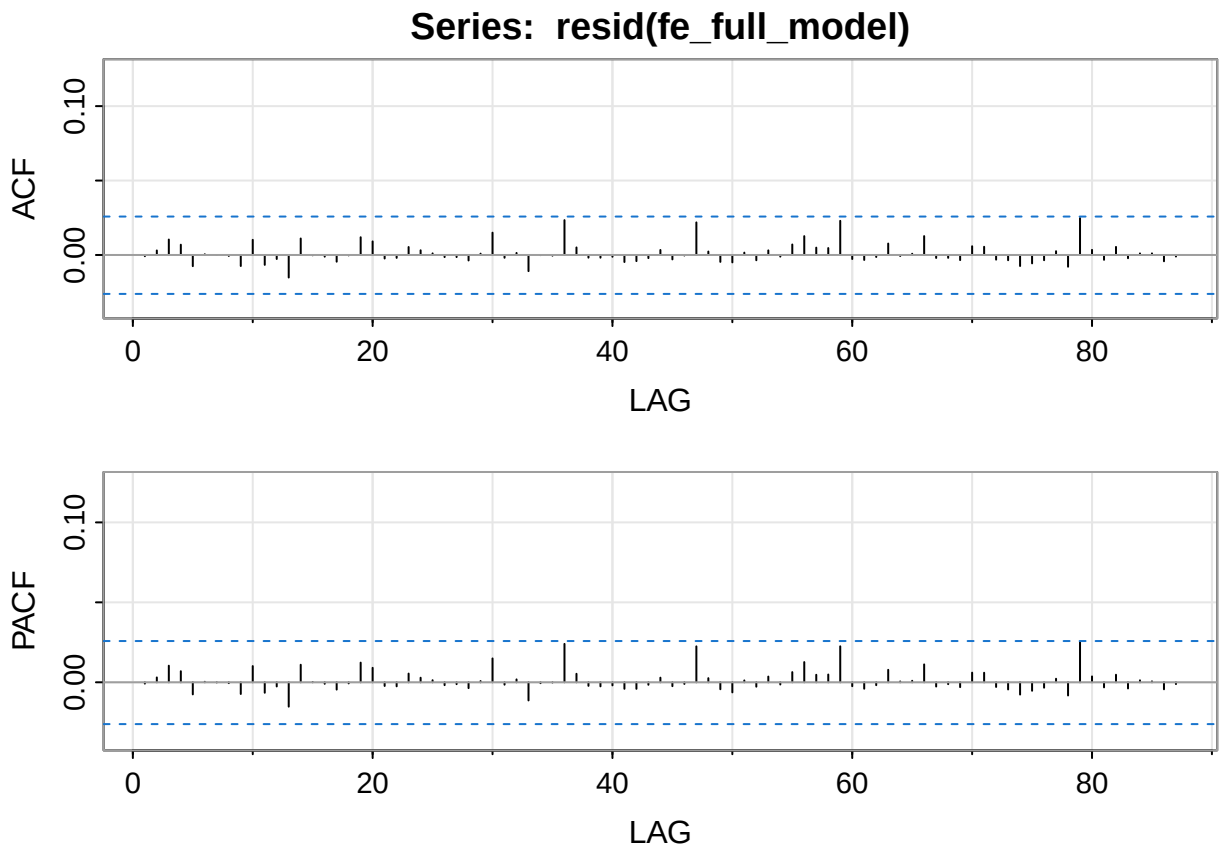
```
##
## Call:
## lm(formula = assault_incid_c ~ t + state_of_emerg + stay_at_home +
##     post_floyd + t_post_floyd + tmax_f + snow_in + precip_in +
##     dark_before_12 + school + as.factor(zcta), data = panel)
##
```

```
## Residuals:
##     Min      1Q  Median      3Q     Max
##  -4.392  -0.698  -0.260   0.050 264.010
##
## Coefficients:
##                        Estimate Std. Error t value Pr(>|t|)
## (Intercept)            0.528781   0.998838   0.529  0.59655
## t                      0.002728   0.001205   2.265  0.02357 *
## state_of_emerg        -0.645033   0.690412  -0.934  0.35020
## stay_at_home           0.242050   0.710366   0.341  0.73331
## post_floyd             1.329893   0.724788   1.835  0.06657 .
## t_post_floyd          -0.034941   0.023636  -1.478  0.13938
## tmax_f                 0.003244   0.006414   0.506  0.61308
## snow_in               -0.094086   0.205723  -0.457  0.64744
## precip_in             -0.256354   0.672088  -0.381  0.70290
## dark_before_12        -0.079221   0.110649  -0.716  0.47404
## school                -0.244403   0.250773  -0.975  0.32980
## as.factor(zcta)55402   2.018846   0.468139   4.312 1.64e-05 ***
## as.factor(zcta)55403   0.017175   0.468139   0.037  0.97073
## as.factor(zcta)55404   0.773201   0.468139   1.652  0.09866 .
## as.factor(zcta)55405  -0.034397   0.468139  -0.073  0.94143
## as.factor(zcta)55406  -0.156014   0.468139  -0.333  0.73895
## as.factor(zcta)55407   0.058258   0.468139   0.124  0.90097
## as.factor(zcta)55408  -0.258652   0.468139  -0.553  0.58062
## as.factor(zcta)55409  -0.236436   0.468139  -0.505  0.61354
## as.factor(zcta)55410  -0.408970   0.468139  -0.874  0.38237
## as.factor(zcta)55411   2.925887   0.468139   6.250 4.39e-10 ***
## as.factor(zcta)55412   2.404515   0.468139   5.136 2.89e-07 ***
## as.factor(zcta)55413  -0.059222   0.468139  -0.127  0.89934
## as.factor(zcta)55414  -0.322758   0.468139  -0.689  0.49057
## as.factor(zcta)55415   1.241611   0.468139   2.652  0.00802 **
## as.factor(zcta)55416  -0.441445   0.468139  -0.943  0.34573
## as.factor(zcta)55417  -0.219008   0.468139  -0.468  0.63993
## as.factor(zcta)55418  -0.226440   0.468139  -0.484  0.62862
## as.factor(zcta)55419  -0.396449   0.468139  -0.847  0.39711
## as.factor(zcta)55430   0.344431   0.468139   0.736  0.46191
## as.factor(zcta)55450  -0.465239   0.468139  -0.994  0.32036
## as.factor(zcta)55454   0.008653   0.468139   0.018  0.98525
## as.factor(zcta)55455  -0.465239   0.468139  -0.994  0.32036
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.348 on 5970 degrees of freedom
## Multiple R-squared:  0.03437,    Adjusted R-squared:  0.0292
## F-statistic: 6.641 on 32 and 5970 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)             0.5786927  1.0076415   0.574 0.565784
## t                       0.0020361  0.0012398   1.642 0.100594
## state_of_emerg         -0.5089950  0.6931282  -0.734 0.462768
## stay_at_home            0.1448869  0.7126788   0.203 0.838908
## post_floyd              1.2563138  0.7275698   1.727 0.084269 .
## t_post_floyd           -0.0314801  0.0237464  -1.326 0.184996
## tmax_f                  0.0038091  0.0064758   0.588 0.556417
## snow_in                -0.1067510  0.2069464  -0.516 0.605986
## precip_in              -0.2121920  0.6767740  -0.314 0.753886
## dark_before_12         -0.0812793  0.1117160  -0.728 0.466916
## school                 -0.2529043  0.2528311  -1.000 0.317212
## uof_lag                -0.1503527  0.0285759  -5.262 1.48e-07 ***
## stops_lag               0.0290073  0.0087517   3.314 0.000924 ***
## shoot_lag              -2.1208767  5.6098691  -0.378 0.705398
## as.factor(zcta)55402    2.5840695  0.6598366   3.916 9.10e-05 ***
## as.factor(zcta)55403    0.0056048  0.4708623   0.012 0.990503
## as.factor(zcta)55404    0.7506650  0.4708060   1.594 0.110894
## as.factor(zcta)55405   -0.0555793  0.4709667  -0.118 0.906063
## as.factor(zcta)55406   -0.1637980  0.4711651  -0.348 0.728120
```

```
## as.factor(zcta)55407  0.0429635  0.4710354   0.091 0.927328
## as.factor(zcta)55408 -0.2952230  0.4709004  -0.627 0.530727
## as.factor(zcta)55409 -0.2529969  0.4711038  -0.537 0.591267
## as.factor(zcta)55410 -0.4093070  0.4712669  -0.869 0.385143
## as.factor(zcta)55411  2.8757967  0.4706397   6.110 1.06e-09 ***
## as.factor(zcta)55412  2.3718894  0.4708321   5.038 4.85e-07 ***
## as.factor(zcta)55413 -0.1100124  0.4709180  -0.234 0.815294
## as.factor(zcta)55414 -0.3364212  0.4710882  -0.714 0.475171
## as.factor(zcta)55415  1.2405828  0.4705738   2.636 0.008403 **
## as.factor(zcta)55416 -0.4395512  0.4713632  -0.933 0.351111
## as.factor(zcta)55417 -0.2200777  0.4712824  -0.467 0.640534
## as.factor(zcta)55418 -0.2572163  0.4709933  -0.546 0.585008
## as.factor(zcta)55419 -0.4082092  0.4711659  -0.866 0.386317
## as.factor(zcta)55430  0.3488112  0.4712332   0.740 0.459202
## as.factor(zcta)55450 -0.7555493  0.5026241  -1.503 0.132839
## as.factor(zcta)55454 -0.0001772  0.4711057   0.000 0.999700
## as.factor(zcta)55455 -0.4587530  0.4711117  -0.974 0.330212
## ---
## 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
```




```
##      [,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
## -10.458  -0.635  -0.263   0.031 263.590
##
## Coefficients:
##                                   Estimate Std. Error t value Pr(>|t|)
## (Intercept)                      6.661e-01  1.004e+00   0.663  0.50716
## t                                2.728e-03  1.202e-03   2.269  0.02330 *
## state_of_emerg                  -6.450e-01  6.891e-01  -0.936  0.34926
## stay_at_home                     2.420e-01  7.090e-01   0.341  0.73281
## post_floyd                      -6.464e-01  1.973e+00  -0.328  0.74325
## t_post_floyd                     2.032e-02  1.027e-01   0.198  0.84318
## tmax_f                           3.244e-03  6.402e-03   0.507  0.61238
## snow_in                         -9.409e-02  2.053e-01  -0.458  0.64679
## precip_in                       -2.564e-01  6.708e-01  -0.382  0.70234
## dark_before_12                  -7.922e-02  1.104e-01  -0.717  0.47317
## school                          -2.444e-01  2.503e-01  -0.977  0.32885
## as.factor(zcta)55402             2.301e+00  4.988e-01   4.613 4.05e-06 ***
```

```
## as.factor(zcta)55403              -1.105e-01  4.988e-01  -0.222  0.82467
## as.factor(zcta)55404               4.278e-01  4.988e-01   0.858  0.39115
## as.factor(zcta)55405              -2.036e-01  4.988e-01  -0.408  0.68322
## as.factor(zcta)55406              -2.168e-01  4.988e-01  -0.435  0.66377
## as.factor(zcta)55407              -6.147e-02  4.988e-01  -0.123  0.90192
## as.factor(zcta)55408              -3.636e-01  4.988e-01  -0.729  0.46605
## as.factor(zcta)55409              -2.695e-01  4.988e-01  -0.540  0.58905
## as.factor(zcta)55410              -4.661e-01  4.988e-01  -0.934  0.35009
## as.factor(zcta)55411               2.256e+00  4.988e-01   4.524 6.19e-06 ***
## as.factor(zcta)55412               1.964e+00  4.988e-01   3.938 8.30e-05 ***
## as.factor(zcta)55413              -1.900e-01  4.988e-01  -0.381  0.70331
## as.factor(zcta)55414              -4.043e-01  4.988e-01  -0.811  0.41763
## as.factor(zcta)55415               8.710e-01  4.988e-01   1.746  0.08084 .
## as.factor(zcta)55416              -5.031e-01  4.988e-01  -1.009  0.31317
## as.factor(zcta)55417              -3.153e-01  4.988e-01  -0.632  0.52734
## as.factor(zcta)55418              -3.157e-01  4.988e-01  -0.633  0.52678
## as.factor(zcta)55419              -4.831e-01  4.988e-01  -0.968  0.33284
## as.factor(zcta)55430               1.214e-01  4.988e-01   0.243  0.80771
## as.factor(zcta)55450              -5.303e-01  4.988e-01  -1.063  0.28780
## as.factor(zcta)55454              -3.370e-02  4.988e-01  -0.068  0.94613
## as.factor(zcta)55455              -5.303e-01  4.988e-01  -1.063  0.28780
## post_floyd:as.factor(zcta)55402   -2.301e+00  2.655e+00  -0.867  0.38610
## post_floyd:as.factor(zcta)55403    2.798e-01  2.655e+00   0.105  0.91607
## post_floyd:as.factor(zcta)55404    4.714e+00  2.655e+00   1.776  0.07582 .
## post_floyd:as.factor(zcta)55405    2.556e+00  2.655e+00   0.963  0.33569
## post_floyd:as.factor(zcta)55406    8.601e-01  2.655e+00   0.324  0.74594
## post_floyd:as.factor(zcta)55407    9.488e-01  2.655e+00   0.357  0.72079
## post_floyd:as.factor(zcta)55408    9.903e-01  2.655e+00   0.373  0.70912
## post_floyd:as.factor(zcta)55409    2.695e-01  2.655e+00   0.102  0.91915
## post_floyd:as.factor(zcta)55410    4.661e-01  2.655e+00   0.176  0.86062
## post_floyd:as.factor(zcta)55411    1.170e+01  2.655e+00   4.408 1.06e-05 ***
## post_floyd:as.factor(zcta)55412    5.706e+00  2.655e+00   2.149  0.03165 *
## post_floyd:as.factor(zcta)55413    1.584e+00  2.655e+00   0.597  0.55062
## post_floyd:as.factor(zcta)55414    1.227e+00  2.655e+00   0.462  0.64401
## post_floyd:as.factor(zcta)55415    5.501e+00  2.655e+00   2.072  0.03828 *
## post_floyd:as.factor(zcta)55416    5.031e-01  2.655e+00   0.190  0.84968
## post_floyd:as.factor(zcta)55417    1.661e+00  2.655e+00   0.626  0.53145
## post_floyd:as.factor(zcta)55418    8.782e-01  2.655e+00   0.331  0.74080
## post_floyd:as.factor(zcta)55419    1.235e+00  2.655e+00   0.465  0.64184
```

```
## post_floyd:as.factor(zcta)55430    4.616e+00  2.655e+00   1.739  0.08209 .
## post_floyd:as.factor(zcta)55450    5.303e-01  2.655e+00   0.200  0.84169
## post_floyd:as.factor(zcta)55454    9.973e-01  2.655e+00   0.376  0.70717
## post_floyd:as.factor(zcta)55455    5.303e-01  2.655e+00   0.200  0.84169
## t_post_floyd:as.factor(zcta)55402 -1.309e-16  1.445e-01   0.000  1.00000
## t_post_floyd:as.factor(zcta)55403  4.914e-02  1.445e-01   0.340  0.73384
## t_post_floyd:as.factor(zcta)55404 -1.224e-01  1.445e-01  -0.847  0.39722
## t_post_floyd:as.factor(zcta)55405 -7.588e-02  1.445e-01  -0.525  0.59956
## t_post_floyd:as.factor(zcta)55406 -2.348e-02  1.445e-01  -0.162  0.87093
## t_post_floyd:as.factor(zcta)55407  1.789e-03  1.445e-01   0.012  0.99012
## t_post_floyd:as.factor(zcta)55408 -8.664e-03  1.445e-01  -0.060  0.95220
## t_post_floyd:as.factor(zcta)55409 -4.877e-16  1.445e-01   0.000  1.00000
## t_post_floyd:as.factor(zcta)55410 -5.325e-16  1.445e-01   0.000  1.00000
## t_post_floyd:as.factor(zcta)55411 -4.026e-01  1.445e-01  -2.786  0.00535 **
## t_post_floyd:as.factor(zcta)55412 -1.365e-01  1.445e-01  -0.945  0.34492
## t_post_floyd:as.factor(zcta)55413 -3.342e-02  1.445e-01  -0.231  0.81715
## t_post_floyd:as.factor(zcta)55414 -3.622e-02  1.445e-01  -0.251  0.80209
## t_post_floyd:as.factor(zcta)55415 -1.599e-01  1.445e-01  -1.106  0.26866
## t_post_floyd:as.factor(zcta)55416 -6.031e-16  1.445e-01   0.000  1.00000
## t_post_floyd:as.factor(zcta)55417 -5.652e-02  1.445e-01  -0.391  0.69576
## t_post_floyd:as.factor(zcta)55418 -9.677e-03  1.445e-01  -0.067  0.94662
## t_post_floyd:as.factor(zcta)55419 -3.408e-02  1.445e-01  -0.236  0.81358
## t_post_floyd:as.factor(zcta)55430 -1.805e-01  1.445e-01  -1.249  0.21179
## t_post_floyd:as.factor(zcta)55450 -6.283e-16  1.445e-01   0.000  1.00000
## t_post_floyd:as.factor(zcta)55454 -4.205e-02  1.445e-01  -0.291  0.77106
## t_post_floyd:as.factor(zcta)55455 -5.201e-16  1.445e-01   0.000  1.00000
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 5.337 on 5926 degrees of freedom
## Multiple R-squared:  0.04524,    Adjusted R-squared:  0.033
## F-statistic: 3.695 on 76 and 5926 DF,  p-value: < 2.2e-16

## 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)      8.338e-01  9.728e-01  4.007e+03   0.857   0.3915
## t                1.975e-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   0.8263
## 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           3.599e-03  6.475e-03  5.893e+03   0.556   0.5784
## snow_in         -1.111e-01  2.069e-01  5.892e+03  -0.537   0.5913
## precip_in       -2.170e-01  6.768e-01  5.891e+03  -0.321   0.7485
## dark_before_12  -8.131e-02  1.117e-01  5.891e+03  -0.728   0.4668
## school          -2.598e-01  2.528e-01  5.892e+03  -1.027   0.3043
## 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: 37237
##
## Scaled residuals:
##    Min     1Q Median     3Q    Max
## -0.762 -0.135 -0.057 -0.001 49.406
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  zcta     (Intercept)  0.8163  0.9035
##  Residual             28.5997  5.3479
## Number of obs: 6003, groups:  zcta, 23
##
## Fixed effects:
##                   Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)      7.941e-01  9.635e-01  4.188e+03   0.824   0.4099
## t                2.728e-03  1.205e-03  5.970e+03   2.265   0.0236 *
## state_of_emerg1 -6.450e-01  6.904e-01  5.970e+03  -0.934   0.3502
## stay_at_home1    2.420e-01  7.104e-01  5.970e+03   0.341   0.7333
## post_floyd1      1.330e+00  7.248e-01  5.970e+03   1.835   0.0666 .
## t_post_floyd    -3.494e-02  2.364e-02  5.970e+03  -1.478   0.1394
## tmax_f           3.244e-03  6.414e-03  5.970e+03   0.506   0.6131
## snow_in         -9.409e-02  2.057e-01  5.970e+03  -0.457   0.6474
## precip_in       -2.564e-01  6.721e-01  5.970e+03  -0.381   0.7029
## dark_before_12  -7.922e-02  1.106e-01  5.970e+03  -0.716   0.4740
## school          -2.444e-01  2.508e-01  5.970e+03  -0.975   0.3298
## ---
```

```
## 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           -0.104
## stat_f_mrg1 -0.084 -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 -0.010 -0.168  0.170 -0.345
## tmax_f      -0.873  0.009  0.089 -0.019 -0.111 -0.090
## snow_in     -0.330 -0.059  0.069 -0.037 -0.043 -0.072  0.478
## precip_in   -0.005 -0.022 -0.034  0.042  0.030  0.059 -0.221 -0.221
## dark_bfr_12 -0.914 -0.060  0.114  0.020 -0.018 -0.263  0.748  0.202  0.038
## school      -0.121  0.042 -0.025 -0.063  0.057 -0.040  0.145  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      -0.103

## 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: 42081.3
```

```
##
## Scaled residuals:
##    Min     1Q Median     3Q    Max
## -1.181 -0.151 -0.058  0.020 45.334
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  zcta     (Intercept)  3.815   1.953
##  Residual             69.972   8.365
## Number of obs: 5928, groups:  zcta, 23
##
## Fixed effects:
##                   Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)     -1.913e-01  1.542e+00  2.403e+03  -0.124  0.90129
## t                4.000e-03  1.933e-03  5.894e+03   2.069  0.03857 *
## state_of_emerg1 -4.217e-02  1.081e+00  5.891e+03  -0.039  0.96888
## stay_at_home1   -8.173e-01  1.111e+00  5.891e+03  -0.735  0.46217
## post_floyd1      3.316e+00  1.135e+00  5.892e+03   2.922  0.00349 **
## t_post_floyd    -1.479e-01  3.703e-02  5.891e+03  -3.995 6.56e-05 ***
## tmax_f           1.568e-02  1.010e-02  5.892e+03   1.553  0.12049
## snow_in         -9.906e-02  3.227e-01  5.891e+03  -0.307  0.75891
## precip_in        2.690e-01  1.055e+00  5.891e+03   0.255  0.79888
## dark_before_12   4.427e-02  1.742e-01  5.891e+03   0.254  0.79944
## school          -5.158e-02  3.943e-01  5.892e+03  -0.131  0.89592
## uof_lag         -1.884e-01  4.320e-02  3.244e+03  -4.362 1.33e-05 ***
## stops_lag        1.420e-02  1.320e-02  2.974e+03   1.076  0.28203
## shoot_lag       -3.259e+00  8.748e+00  5.894e+03  -0.373  0.70949
## ---
## 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: 42081.3
##
## Scaled residuals:
##    Min     1Q Median     3Q    Max
## -1.181 -0.151 -0.058  0.020 45.334
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  zcta     (Intercept)  3.815   1.953
##  Residual             69.972   8.365
## Number of obs: 5928, groups:  zcta, 23
##
## Fixed effects:
##                   Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)     -1.913e-01  1.542e+00  2.403e+03  -0.124  0.90129
## t                4.000e-03  1.933e-03  5.894e+03   2.069  0.03857 *
## state_of_emerg1 -4.217e-02  1.081e+00  5.891e+03  -0.039  0.96888
## stay_at_home1   -8.173e-01  1.111e+00  5.891e+03  -0.735  0.46217
## post_floyd1      3.316e+00  1.135e+00  5.892e+03   2.922  0.00349 **
## t_post_floyd    -1.479e-01  3.703e-02  5.891e+03  -3.995 6.56e-05 ***
## tmax_f           1.568e-02  1.010e-02  5.892e+03   1.553  0.12049
## snow_in         -9.906e-02  3.227e-01  5.891e+03  -0.307  0.75891
## precip_in        2.690e-01  1.055e+00  5.891e+03   0.255  0.79888
## dark_before_12   4.427e-02  1.742e-01  5.891e+03   0.254  0.79944
## school          -5.158e-02  3.943e-01  5.892e+03  -0.131  0.89592
## uof_lag         -1.884e-01  4.320e-02  3.244e+03  -4.362 1.33e-05 ***
## stops_lag        1.420e-02  1.320e-02  2.974e+03   1.076  0.28203
## shoot_lag       -3.259e+00  8.748e+00  5.894e+03  -0.373  0.70949
## ---
## 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)      9.609e-03  7.961e-02  5.508e+03   0.121   0.9039
## t               -5.642e-06  1.027e-04  5.903e+03  -0.055   0.9562
## 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          -4.373e-05  5.365e-04  5.896e+03  -0.082   0.9350
## 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         -3.591e-04  2.146e-03  9.104e+02  -0.167   0.8671
## stops_lag       -8.683e-05  6.511e-04  7.687e+02  -0.133   0.8940
## 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: 7330.4
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -0.5595 -0.1276 -0.0581 -0.0152 23.4325
##
## Random effects:
##  Groups   Name        Variance Std.Dev.
##  zcta     (Intercept) 0.002113 0.04597
##  Residual             0.194994 0.44158
## Number of obs: 6003, groups:  zcta, 23
##
## Fixed effects:
##                   Estimate Std. Error         df t value Pr(>|t|)
## (Intercept)      9.119e-03  7.861e-02  5.579e+03   0.116   0.9077
## t                1.758e-06  9.946e-05  5.970e+03   0.018   0.9859
## state_of_emerg1 -4.880e-02  5.701e-02  5.970e+03  -0.856   0.3921
## stay_at_home1    3.887e-02  5.866e-02  5.970e+03   0.663   0.5075
## post_floyd1      1.378e-01  5.985e-02  5.970e+03   2.302   0.0214 *
## t_post_floyd    -2.037e-03  1.952e-03  5.970e+03  -1.044   0.2966
## tmax_f          -3.808e-05  5.296e-04  5.970e+03  -0.072   0.9427
## snow_in         -1.033e-02  1.699e-02  5.970e+03  -0.608   0.5430
## precip_in       -2.847e-02  5.550e-02  5.970e+03  -0.513   0.6080
## dark_before_12   3.949e-03  9.136e-03  5.970e+03   0.432   0.6656
## school           1.453e-02  2.071e-02  5.970e+03   0.702   0.4828
## ---
## 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           -0.105
## stat_f_mrg1 -0.085 -0.203
```

```
## stay_at_hm1  0.002 -0.009 -0.816
## post_floyd1  0.049 -0.027 -0.792  0.662
## t_post_flyd  0.212 -0.010 -0.168  0.170 -0.345
## tmax_f      -0.884  0.009  0.089 -0.019 -0.111 -0.090
## snow_in     -0.333 -0.059  0.069 -0.037 -0.043 -0.072  0.478
## precip_in   -0.005 -0.022 -0.034  0.042  0.030  0.059 -0.221 -0.221
## dark_bfr_12 -0.925 -0.060  0.114  0.020 -0.018 -0.263  0.748  0.202  0.038
## school      -0.123  0.042 -0.025 -0.063  0.057 -0.040  0.145  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      -0.103
```

```
## 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  0.73393
## t                      9.744e-04  1.414e-03  1.354e+03   0.689  0.49074
## state_of_emerg1       -4.385e-01  7.544e-01  5.425e+03  -0.581  0.56110
## stay_at_home1          1.890e-01  7.755e-01  5.424e+03   0.244  0.80742
## post_floyd1            2.815e-01  8.450e-01  5.430e+03   0.333  0.73901
## 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  0.51630
## snow_in               -9.885e-02  2.245e-01  5.423e+03  -0.440  0.65979
## precip_in             -2.404e-01  7.336e-01  5.424e+03  -0.328  0.74318
## dark_before_12        -7.092e-02  1.210e-01  5.442e+03  -0.586  0.55780
## school                -2.927e-01  2.738e-01  5.425e+03  -1.069  0.28517
## 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  0.29305
## black_pop              3.780e-02  1.226e-02  1.806e+01   3.084  0.00639 **
## post_floyd1:black_pop  6.295e-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 0.474832
## t                      3.496e-03  2.355e-03  3.514e+02   1.484 0.138663
## state_of_emerg1        3.915e-02  1.178e+00  5.420e+03   0.033 0.973481
## stay_at_home1         -8.766e-01  1.210e+00  5.417e+03  -0.724 0.468997
## post_floyd1            1.812e+00  1.319e+00  5.427e+03   1.373 0.169778
## 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 0.116455
## snow_in               -1.032e-01  3.505e-01  5.417e+03  -0.295 0.768366
## 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 0.753234
## school                -6.942e-02  4.275e-01  5.418e+03  -0.162 0.870985
## uof_lag               -1.689e-01  4.416e-02  1.243e+03  -3.823 0.000138 ***
## stops_lag              4.167e-02  1.895e-02  3.129e+02   2.199 0.028632 *
## shoot_lag             -2.942e+00  9.103e+00  5.423e+03  -0.323 0.746605
```

```
## med_hh_inc             4.628e-06  1.705e-05  1.561e+01   0.271 0.789597
## black_pop              5.525e-02  2.953e-02  1.572e+01   1.871 0.080126 .
## 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)            8.180e-03  9.848e-02  3.090e+02   0.083    0.934
## t                      1.296e-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                -6.160e-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         4.267e-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               -4.853e-04  2.206e-03  1.006e+03  -0.220    0.826
## stops_lag             -2.440e-04  8.723e-04  1.790e+02  -0.280    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  -0.574    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
```

Figure 3: Post−Killing X Percent Black Interaction Plot

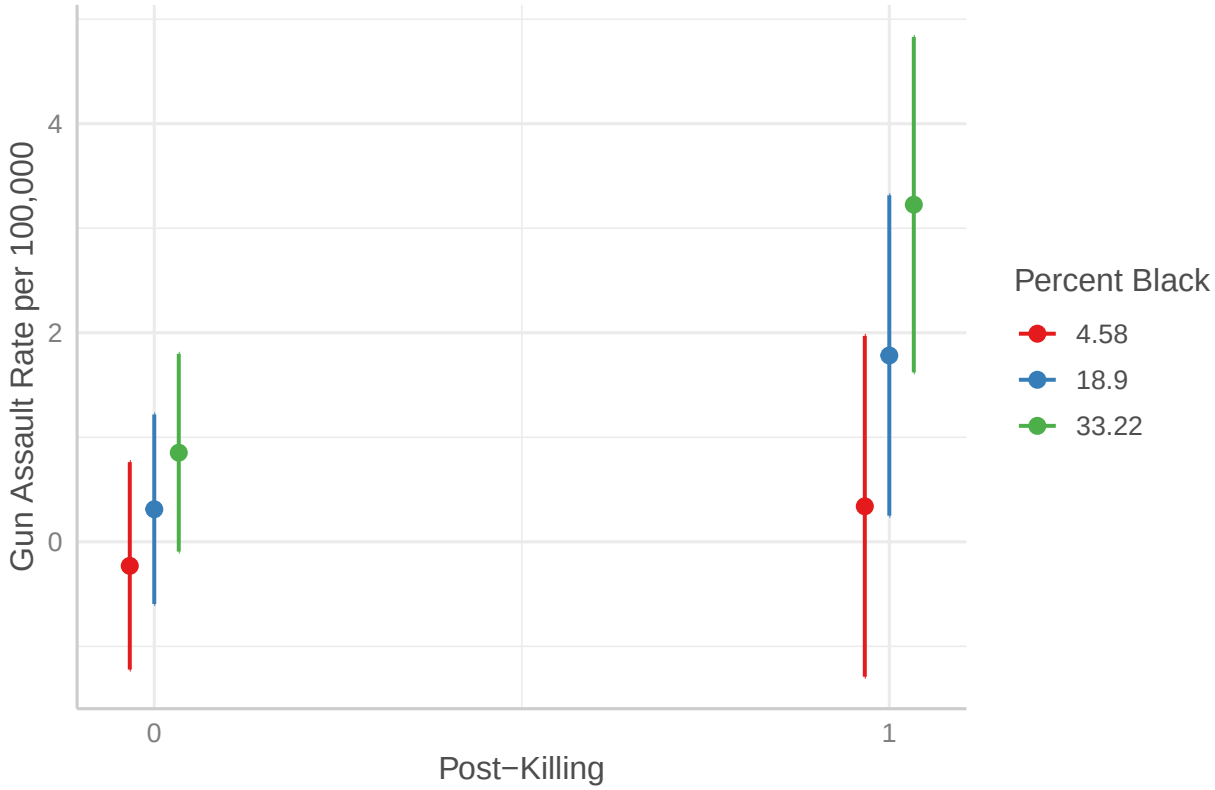


Figure A6: Post−Killing X Percent B

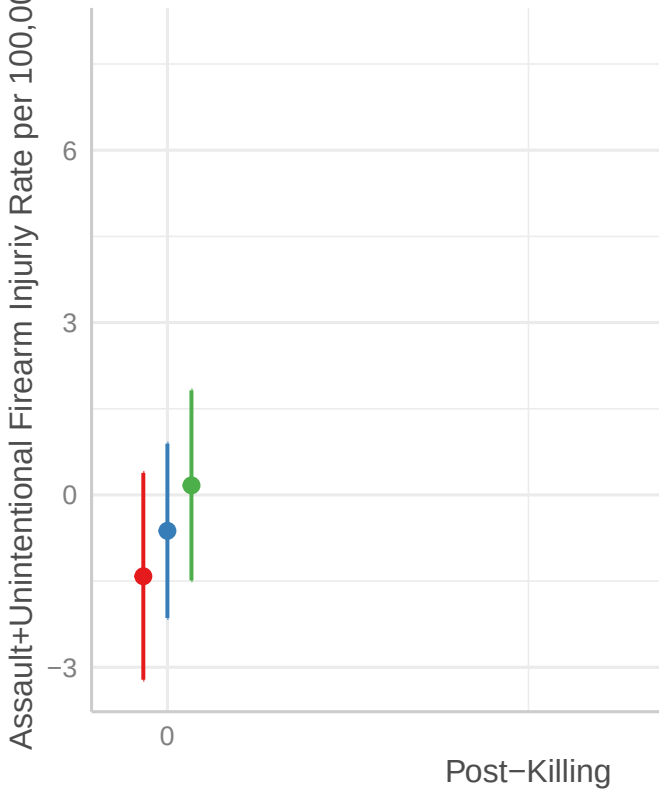
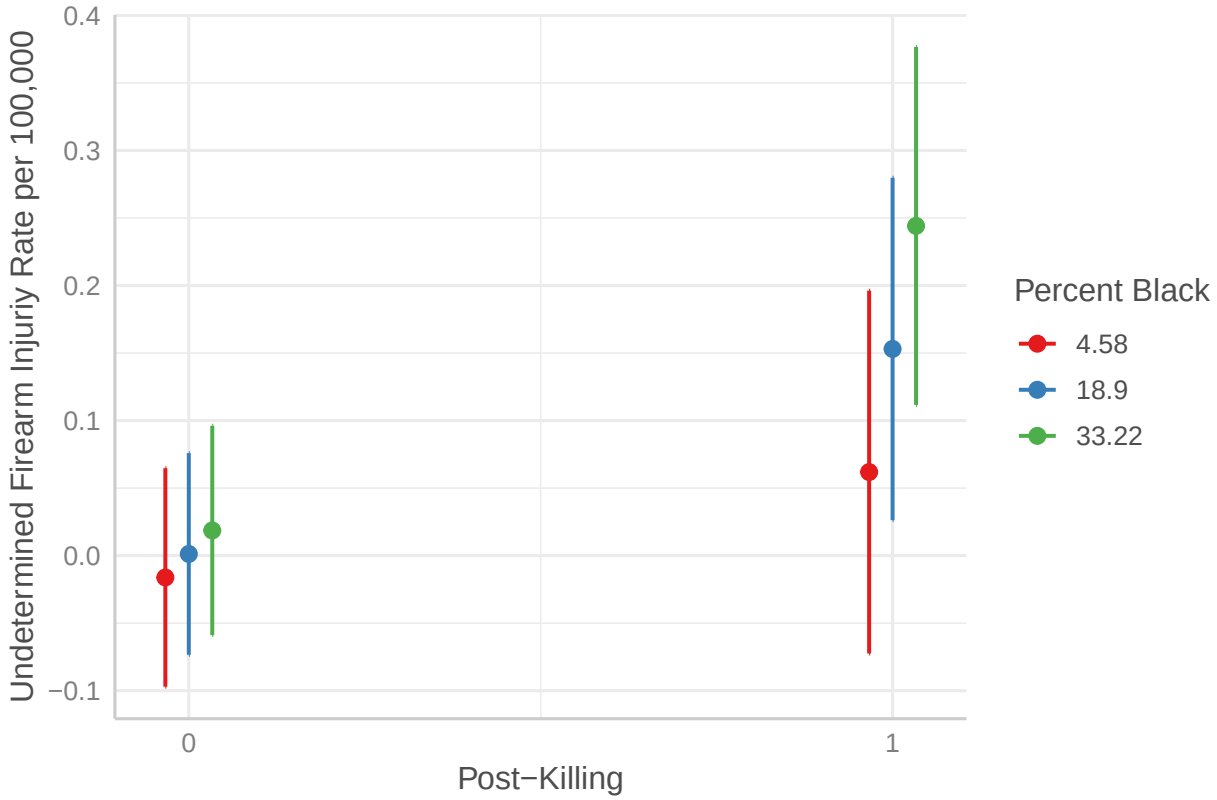


Figure A9: Post−Killing X Percent Black Interaction Plot




```
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,
          type = "html",
          out = "C:/Users/rlarson21/Documents/Research/Gun-Violence-MN/Gun Violence Submissions/SSTE Submission/SSTE R&R/table2.html")
```

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

-0.645

-0.506

-0.439

(-1.026|0.100)

(-0.995|0.173)

(-1.998|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)

(-1.150|1.634)

(-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)

(-0.091|2.750)

(-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

0.794

0.834

-0.412

(-0.194|1.352)

(-0.204|2.066)

(-1.094|2.683)

(-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

6,003

5,928

5,460

R2

0.385

0.407

Log Likelihood

-18,618.490

-18,406.520

-17,172.070

Akaike Inf. Crit.

37,262.990

36,845.050

34,382.150

Bayesian Inf. Crit.

37,350.090

36,952.040

34,507.650

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

```
#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
coef_zip_level <- zip_level %>%
  filter(period!="Pre-Killing") %>%
  left_join(coef, by = c("zcta", "period"))
coef_gfs <- gfs
coef_gfs[2,] <- gfs[1,]
```

```r
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")
```

```r
#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)`) %>%
  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))
```

```r
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
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
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
```

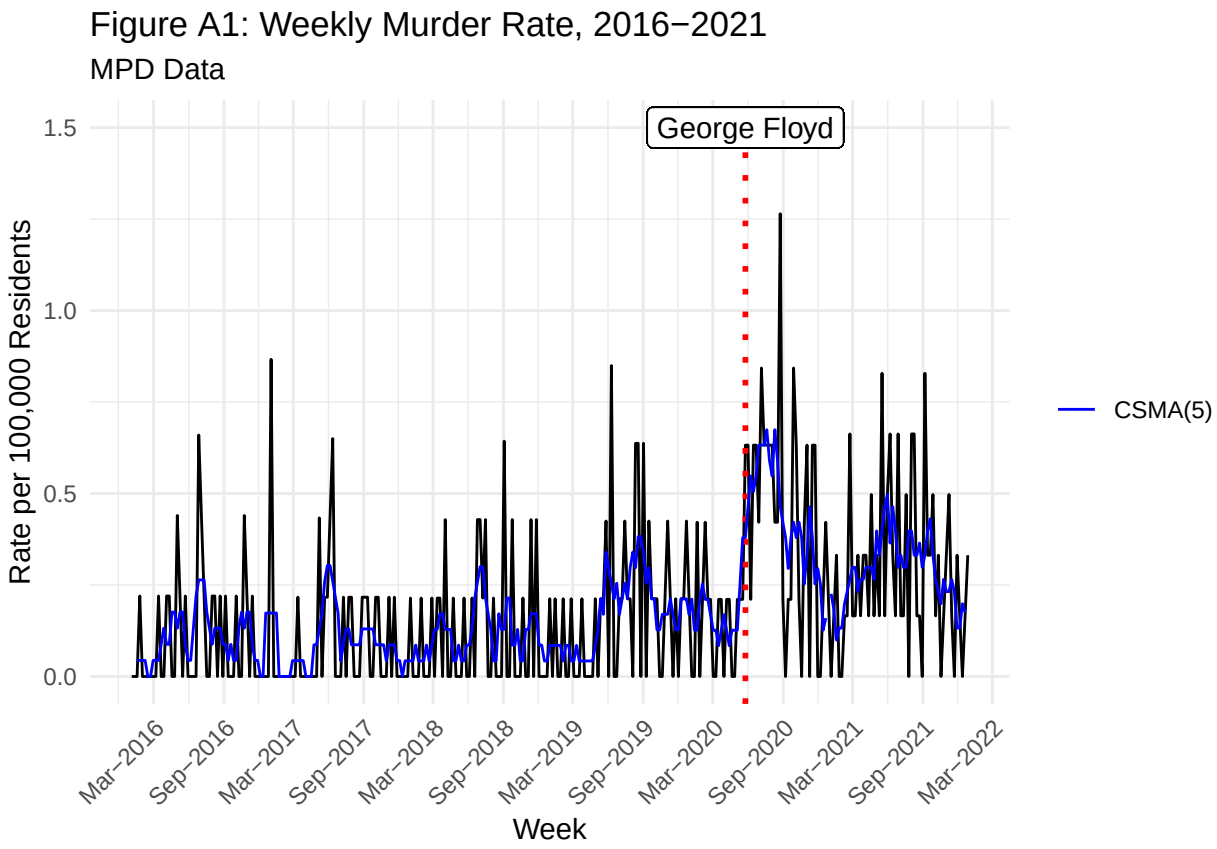
```
school_murder[209,6] <- 0
school_murder[210,6] <- 0
school_murder[211,6] <- 5
school_murder[212,6] <- 4
school_murder[213,6] <- 4
school_murder[214,6] <- 5
school_murder[215,6] <- 5
school_murder[216,6] <- 5
school_murder[217,6] <- 3
school_murder[218,6] <- 5
school_murder[219,6] <- 5
school_murder[220,6] <- 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 %>%
  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 100,000 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"))
```




```
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
```

```r
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
```

```
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),
          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")) %>%
  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")
```

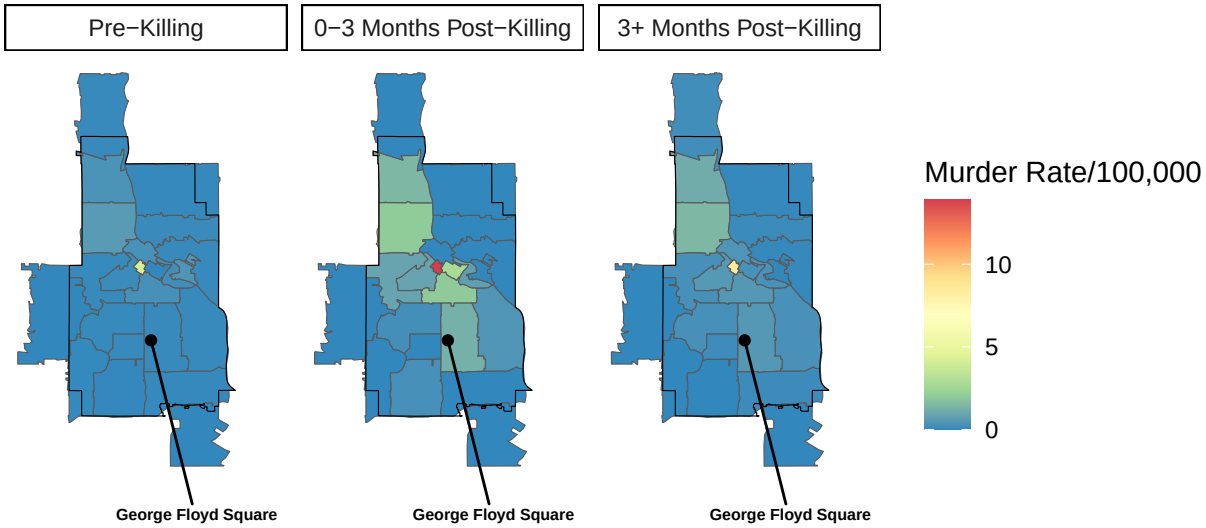
```
## `summarise()` has grouped output by 'zcta'. You can override using the
## `.groups` argument.
```

```
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)      3.065e-01  1.064e+00  4.566e+03   0.288 0.773317
## t                1.067e-04  5.727e-05  5.572e+03   1.864 0.062426 .
## state_of_emerg1 -3.317e-01  7.412e-01  5.885e+03  -0.448 0.654498
## stay_at_home1   -3.308e-01  7.615e-01  5.874e+03  -0.434 0.664015
## 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 0.225310
## tmax_f           5.859e-03  7.024e-03  5.885e+03   0.834 0.404253
## snow_in         -3.406e-02  2.213e-01  5.875e+03  -0.154 0.877652
## precip_in       -7.428e-01  7.223e-01  5.873e+03  -1.028 0.303820
## dark_before_12  -1.088e-01  1.198e-01  5.875e+03  -0.909 0.363561
## school           1.284e-01  2.730e-01  5.877e+03   0.470 0.638130
## uof_lag         -9.484e-02  2.835e-02  8.849e+02  -3.346 0.000855 ***
## stops_lag        1.991e-02  8.472e-03  8.345e+02   2.350 0.019029 *
## 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
```

```
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
```

```
summary(re_int_m)
```

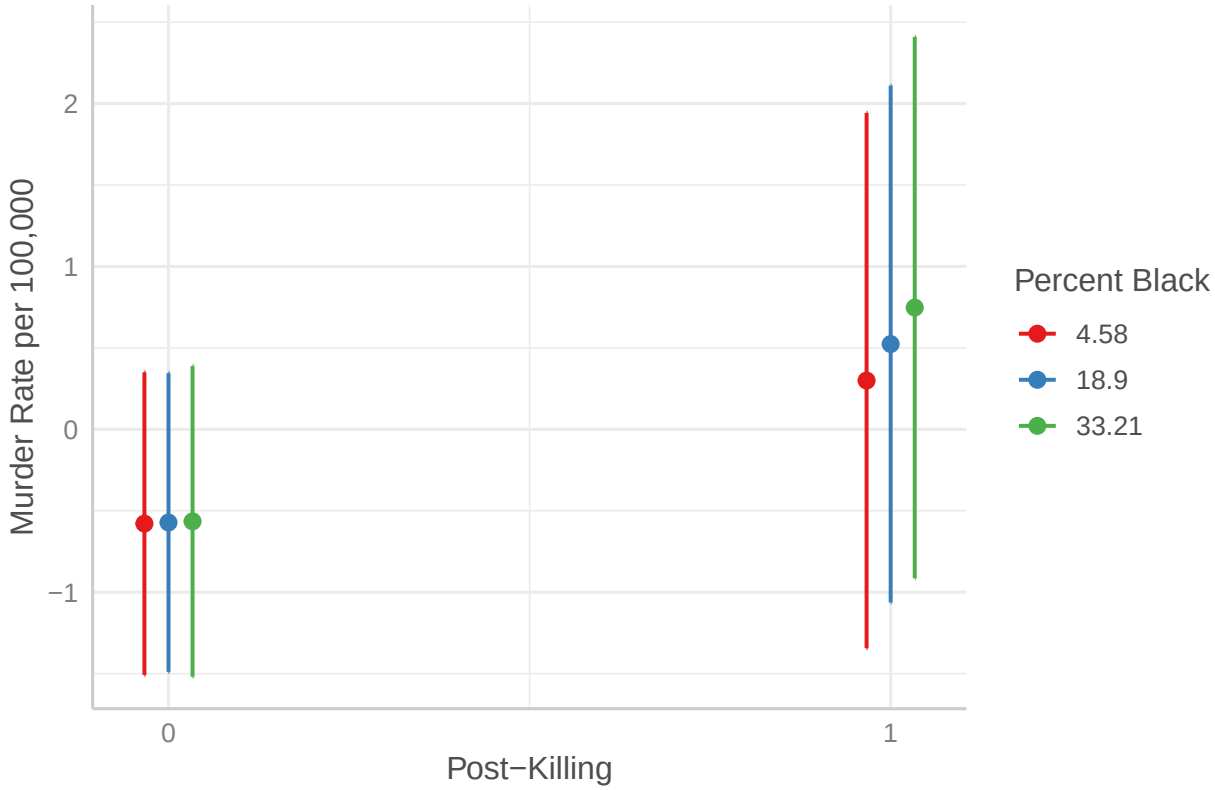
```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: murder_rate ~ t + state_of_emerg + stay_at_home + post_floyd +
##     t_post_floyd + tmax_f + snow_in + precip_in + dark_before_12 +
##     school + uof_lag + stops_lag + shoot_lag + med_hh_inc + 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   0.6813
## 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               4.716e-04  7.637e-03  5.441e+03   0.062   0.9508
## 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",
```

```
                            "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,
          type = "html",
          out = "C:/Users/rlarson21/Documents/Research/Gun-Violence-MN/Gun Violence Submissions/SSTE Submission/SSTE R&R/tableA1.html")
```

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|1.257)

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

R2

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

```
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",
                               "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,
          type = "html",
          out = "C:/Users/rlarson21/Documents/Research/Gun-Violence-MN/Gun Violence Submissions/SSTE Submission/SSTE R&R/tableA2.html")
```

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|0.008)

(0.0002|0.008)

(-0.001|0.008)

COVID - State of Emergency

-0.608

-0.464

-0.176

-0.042

0.039

(-1.486|0.270)

(-1.380|0.452)

(-2.293|1.941)

(-2.161|2.077)

(-2.269|2.347)

COVID - Stay at Home

0.445

0.451

-0.699

-0.817

-0.877

(-0.464|1.354)

(-0.490|1.393)

(-2.877|1.478)

(-2.996|1.361)

(-3.249|1.496)

Post-Killing

3.394

3.341

3.428

3.316

1.812

(2.443|4.345)

(2.337|4.344)

(1.206|5.650)

(1.092|5.540)

(-0.774|4.397)

T Post-Killing

-0.097

-0.092

-0.152

-0.148

-0.163

(-0.128|-0.065)

(-0.127|-0.057)

(-0.224|-0.079)

(-0.221|-0.075)

(-0.242|-0.084)

MPD Use of Force t-1

-0.083

-0.188

-0.169

(-2.252|2.086)

(-0.273|-0.104)

(-0.255|-0.082)

MPD Stops t-1

-0.265

0.014

0.042

(-0.649|0.118)

(-0.012|0.040)

(0.005|0.079)

MPD OIS t-1

-10.263

-3.259

-2.942

(-73.259|52.733)

(-20.405|13.886)

(-20.784|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

-0.258

-0.191

-1.599

(-0.787|1.609)

(-0.483|3.063)

(-3.262|2.745)

(-3.214|2.831)

(-5.960|2.762)

SD(ZCTA)

1.779

1.916

1.449

SD(Residual)

8.493

8.494

8.704

Observations

260

217

5,951

5,928

5,460

R2

0.491

0.513

Log Likelihood

-21,118.790

-21,040.630

-19,603.880

Akaike Inf. Crit.

42,263.570

42,113.260

39,245.770

Bayesian Inf. Crit.

42,350.560

42,220.260

39,371.270

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

```
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",
                              "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,
          type = "html",
          out = "C:/Users/rlarson21/Documents/Research/Gun-Violence-MN/Gun Violence Submissions/SSTE Submission/SSTE R&R/tableA3.html")
```

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)

(-0.145|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

6,003

5,928

5,460

R2

0.057

0.068

Log Likelihood

-3,665.197

-3,668.384

-3,618.112

Akaike Inf. Crit.

7,356.394

7,368.768

7,274.223

Bayesian Inf. Crit.

7,443.494

7,475.767

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

```
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",
                        "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,
          type = "html",
          out = "C:/Users/rlarson21/Documents/Research/Gun-Violence-MN/Gun Violence Submissions/SSTE Submission/SSTE R&R/tableA4.html")
```

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

-0.519

-0.352

-0.313

(-0.786|0.490)

(-0.706|0.580)

(-2.111|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)

(-1.657|1.819)

(-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)

(-0.714|3.936)

(-0.715|3.950)

(-2.040|3.166)

1 Month Post

-0.699

-0.853

-0.012

-0.067

0.052

(-1.906|0.509)

(-2.080|0.374)

(-3.026|3.001)

(-3.090|2.956)

(-3.237|3.342)

2 Months Post

-1.241

-1.538

-0.901

-1.059

-0.972

(-2.454|-0.028)

(-2.785|-0.292)

(-3.928|2.125)

(-4.096|1.977)

(-4.276|2.331)

3 Months Post

-2.128

-2.355

-1.248

-1.331

-1.337

(-3.345|-0.911)

(-3.596|-1.114)

(-4.284|1.789)

(-4.377|1.716)

(-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)

(-4.207|1.855)

(-4.185|1.896)

(-4.464|2.153)

5 Months Post

-2.121

-2.111

-1.373

-1.353

-1.401

(-3.334|-0.907)

(-3.339|-0.884)

(-4.401|1.655)

(-4.390|1.684)

(-4.706|1.903)

6 Months Post

-1.330

-1.337

-0.250

-0.304

-0.179

(-2.548|-0.111)

(-2.566|-0.108)

(-3.291|2.791)

(-3.355|2.746)

(-3.498|3.140)

7+ Months Post

-2.489

-2.485

-1.528

-1.524

-1.566

(-3.672|-1.307)

(-3.674|-1.295)

(-4.478|1.423)

(-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

0.871

0.924

-0.320

(-0.029|1.474)

(0.178|2.348)

(-1.040|2.782)

(-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

6,003

5,928

5,460

R2

0.436

0.485

Log Likelihood

-18,608.870

-18,396.930

-17,161.870

Akaike Inf. Crit.

37,255.730

36,837.860

34,373.740

Bayesian Inf. Crit.

37,383.030

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