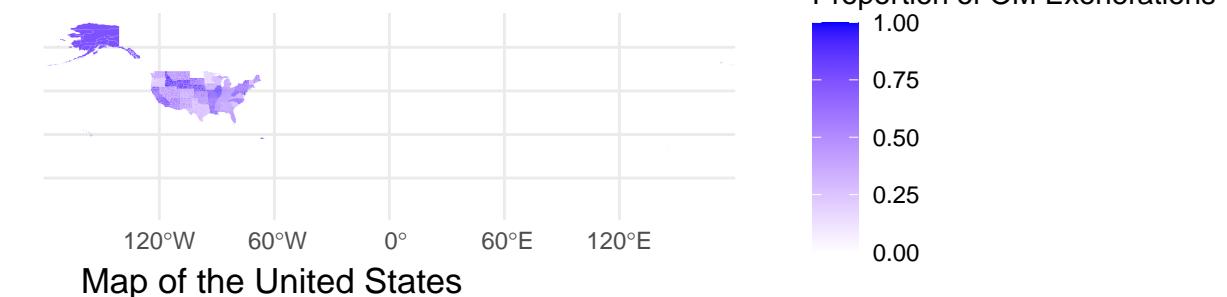
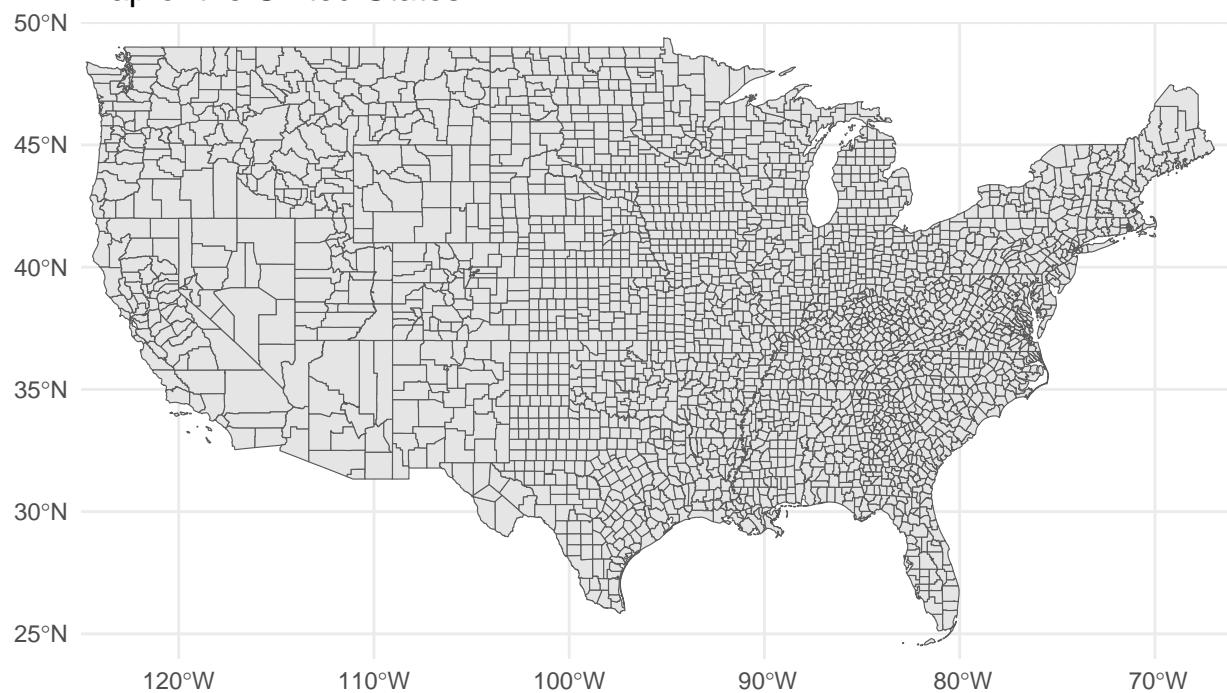




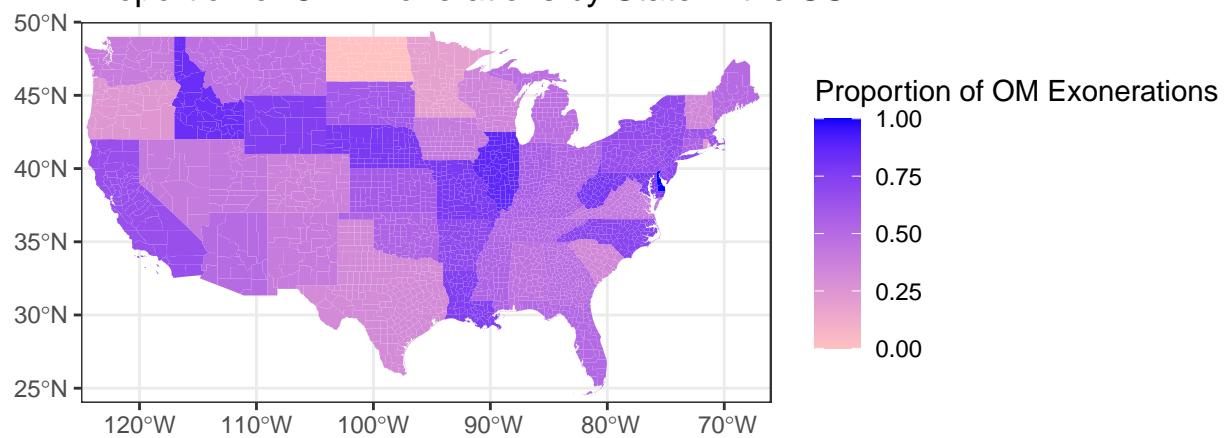
## Proportion of OM Exonerations by State in the US



Map of the United States



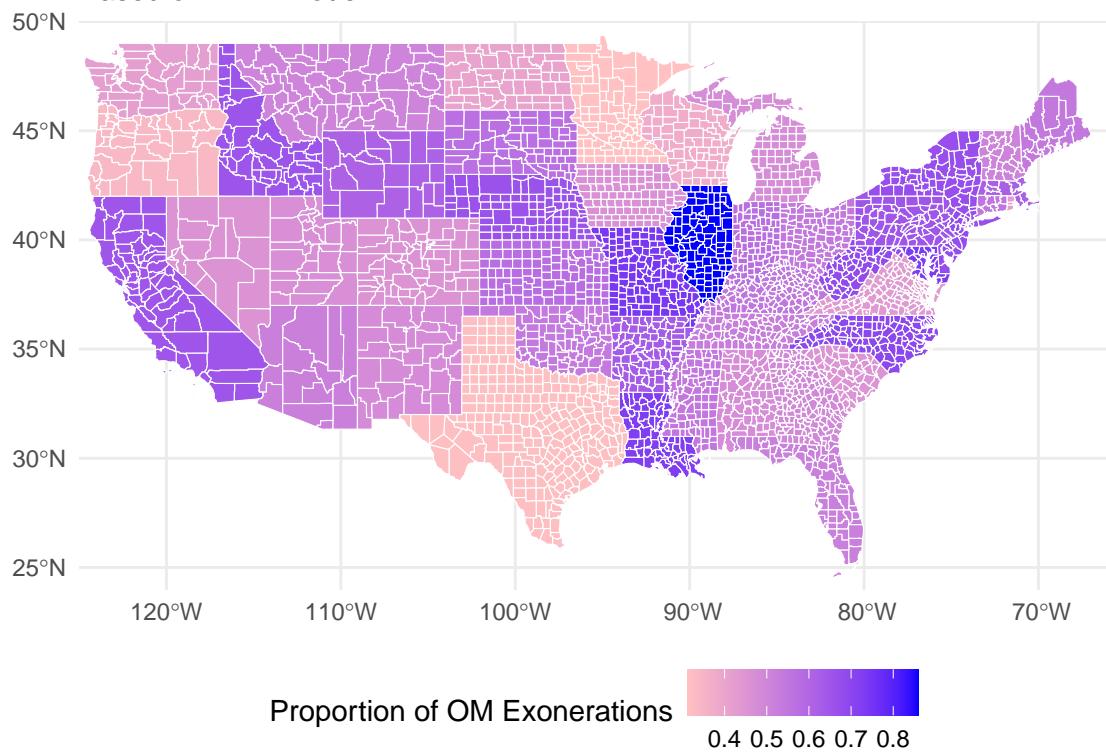
Proportion of OM Exonerations by State in the US



```
## Warning in .recacheSubclasses(def@class, def, env): undefined subclass
## "ndiMatrix" of class "replValueSp"; definition not updated
```

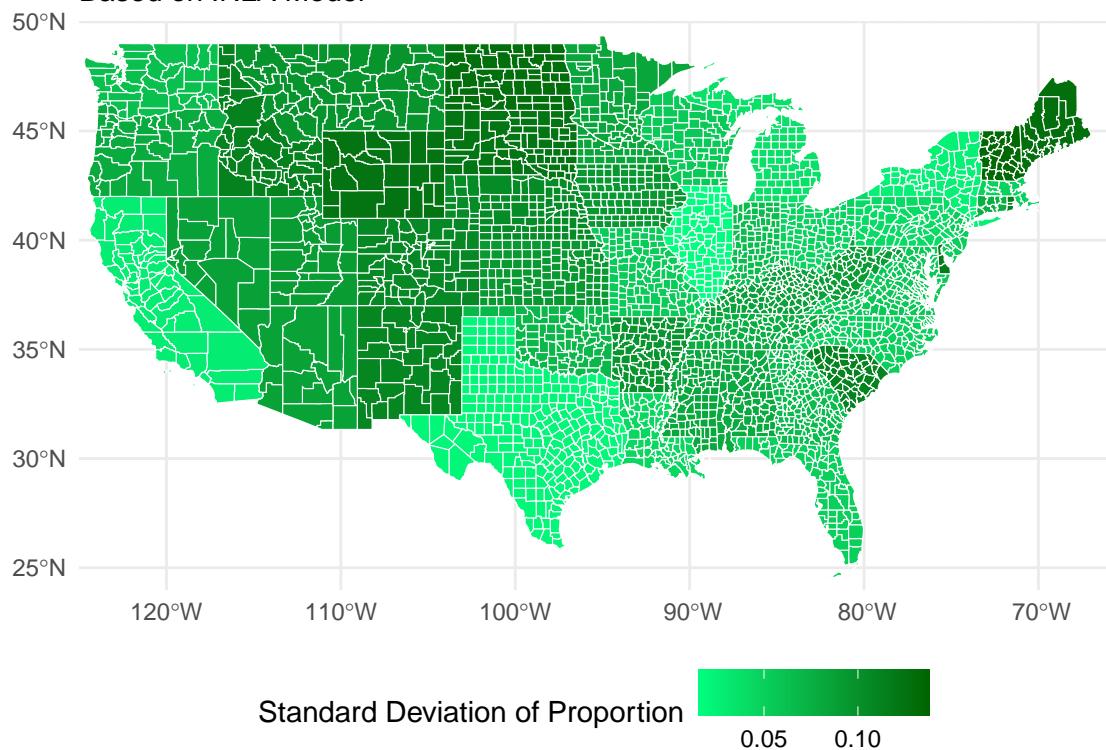
## Proportion of OM Exonerations by State in the US

Based on INLA Model



## Standard Deviation of OM Exonerations Proportion by State in the US

Based on INLA Model



## Code Appendix

```
knitr::opts_chunk$set(echo = TRUE)

library(tidyverse)
library(dplyr)
library(knitr)
library(sf)
library(ggplot2)
library(INLA)

inn_pro <- read_csv("UMIPdata555.csv")

# USA filtered data
us_cases <- inn_pro %>%
  select(State, County, OM, Exonerated) %>%
  mutate(OM = ifelse(OM == "OM", "OM", "NoM"),
        Exonerated = as.numeric(format(as.Date(Exonerated, format="%m/%d/%Y"), "%Y")))

us_cases <- us_cases %>%
  mutate(OM = ifelse(is.na(OM), "NoM", OM))

exonerated_summary_by_state <- us_cases %>%
  group_by(State, OM) %>%
  summarise(Total_Exonerated = n(), .groups = 'drop')

# Pivot the data to compare "OM" vs "NoM" within each state
exonerated_pivot_by_state <- exponentiated_summary_by_state %>%
  pivot_wider(names_from = OM, values_from = Total_Exonerated, values_fill = list(Total_Exonerated = 0))

# Geospatial for USA states
us_states_geop <- st_read("usa.gpkg_2")

# Join spatial with data
geop_with_exonerated_states <- us_states_geop %>%
  left_join(exonerated_pivot_by_state, by = c("adm1_name" = "State"))

glimpse(exonerated_summary_by_state)
exonerated_summary_by_state

# Calculate the proportion of "OM" exonerations by state
geop_with_exonerated_states <- geop_with_exonerated_states %>%
  mutate(OM_Rate = OM / (OM + NoM)) # Calculate the proportion of "OM"

# Visualize the proportion of "OM" exonerations by state on a map
ggplot(data = geop_with_exonerated_states) +
  geom_sf(aes(fill = OM_Rate), color = NA) +
  scale_fill_gradient(low = "white", high = "blue", na.value = "grey", name = "Proportion of OM Exonerations")
```

```

theme_minimal() +
  labs(title = "Proportion of OM Exonerations by State in the US")

ggplot(data = us_states_geop) +
  geom_sf() + # No need to specify fill or color if the defaults are acceptable
  coord_sf(xlim = c(-125, -66), ylim = c(24, 50), expand = FALSE) + # Adjust these limits as needed
  labs(title = "Map of the United States") +
  theme_minimal()

ggplot(data = geop_with_exonerated_states) +
  geom_sf(aes(fill = OM_Rate), color = NA) + # Fill states based on 'OM_Rate'
  scale_fill_gradient(low = "rosybrown1", high = "blue", na.value = "grey", name = "Proportion of OM Exonerations by State in the US")
  coord_sf(xlim = c(-125, -66), ylim = c(24, 50), expand = FALSE) + # Focus map on the mainland U.S.
  labs(title = "Proportion of OM Exonerations by State in the US") +
  theme_bw()

#####
### Posterior Means ###
#####

library(tidyverse)
library(INLA)
library(sf)
library(ggplot2)

# Assuming us_cases and us_states_geop are already loaded and prepared

# Aggregate exoneration data by state
exonerations_aggregated <- us_cases %>%
  group_by(State) %>%
  summarise(OM_Count = sum(OM == "OM", na.rm = TRUE),
            Total_Count = n(),
            .groups = 'drop') %>%
  mutate(Proportion_OM = OM_Count / Total_Count)

# Running the INLA model
formula <- OM_Count ~ 1 + f(State, model = "iid")
result <- inla(formula,
                family = "binomial",
                data = exonerations_aggregated,
                Ntrials = exonerations_aggregated$Total_Count,
                control.compute = list(dic = TRUE, waic = TRUE),
                verbose = TRUE)

# State ID to Name Mapping
state_id_name_mapping <- data.frame(
  State_ID = 1:84,
  Name = c("Alabama", "Alaska", "Arizona", "Arkansas", "California",
          "Colorado", "Connecticut", "Delaware", "District of Columbia",
          "Fed-AL", "Fed-AZ", "Fed-CA", "Fed-CT", "Fed-DC", "Fed-DE",
          "Fed-FL", "Fed-IL", "Fed-KY", "Fed-LA", "Fed-MA", "Fed-MD",
          "Fed-MI", "Fed-MN", "Fed-MO", "Fed-MT", "Fed-Military", "Fed-ND",

```

```

    "Fed-NJ", "Fed-NM", "Fed-NV", "Fed-NY", "Fed-OH", "Fed-OK",
    "Fed-PA", "Fed-SD", "Fed-TN", "Fed-TX", "Fed-VA", "Fed-WA",
    "Fed-WI", "Florida", "Georgia", "Guam", "Hawaii", "Idaho",
    "Illinois", "Indiana", "Iowa", "Kansas", "Kentucky", "Louisiana",
    "Maine", "Maryland", "Massachusetts", "Michigan", "Minnesota",
    "Mississippi", "Missouri", "Montana", "Nebraska", "Nevada",
    "New Hampshire", "New Jersey", "New Mexico", "New York",
    "North Carolina", "North Dakota", "Ohio", "Oklahoma", "Oregon",
    "Pennsylvania", "Puerto Rico", "Rhode Island", "South Carolina",
    "South Dakota", "Tennessee", "Texas", "Utah", "Vermont",
    "Virginia", "Washington", "West Virginia", "Wisconsin", "Wyoming")
)

# Assuming state_id_name_mapping has been correctly set up as shown previously

# Extracting posterior means directly from fitted values
# Assuming the order of fitted.Predictor.xx corresponds directly to the order in state_id_name_mapping
posterior_means <- result$summary.fitted.values$mean
posterior_sds <- result$summary.fitted.values$sd

# Create a mapping from Predictor IDs to State Names
predictor_to_state <- state_id_name_mapping>Name # Ensure this is correctly ordered

# Create a data frame for mapping
posterior_df <- data.frame(State = predictor_to_state,
                           PosteriorMean = posterior_means,
                           PosteriorSD = posterior_sds)

# Merge with geospatial data
map_data <- merge(us_states_geop, posterior_df, by.x = "adm1_name", by.y = "State", all.x = TRUE)

# Visualization with ggplot2
ggplot(data = map_data) +
  geom_sf(aes(fill = PosteriorMean), color = "white") +
  scale_fill_gradient(low = "rosybrown1", high = "blue", na.value = "grey", name = "Proportion of OM Exonerations by State in the US", subtitle = "Based on INLA Model") +
  theme_minimal() +
  theme(legend.position = "bottom") +
  coord_sf(xlim = c(-125, -66), ylim = c(24, 50), expand = FALSE)

#####
### Posterior SD #####
#####

ggplot(data = map_data) +
  geom_sf(aes(fill = PosteriorSD), color = "white") +
  scale_fill_gradient(low = "springgreen", high = "darkgreen", name = "Standard Deviation of Proportion of OM Exonerations by State in the US", subtitle = "Based on INLA Model") +
  theme_minimal() +
  theme(legend.position = "bottom") +
  coord_sf(xlim = c(-125, -66), ylim = c(24, 50), expand = FALSE)

```