

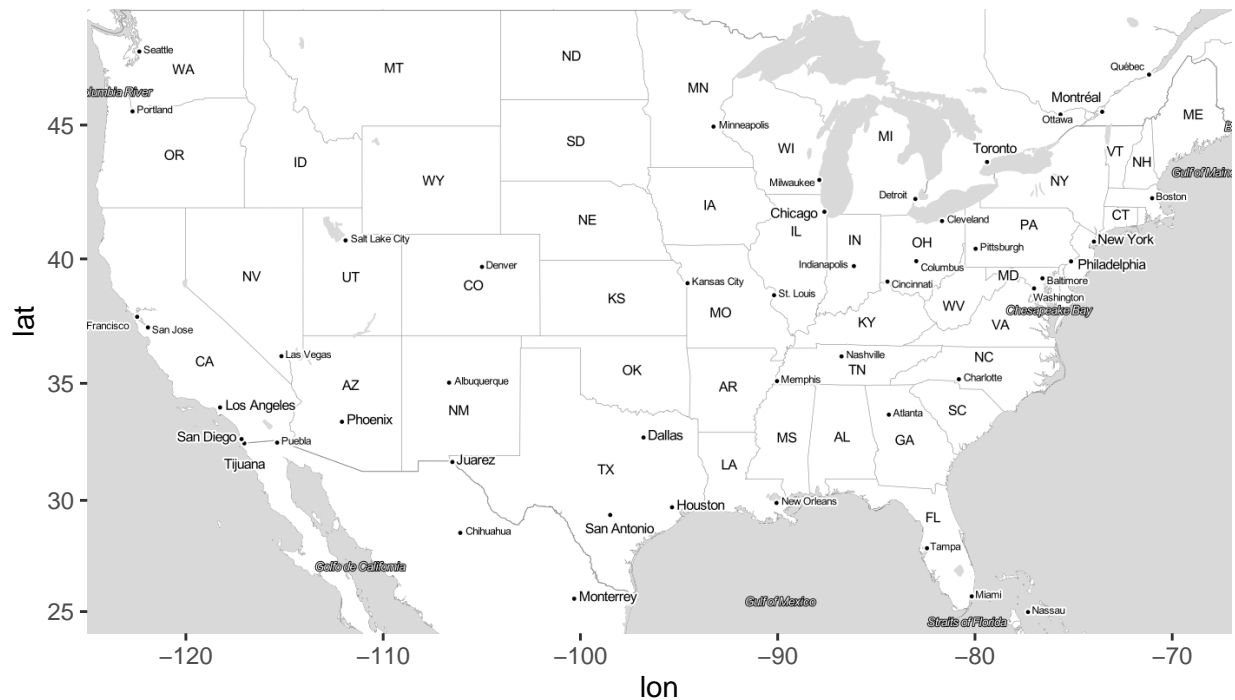
Visualizing Geographic Data

2023-06-16

```
US <- c(left = -125, bottom = 24, right = -67, top = 49)
```

```
map <- get_stamenmap(US, zoom = 5, maptype = "toner-lite")
```

```
ggmap(map)
```



Types of Spatial Data

1. Point Pattern Data
2. Point-Referenced Data
3. Areal Data

```
hospitals <- read_csv("https://shorturl.at/hiLR5", na = c("", "NA", "-999"))
```

```
hospitals <- hospitals %>% filter(STATUS == "OPEN") %>% select(-c(X, Y, OBJECTID, ID, ZIP4, TELEPHONE))
```

```
head(hospitals, 2)
```

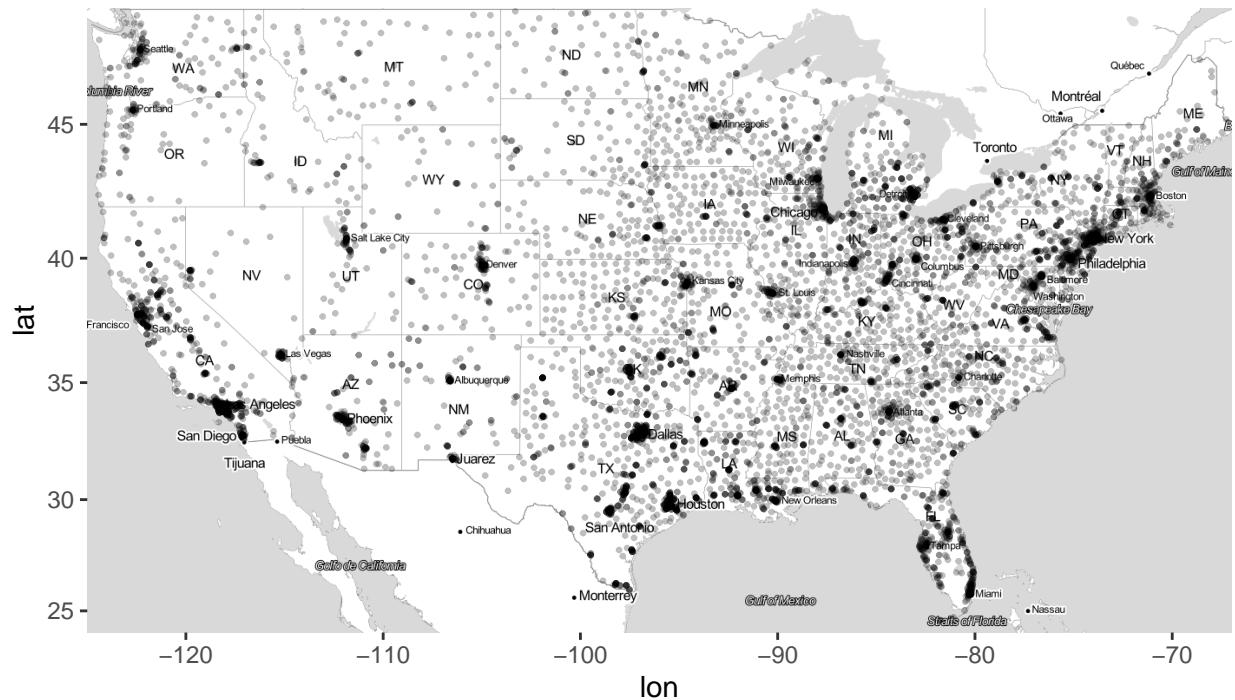
```
## # A tibble: 2 x 19
```

##	NAME	ADDRESS	CITY	STATE	ZIP	TYPE	STATUS	POPULATION	COUNTY	COUNTYFIPS
##	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<chr>	<dbl>	<chr>	<chr>
## 1	ANDALUSIA~	849 SO~	ANDA~	AL	36420	GENE~	OPEN	88	COVIN~	01039

```
## 2 ATHENS LI~ 700 WE~ ATHE~ AL 35611 GENE~ OPEN 71 LINES~ 01083
## # i 9 more variables: COUNTRY <chr>, LATITUDE <dbl>, LONGITUDE <dbl>,
## # STATE_ID <chr>, ST_FIPS <chr>, OWNER <chr>, BEDS <dbl>, TRAUMA <chr>,
## # HELIPAD <chr>
```

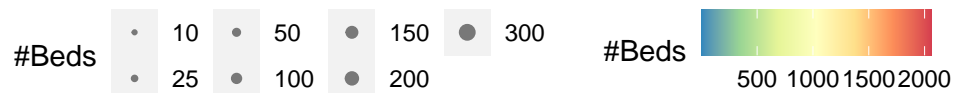
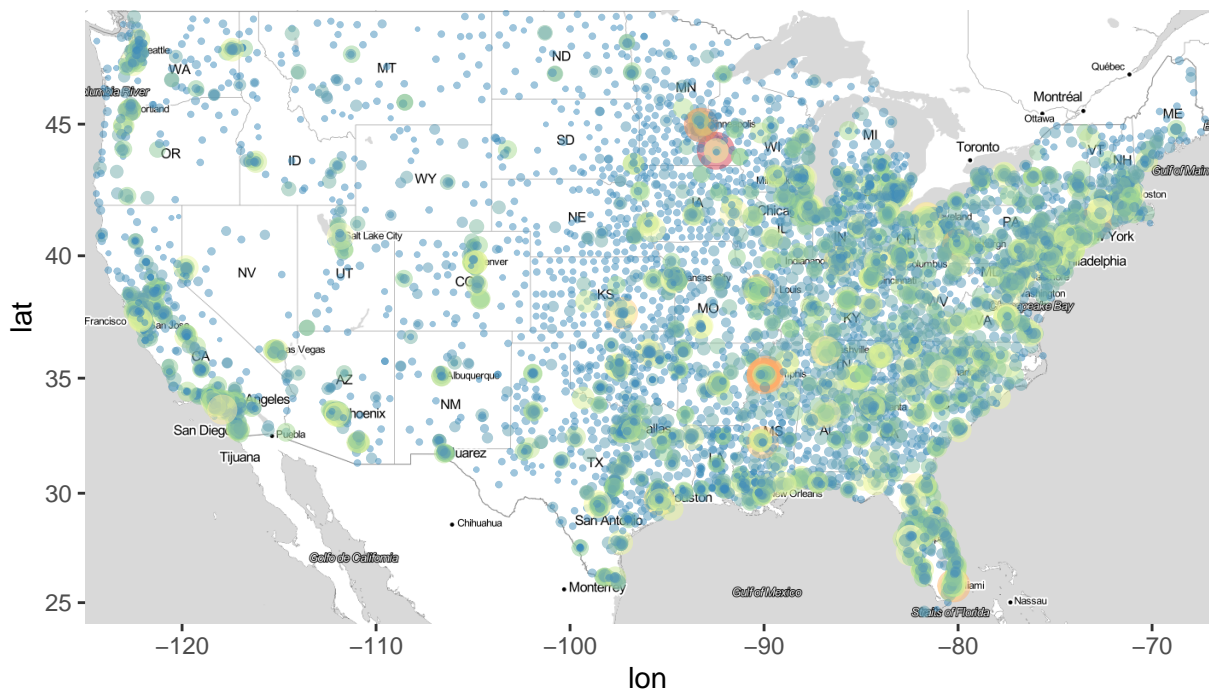
Point-Pattern Data on a Map

```
ggmap(map) +
  geom_point(data = hospitals, aes(x = LONGITUDE, y = LATITUDE), alpha = 0.25, size = 0.5)
```



Point-Referenced Data on a Map

```
ggmap(map) +
  geom_point(data = hospitals, aes(x = LONGITUDE, y = LATITUDE, size = BEDS, color = BEDS), alpha = .5) +
  scale_size_area(breaks = c(1, 10, 25, 50, 100, 150, 200, 300),
    labels = c(1, 10, 25, 50, 100, 150, 200, 300), name = "#Beds") +
  scale_color_distiller(palette = "Spectral") +
  labs(color = "#Beds") +
  theme(legend.position = "bottom")
```



Areal Data on a Map

```
state_hospitals <- hospitals %>%
  filter(!is.na(BEDS), !STATE %in% c("AS", "GU", "MP", "PW", "PR", "VI")) %>%
  group_by(STATE) %>%
  summarise(total_beds = sum(BEDS)) %>%
  mutate(state = tolower(abbr2state(STATE)))
```

```
head(state_hospitals)
```

```
## # A tibble: 6 x 3
##   STATE total_beds state
##   <chr>      <dbl> <chr>
## 1 AK          1826 alaska
## 2 AL          18903 alabama
## 3 AR          13181 arkansas
## 4 AZ          18555 arizona
## 5 CA          90324 california
## 6 CO          14684 colorado
```

```
state_borders <- map_data("state")
```

```
head(state_borders)
```

```
##       long      lat group order  region subregion
## 1 -87.46201 30.38968     1     1 alabama    <NA>
## 2 -87.48493 30.37249     1     2 alabama    <NA>
## 3 -87.52503 30.37249     1     3 alabama    <NA>
```

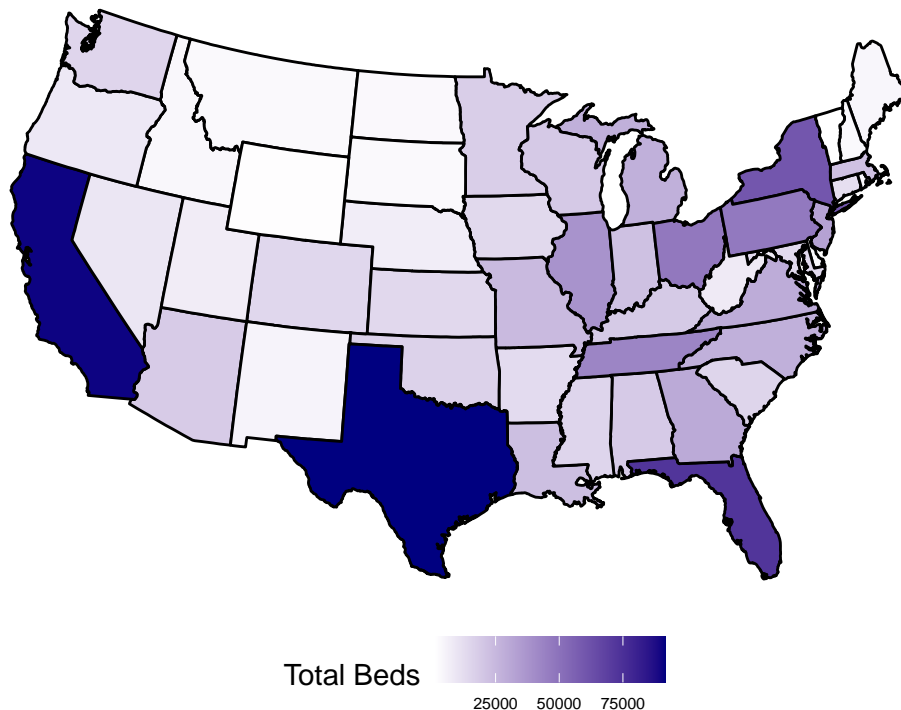
```
## 4 -87.53076 30.33239 1 4 alabama <NA>
## 5 -87.57087 30.32665 1 5 alabama <NA>
## 6 -87.58806 30.32665 1 6 alabama <NA>
```

```
state_plot_data <- state_borders %>%
  left_join(state_hospitals, by = c("region" = "state"))
```

```
head(state_plot_data)
```

```
##      long      lat group order region subregion STATE total_beds
## 1 -87.46201 30.38968 1 1 alabama <NA> AL 18903
## 2 -87.48493 30.37249 1 2 alabama <NA> AL 18903
## 3 -87.52503 30.37249 1 3 alabama <NA> AL 18903
## 4 -87.53076 30.33239 1 4 alabama <NA> AL 18903
## 5 -87.57087 30.32665 1 5 alabama <NA> AL 18903
## 6 -87.58806 30.32665 1 6 alabama <NA> AL 18903
```

```
state_plot_data %>% ggplot() +
  geom_polygon(aes(x = long, y = lat, group = group, fill = total_beds), color = "black") +
  scale_fill_gradient(low = "white", high = "navy") +
  theme_void() +
  coord_map("polyconic") +
  labs(fill = "Total Beds") +
  theme(legend.position = "bottom", legend.text = element_text(size = 6))
```



```
state_pop <- tibble(state_stats) %>%
  select(abbr, pop2010)
```

```
state_hospitals <- left_join(state_hospitals, state_pop,
  mutate(bed_per_cap = total_beds / pop2010)
```

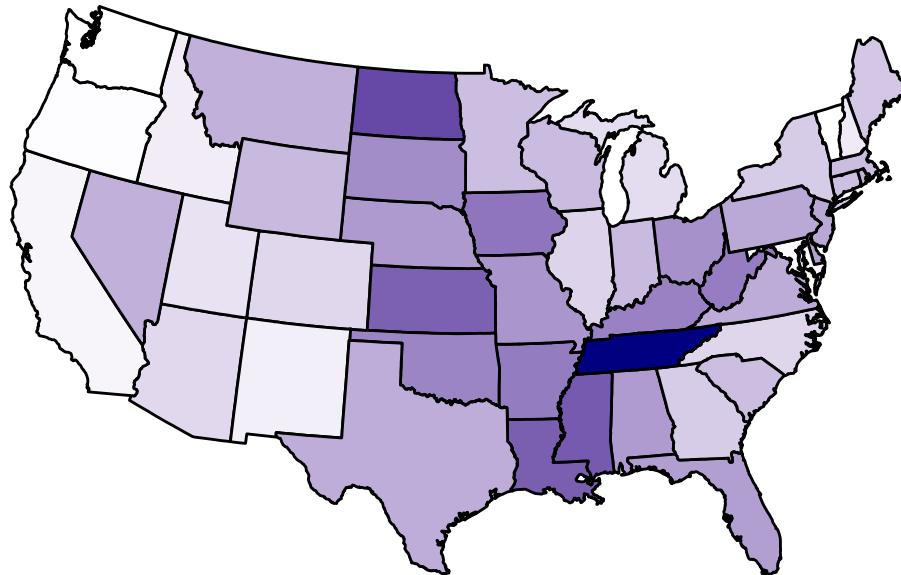
```
by = c("STATE" =
```

```
head(state_hospitals)
```

```
## # A tibble: 6 x 5
##   STATE total_beds state      pop2010 bed_per_cap
##   <chr>      <dbl> <chr>      <dbl>      <dbl>
## 1 AK          1826 alaska      710231    0.00257
## 2 AL          18903 alabama     4779736    0.00395
## 3 AR          13181 arkansas   2915918    0.00452
## 4 AZ          18555 arizona    6392017    0.00290
## 5 CA          90324 california 37253956    0.00242
## 6 CO          14684 colorado   5029196    0.00292
```

```
per_capita_plot_data <- state_borders %>%
  left_join(state_hospitals, by = c("region" = "state"))
```

```
per_capita_plot_data %>% ggplot() +
  geom_polygon(aes(x = long, y = lat, group = group, fill = bed_per_cap), color = "black") +
  scale_fill_gradient(low = "white", high = "navy") +
  theme_void() +
  coord_map("polyconic") +
  labs(fill = "Beds / Population") +
  theme(legend.position = "bottom", legend.text = element_text(size = 6))
```



Beds / Population

0.003 0.004 0.005 0.006