

Looking at covid-19

First we have to fetch the data. The source used here is <https://covidtracking.com>. The provide an API for fetching data by state. In the following data chunk, we end up with a list of lists. The number of measurements is shown along with the structure of a measurement.

```
library(httr)
req <- GET("https://covidtracking.com/api/v1/states/daily.json")

data <- content(req, as = "parsed")
length(data)

## [1] 11130
str(data[[1]])

## List of 54
## $ date                  : int 20200918
## $ state                 : chr "AK"
## $ positive              : int 7587
## $ negative              : int 410706
## $ pending               : NULL
## $ totalTestResults       : int 418293
## $ hospitalizedCurrently : int 36
## $ hospitalizedCumulative: NULL
## $ inIcuCurrently        : NULL
## $ inIcuCumulative       : NULL
## $ onVentilatorCurrently : int 13
## $ onVentilatorCumulative: NULL
## $ recovered              : int 2422
## $ dataQualityGrade       : chr "A"
## $ lastUpdateEt           : chr "9/18/2020 03:59"
## $ dateModified           : chr "2020-09-18T03:59:00Z"
## $ checkTimeEt             : chr "09/17 23:59"
## $ death                  : int 45
## $ hospitalized           : NULL
## $ dateChecked            : chr "2020-09-18T03:59:00Z"
## $ totalTestsViral         : int 418293
## $ positiveTestsViral      : int 6865
## $ negativeTestsViral      : int 411148
## $ positiveCasesViral      : int 7587
## $ deathConfirmed          : int 45
## $ deathProbable           : NULL
## $ totalTestEncountersViral: NULL
## $ totalTestsPeopleViral    : NULL
## $ totalTestsAntibody       : NULL
## $ positiveTestsAntibody    : NULL
## $ negativeTestsAntibody    : NULL
## $ totalTestsPeopleAntibody : NULL
## $ positiveTestsPeopleAntibody: NULL
```

```

## $ negativeTestsPeopleAntibody: NULL
## $ totalTestsPeopleAntigen : NULL
## $ positiveTestsPeopleAntigen : NULL
## $ totalTestsAntigen : NULL
## $ positiveTestsAntigen : NULL
## $ fips : chr "02"
## $ positiveIncrease : int 116
## $ negativeIncrease : int 2314
## $ total : int 418293
## $ totalTestResultsSource : chr "posNeg"
## $ totalTestResultsIncrease : int 2430
## $ posNeg : int 418293
## $ deathIncrease : int 1
## $ hospitalizedIncrease : int 0
## $ hash : chr "cc5fc47f4be842f963af84b7fc1d10209b229c2b9"
## $ commercialScore : int 0
## $ negativeRegularScore : int 0
## $ negativeScore : int 0
## $ positiveScore : int 0
## $ score : int 0
## $ grade : chr ""

library(httr)
library(data.table)
info_req <- GET("https://covidtracking.com/api/v1/states/info.json")
info <- content(info_req, as = "parsed")
length(info)

## [1] 56
str(info[[1]])

## List of 14
## $ state : chr "AK"
## $ notes : chr "Alaska combines PCR and antigen tests in the to"
## $ covid19Site : chr "http://dhss.alaska.gov/dph/Epi/id/Pages/COVID-1"
## $ covid19SiteSecondary : chr "https://experience.arcgis.com/experience/ed1c87"
## $ covid19SiteTertiary : chr "https://alaska-dhss.maps.arcgis.com/apps/opsdash"
## $ twitter : chr "@Alaska_DHSS"
## $ covid19SiteOld : chr "http://dhss.alaska.gov/dph/Epi/id/Pages/COVID-1"
## $ covidTrackingProjectPreferredTotalTestUnits: chr "Specimens"
## $ covidTrackingProjectPreferredTotalTestField: chr "totalTestsViral"
## $ totalTestResultsField : chr "Total Tests (PCR)"
## $ name : chr "Alaska"
## $ fips : chr "02"
## $ pui : chr ""
## $ pum : logi FALSE

state_info <- rbindlist(as.list(info), fill=TRUE)

get_state_name <- function(abbr) {
  state_info[state_info$state == abbr]$name
}

```

```

library(data.table)
library(ggplot2)
dt <- rbindlist(data, fill=TRUE)

## Warning in rbindlist(data, fill = TRUE): Column 5 ['pending'] of item 1 is
## length 0. This (and 225109 others like it) has been filled with NA (NULL for
## list columns) to make each item uniform.

dt$date <- as.Date(as.character(dt$date), format = "%Y%m%d")
dt$dateChecked <- as.POSIXct(dt$dateChecked, "%Y-%m-%dT%H:%M:%S", tz="UTC")
dt$state <- as.factor(dt$state)
dt$fips <- as.factor(dt$fips)
dt <- dt[, -"hash"]

str(dt[1,])

## Classes 'data.table' and 'data.frame': 1 obs. of  53 variables:
## $ date                  : Date, format: "2020-09-18"
## $ state                 : Factor w/ 56 levels "AK","AL","AR",...: 1
## $ positive              : int 7587
## $ negative              : int 410706
## $ pending               : int NA
## $ totalTestResults      : int 418293
## $ hospitalizedCurrently : int 36
## $ hospitalizedCumulative: int NA
## $ inIcuCurrently        : int NA
## $ inIcuCumulative       : int NA
## $ onVentilatorCurrently : int 13
## $ onVentilatorCumulative: int NA
## $ recovered              : int 2422
## $ dataQualityGrade      : chr "A"
## $ lastUpdateEt           : chr "9/18/2020 03:59"
## $ dateModified           : chr "2020-09-18T03:59:00Z"
## $ checkTimeEt             : chr "09/17 23:59"
## $ death                 : int 45
## $ hospitalized           : int NA
## $ dateChecked            : POSIXct, format: "2020-09-18 03:59:00"
## $ totalTestsViral         : int 418293
## $ positiveTestsViral     : int 6865
## $ negativeTestsViral     : int 411148
## $ positiveCasesViral     : int 7587
## $ deathConfirmed          : int 45
## $ deathProbable           : int NA
## $ totalTestEncountersViral: num NA
## $ totalTestsPeopleViral   : int NA
## $ totalTestsAntibody      : int NA
## $ positiveTestsAntibody   : int NA
## $ negativeTestsAntibody   : int NA
## $ totalTestsPeopleAntibody: int NA
## $ positiveTestsPeopleAntibody: int NA
## $ negativeTestsPeopleAntibody: int NA
## $ totalTestsPeopleAntigen  : int NA
## $ positiveTestsPeopleAntigen: int NA
## $ totalTestsAntigen         : int NA

```

```

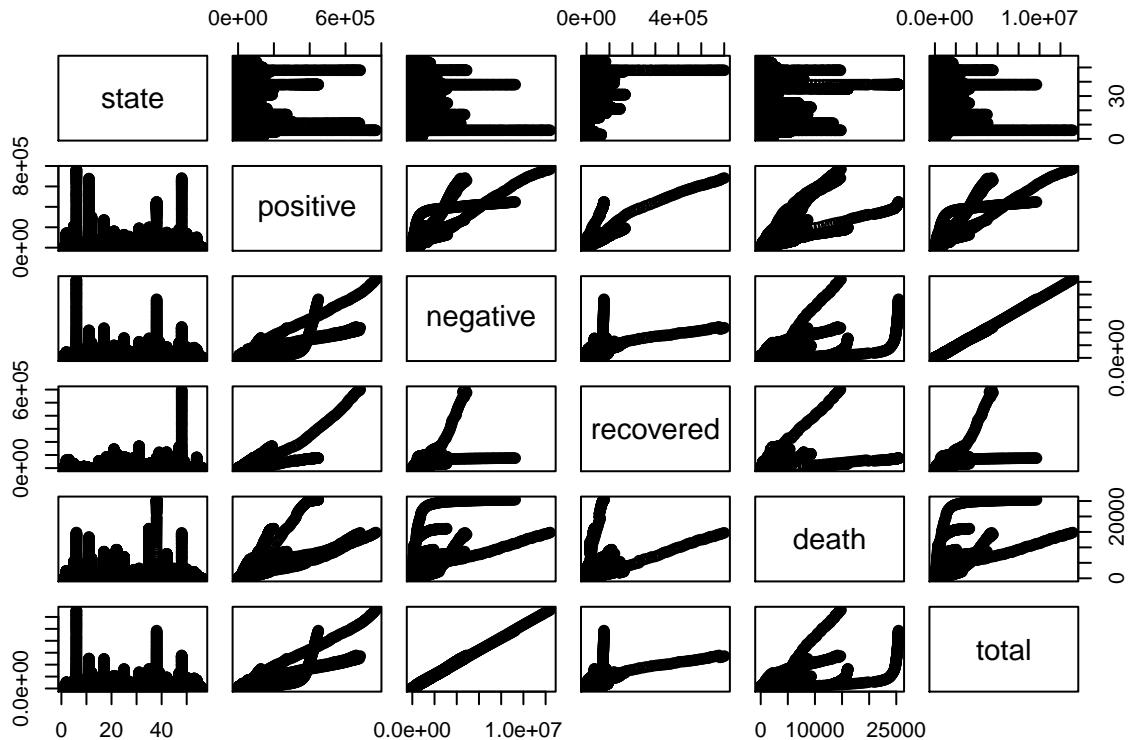
## $ positiveTestsAntigen      : int NA
## $ fips                      : Factor w/ 56 levels "01","02","04",...
## $ positiveIncrease           : int 116
## $ negativeIncrease          : int 2314
## $ total                      : int 418293
## $ totalTestResultsSource     : chr "posNeg"
## $ totalTestResultsIncrease   : int 2430
## $ posNeg                     : int 418293
## $ deathIncrease              : int 1
## $ hospitalizedIncrease       : int 0
## $ commercialScore            : int 0
## $ negativeRegularScore       : int 0
## $ negativeScore               : int 0
## $ positiveScore               : int 0
## $ score                       : int 0
## $ grade                        : chr ""
## - attr(*, ".internal.selfref")=<externalptr>

```

```

picked <- dt[, c("state", "positive", "negative", "recovered", "death", "total")]
pairs(picked)

```



```

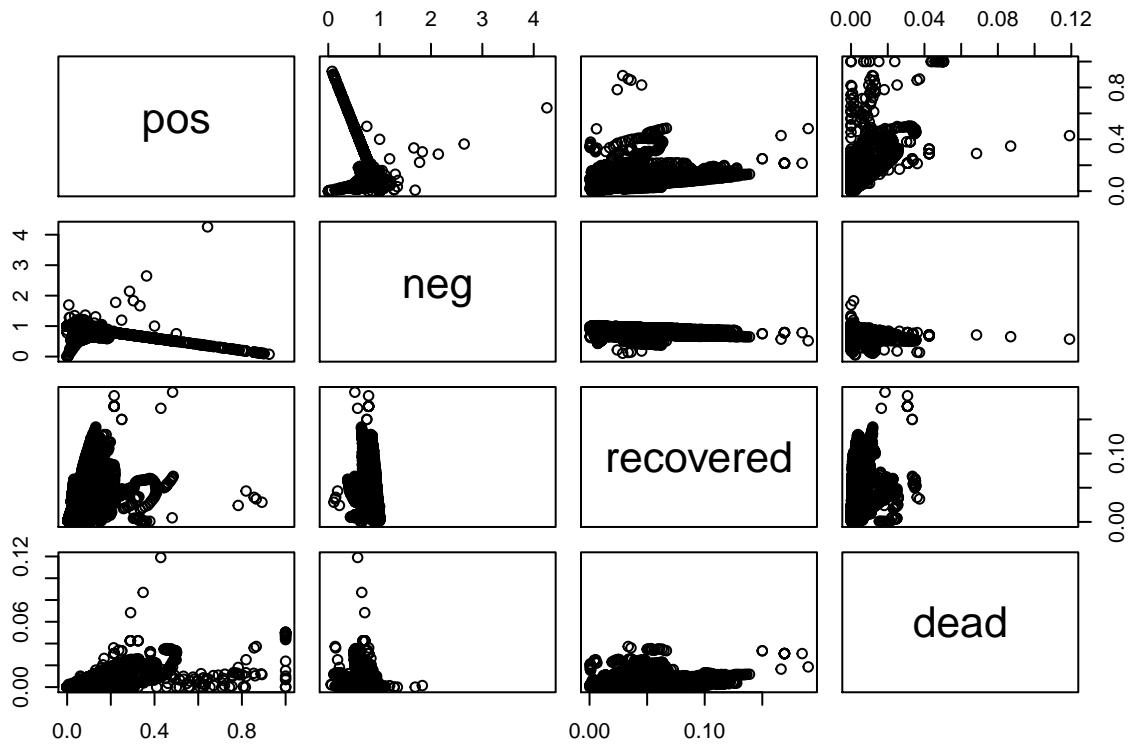
normalized <- cbind.data.frame(dt$positive/dt$totalTestResults, dt$negative/dt$totalTestResults, dt$reco
colnames(normalized) <- c("pos", "neg", "recovered", "dead")

```

```

pairs(normalized)

```



```

library(ggplot2)
library(cowplot)

plot_list <- list()

for(s in levels(dt$state)) {

  by_state <- dt[dt$state == s,]
  date_order <- order(by_state$date)

  by_state_ordered_by_date <- by_state[date_order,]
  # to find the earliest measurment, restrict by complete cases
  # the date of element 0.
  earliest_death_report <- na.omit(by_state_ordered_by_date[,c("date", "death")])[1,]
  earliest_death <- by_state_ordered_by_date[by_state_ordered_by_date$death > 0,c("date", "death")][1,]
  print(data.frame(state = s, earliest_report = earliest_death_report$date, earliest_death = earliest_death))

  setnafill(by_state_ordered_by_date,type="locf", cols=c("death"))
  setnafill(by_state_ordered_by_date,type="const", fill=0, cols=c("death"))

  integral_breaks <- function(values) {
    breaks <- unique(floor(pretty(seq(0, 1.1 * max(values) + 1))))
    return(breaks)
  }
  y_breaks <- integral_breaks(
    by_state_ordered_by_date$death
  )

  p <- ggplot(by_state_ordered_by_date, aes(x=date, y=death)) +
    geom_point(shape=1) +
  
```

```

    scale_y_continuous(breaks = y_breaks)

    # ggtitle(get_state_name(s))

plot_list[[s]] <- p

}

## state earliest_report earliest_death earliest_number
## 1 AK 2020-03-06 2020-03-25 1
## state earliest_report earliest_death earliest_number
## 1 AL 2020-03-15 2020-03-26 1
## state earliest_report earliest_death earliest_number
## 1 AR 2020-03-22 2020-03-25 2
## state earliest_report earliest_death earliest_number
## 1 AS 2020-03-18 <NA> NA
## state earliest_report earliest_death earliest_number
## 1 AZ 2020-03-13 2020-03-21 1
## state earliest_report earliest_death earliest_number
## 1 CA 2020-03-12 2020-03-12 4
## state earliest_report earliest_death earliest_number
## 1 CO 2020-03-14 2020-03-14 1
## state earliest_report earliest_death earliest_number
## 1 CT 2020-03-19 2020-03-19 1
## state earliest_report earliest_death earliest_number
## 1 DC 2020-03-19 2020-03-20 1
## state earliest_report earliest_death earliest_number
## 1 DE 2020-03-08 2020-03-24 1
## state earliest_report earliest_death earliest_number
## 1 FL 2020-03-11 2020-03-11 2
## state earliest_report earliest_death earliest_number
## 1 GA 2020-03-13 2020-03-13 1
## state earliest_report earliest_death earliest_number
## 1 GU 2020-03-22 2020-03-22 1
## state earliest_report earliest_death earliest_number
## 1 HI 2020-04-01 2020-04-01 1
## state earliest_report earliest_death earliest_number
## 1 IA 2020-03-25 2020-03-25 1
## state earliest_report earliest_death earliest_number
## 1 ID 2020-03-22 2020-03-27 3
## state earliest_report earliest_death earliest_number
## 1 IL 2020-03-17 2020-03-17 1
## state earliest_report earliest_death earliest_number
## 1 IN 2020-03-14 2020-03-16 1
## state earliest_report earliest_death earliest_number
## 1 KS 2020-03-14 2020-03-14 1
## state earliest_report earliest_death earliest_number
## 1 KY 2020-03-14 2020-03-14 1
## state earliest_report earliest_death earliest_number
## 1 LA 2020-03-15 2020-03-15 2
## state earliest_report earliest_death earliest_number
## 1 MA 2020-03-18 2020-03-18 2
## state earliest_report earliest_death earliest_number
## 1 MD 2020-03-16 2020-03-16 2

```

```

## state earliest_report earliest_death earliest_number
## 1 ME 2020-03-27 2020-03-27 1
## state earliest_report earliest_death earliest_number
## 1 MI 2020-03-17 2020-03-17 2
## state earliest_report earliest_death earliest_number
## 1 MN 2020-03-21 2020-03-21 1
## state earliest_report earliest_death earliest_number
## 1 MO 2020-03-14 2020-03-19 1
## state earliest_report earliest_death earliest_number
## 1 MP 2020-03-18 2020-04-02 1
## state earliest_report earliest_death earliest_number
## 1 MS 2020-03-20 2020-03-20 1
## state earliest_report earliest_death earliest_number
## 1 MT 2020-03-28 2020-03-28 1
## state earliest_report earliest_death earliest_number
## 1 NC 2020-03-16 2020-03-25 1
## state earliest_report earliest_death earliest_number
## 1 ND 2020-03-13 2020-03-28 1
## state earliest_report earliest_death earliest_number
## 1 NE 2020-03-19 2020-03-28 2
## state earliest_report earliest_death earliest_number
## 1 NH 2020-03-24 2020-03-24 1
## state earliest_report earliest_death earliest_number
## 1 NJ 2020-02-10 2020-03-11 1
## state earliest_report earliest_death earliest_number
## 1 NM 2020-03-25 2020-03-25 1
## state earliest_report earliest_death earliest_number
## 1 NV 2020-03-05 2020-03-15 1
## state earliest_report earliest_death earliest_number
## 1 NY 2020-03-15 2020-03-15 3
## state earliest_report earliest_death earliest_number
## 1 OH 2020-03-20 2020-03-20 1
## state earliest_report earliest_death earliest_number
## 1 OK 2020-03-19 2020-03-19 1
## state earliest_report earliest_death earliest_number
## 1 OR 2020-03-18 2020-03-18 3
## state earliest_report earliest_death earliest_number
## 1 PA 2020-03-18 2020-03-18 1
## state earliest_report earliest_death earliest_number
## 1 PR 2020-03-22 2020-03-22 1
## state earliest_report earliest_death earliest_number
## 1 RI 2020-03-29 2020-03-29 3
## state earliest_report earliest_death earliest_number
## 1 SC 2020-03-16 2020-03-16 1
## state earliest_report earliest_death earliest_number
## 1 SD 2020-03-18 2020-03-18 1
## state earliest_report earliest_death earliest_number
## 1 TN 2020-03-23 2020-03-23 2
## state earliest_report earliest_death earliest_number
## 1 TX 2020-03-17 2020-03-17 1
## state earliest_report earliest_death earliest_number
## 1 UT 2020-03-15 2020-03-22 1
## state earliest_report earliest_death earliest_number
## 1 VA 2020-03-15 2020-03-15 1

```

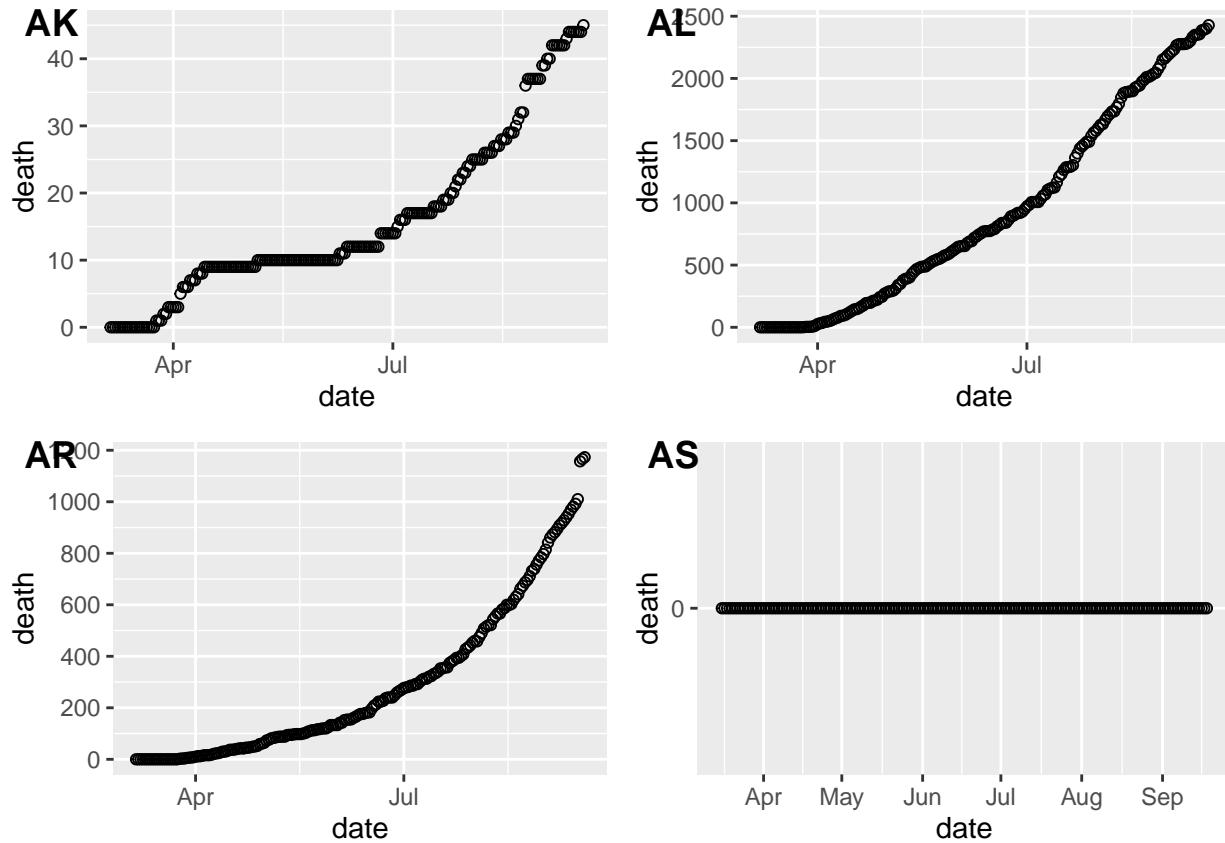
```

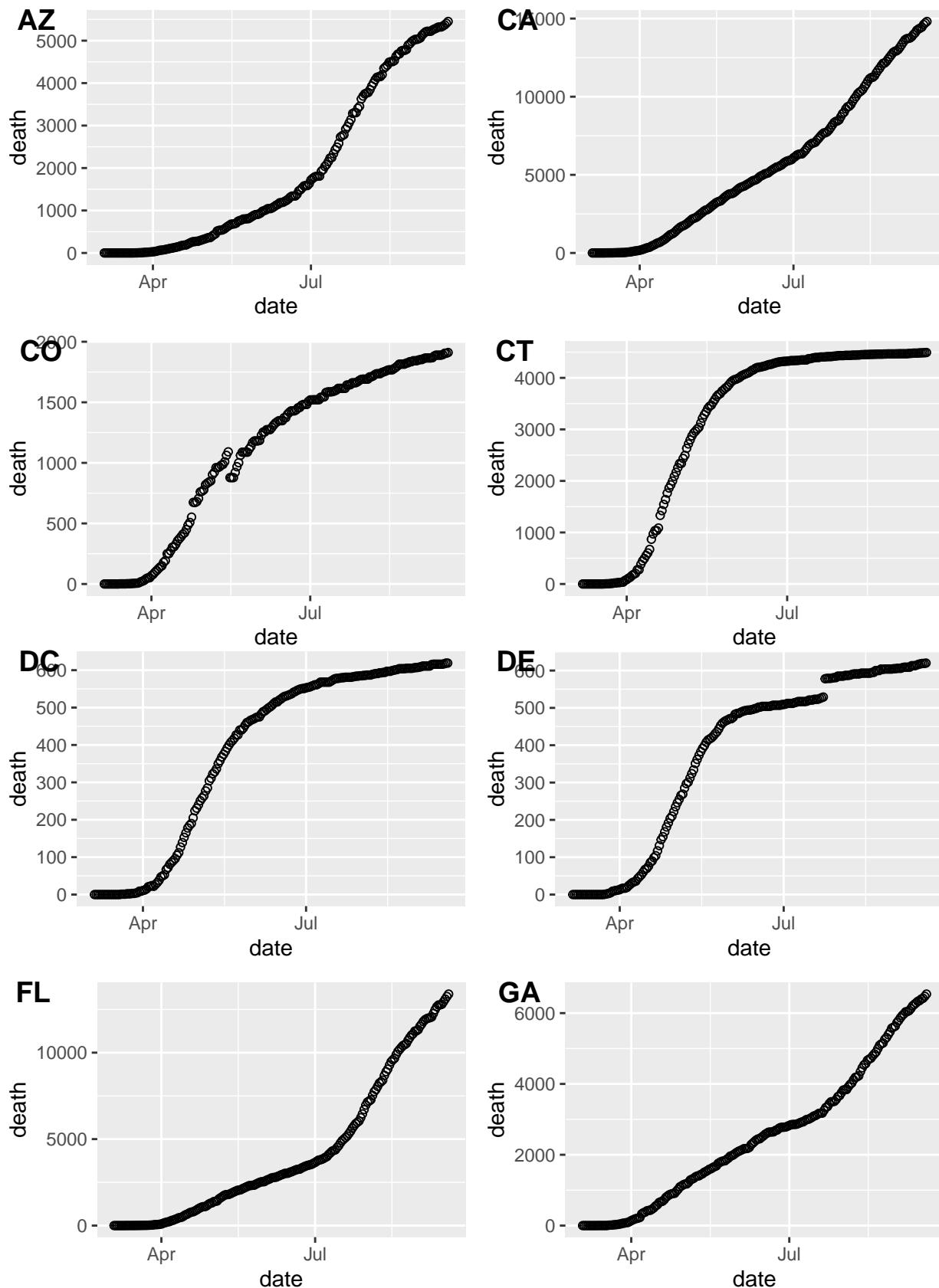
##   state earliest_report earliest_death earliest_number
## 1    VI      2020-04-05     2020-04-05           1
## 2    VT      2020-03-20     2020-03-20           2
## 3    WA      2020-02-26     2020-02-26           2
## 4    WI      2020-03-20     2020-03-20           3
## 5    WV      2020-03-15     2020-03-30           1
## 6    WY      2020-03-27     2020-04-13           1

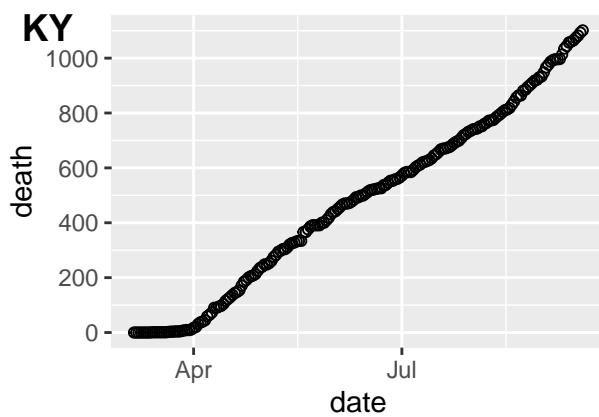
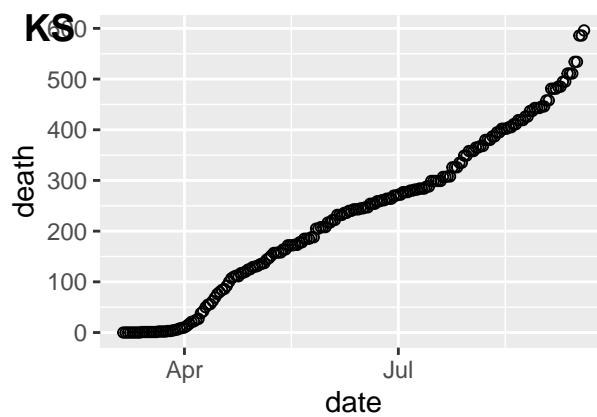
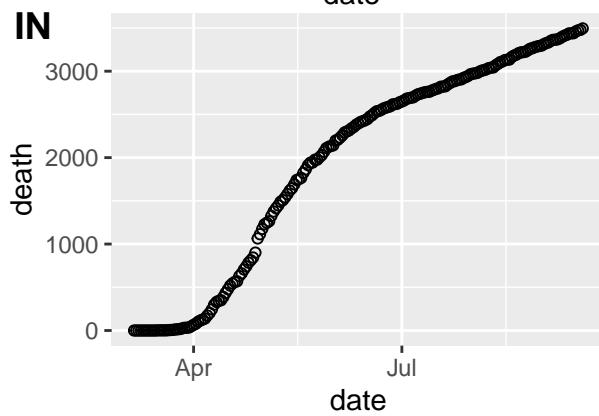
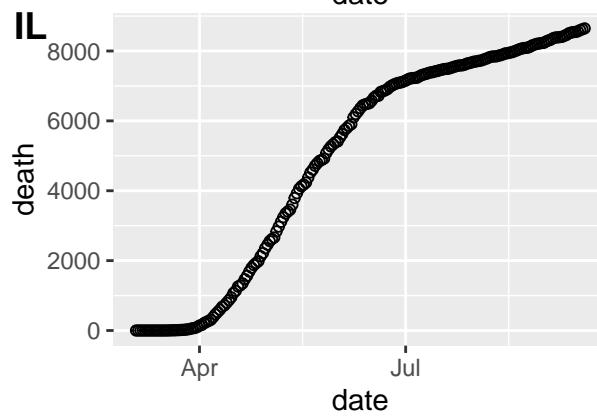
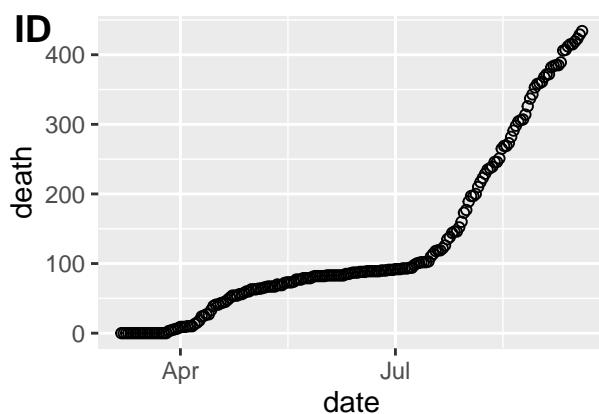
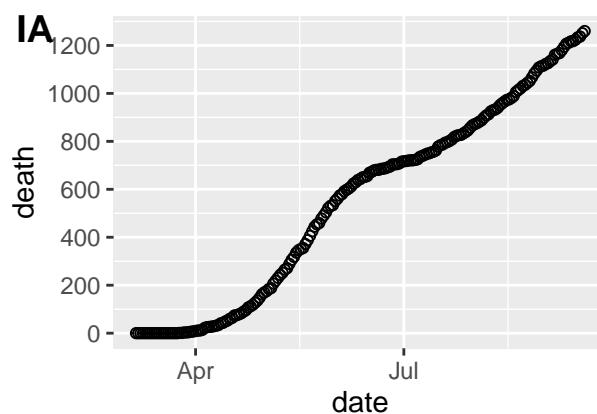
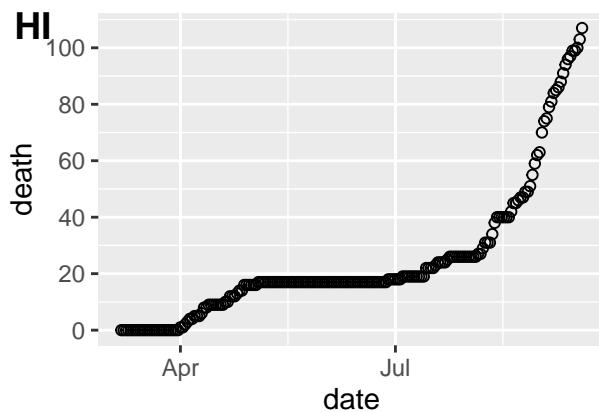
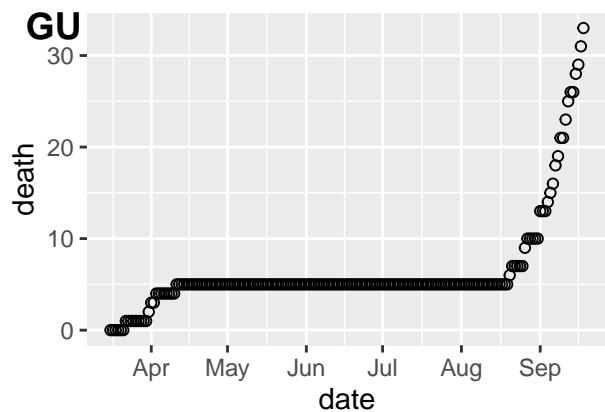
step = 4
for (i in seq(from = 1, to = length(plot_list), by = step)) {

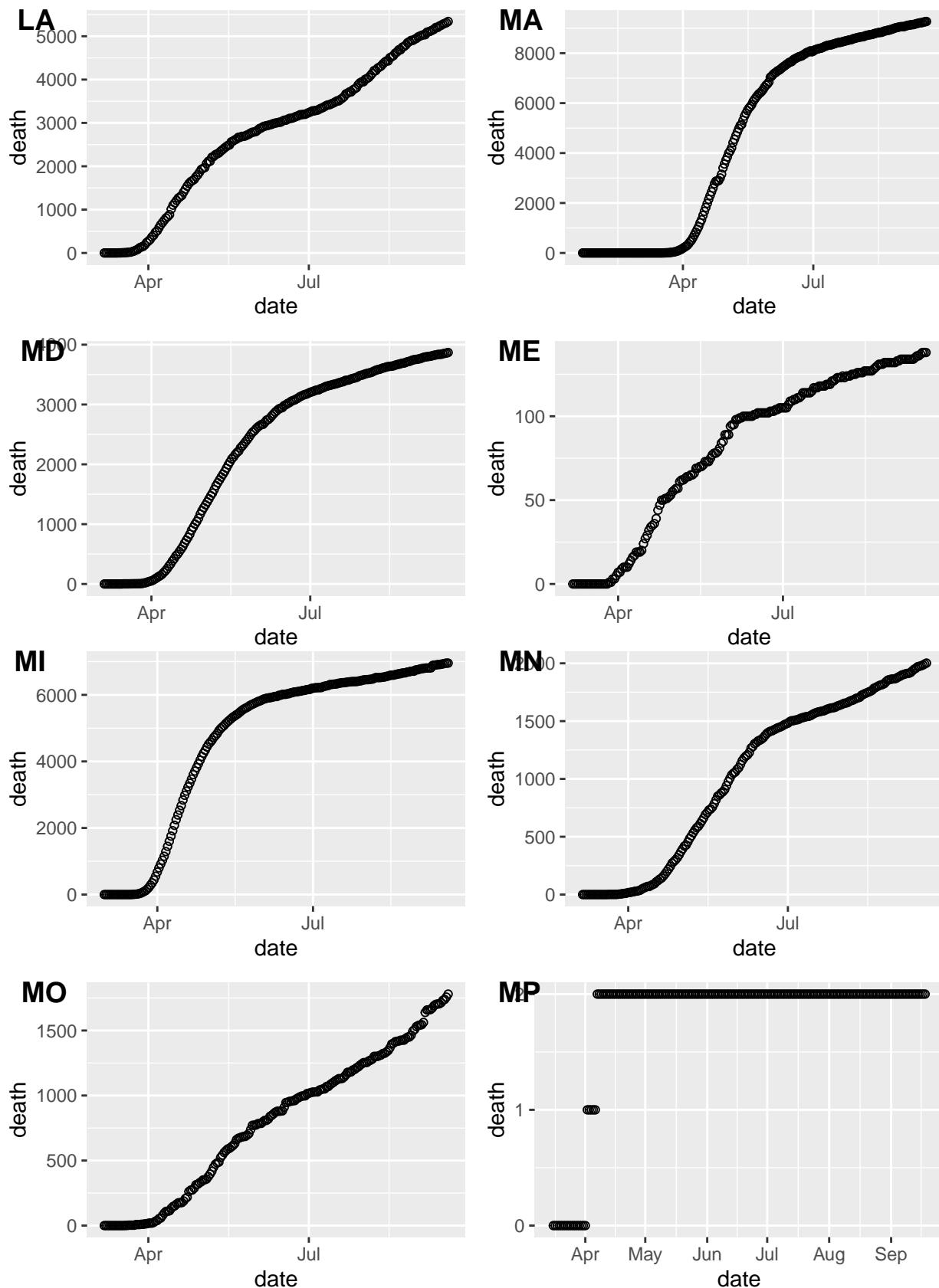
  group <- plot_list[i:(i+step-1)]
  #print(str(group))
  print(plot_grid(plotlist = group, ncol = 2, labels = names(group)))
}

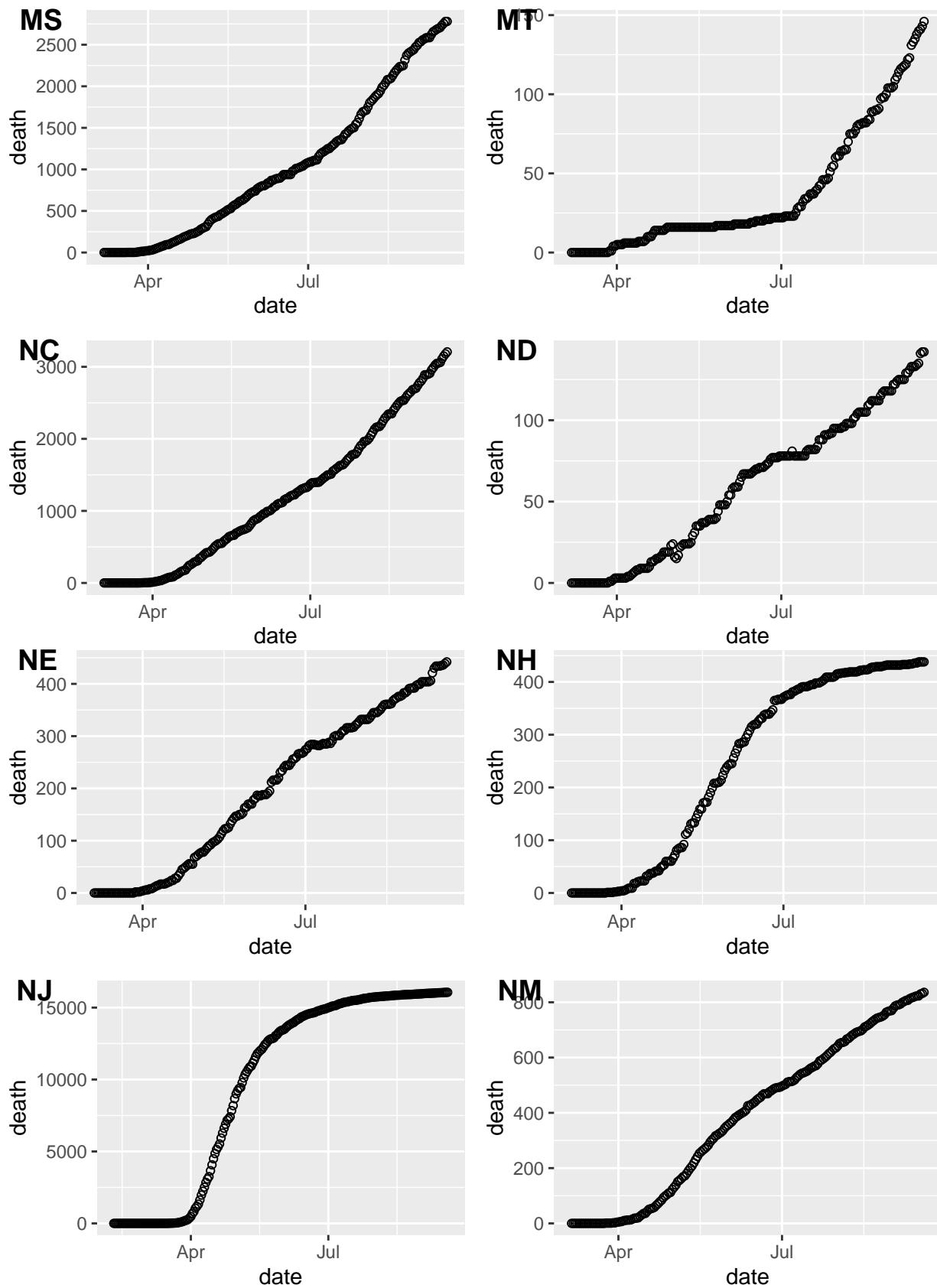
```

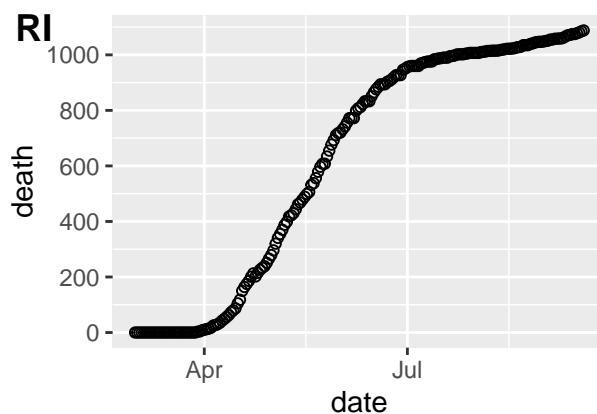
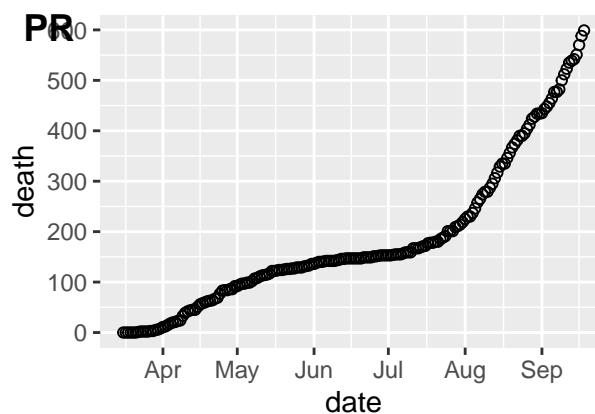
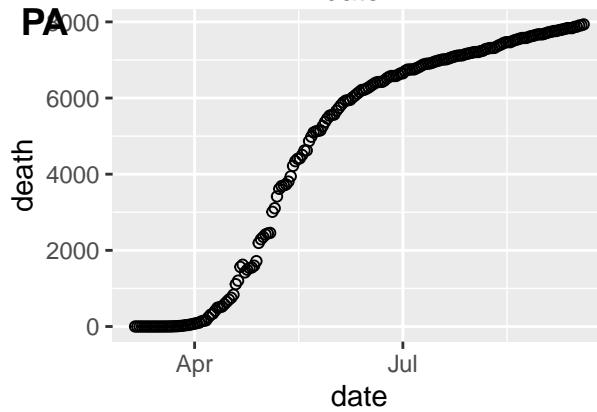
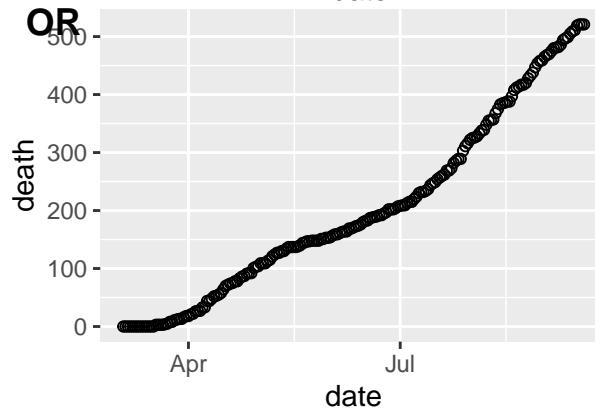
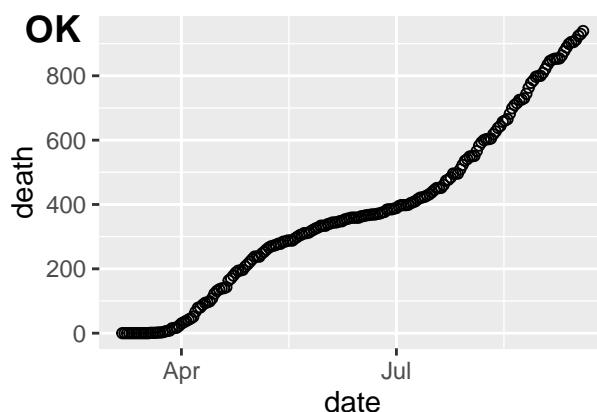
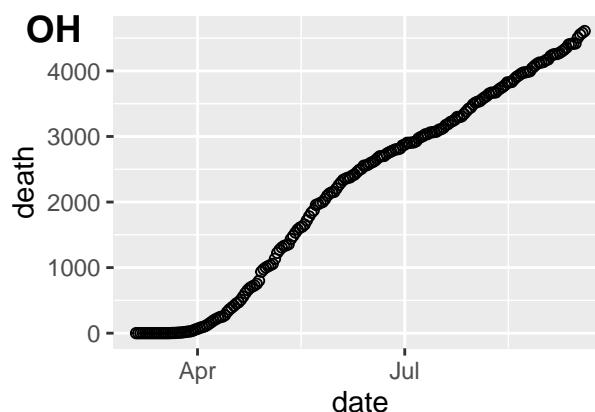
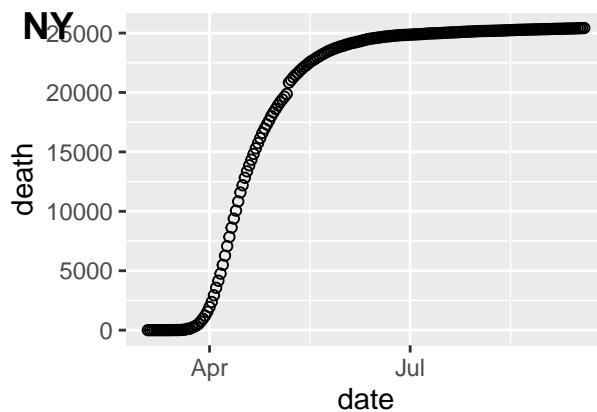
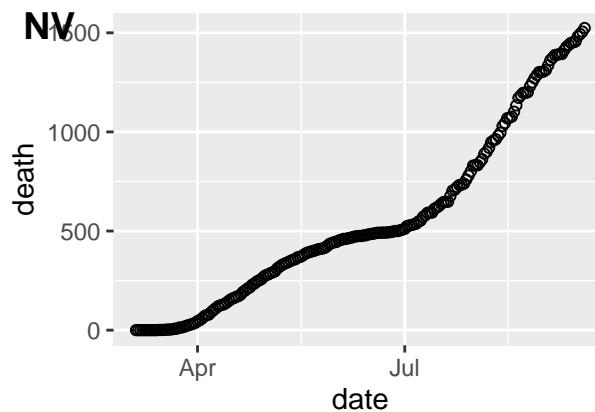


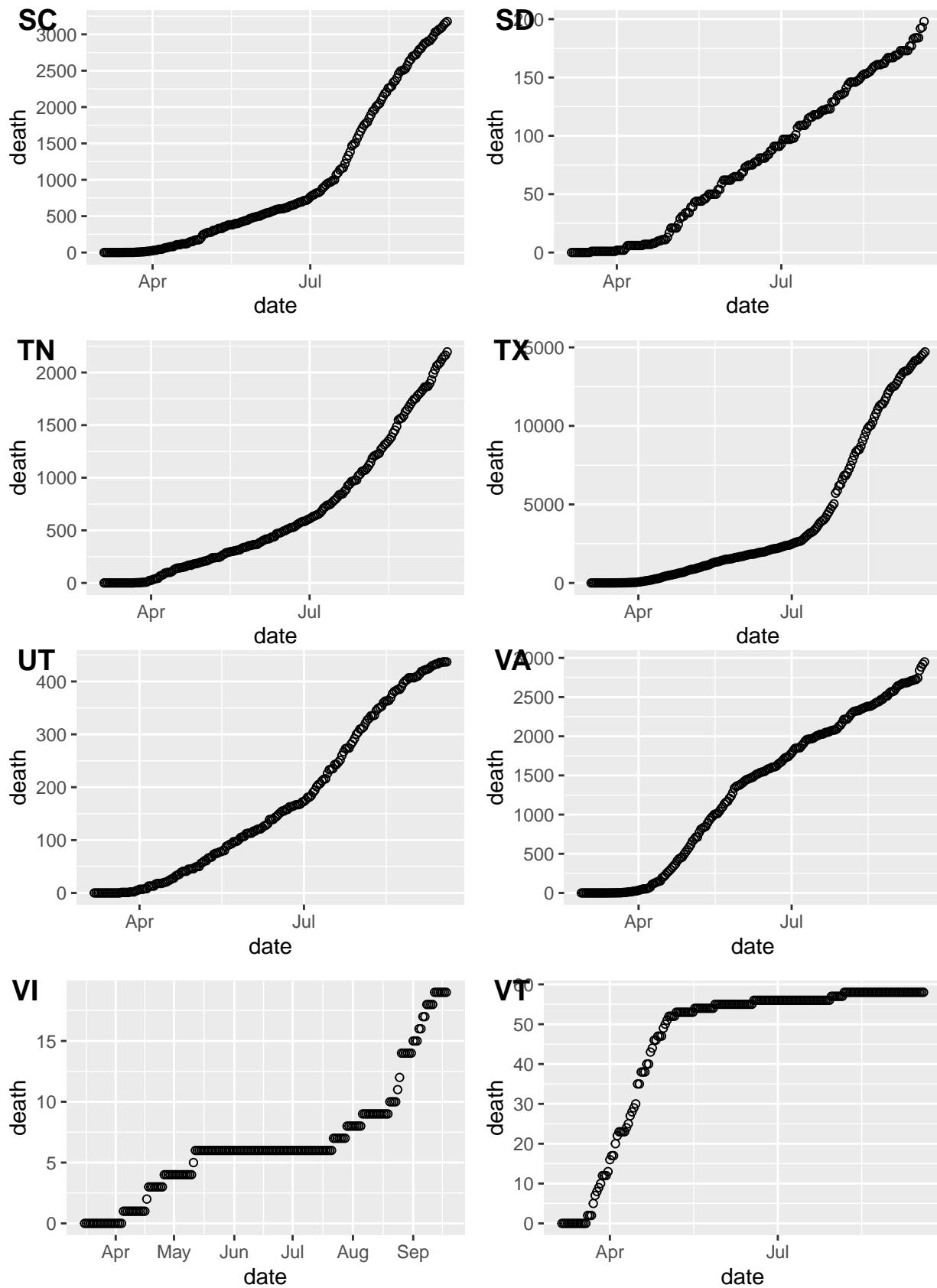


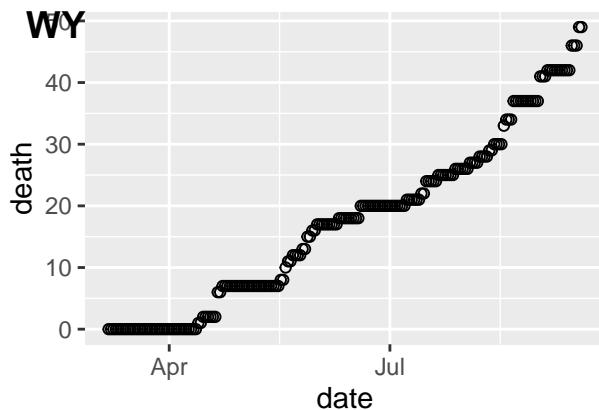
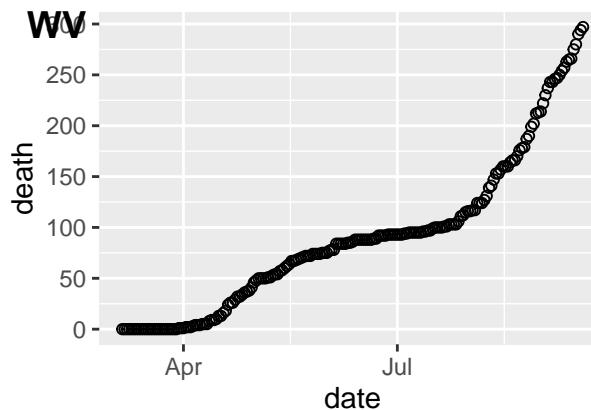
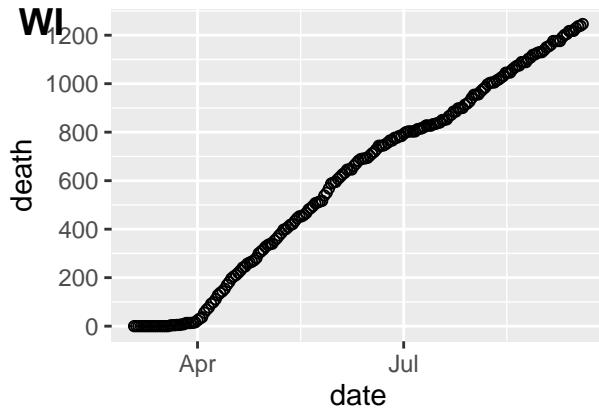
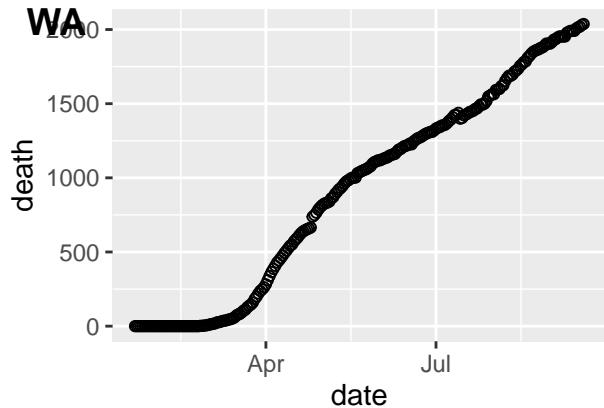












Now let's look at overall population stats

```
pop <- GET("https://api.census.gov/data/2019/pep/population?get=DATE_CODE,POP,NAME&for=STATE:*)  
popdata <- content(pop, as = "parsed")
```

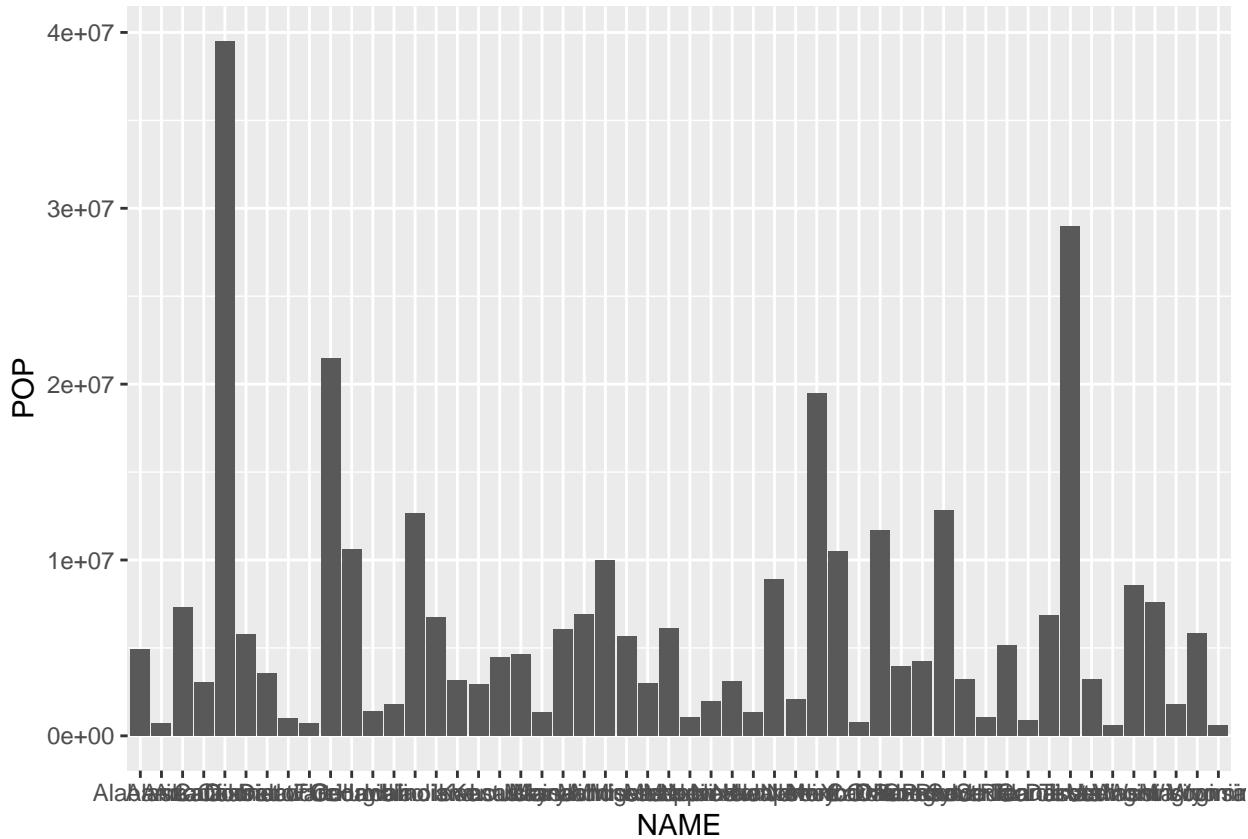
```
dt2 <- rbindlist(popdata[2:length(popdata)])  
colnames(dt2) <- unlist(popdata[[1]])  
  
dt2 <- dt2[dt2$DATE_CODE == 12,-c("DATE_CODE")]  
  
dt2$POP <- as.numeric(dt2$POP)  
dt2$state <- as.factor(dt2$state)  
names(dt2)[names(dt2) == "state"] <- "fips"  
dt2[order(dt2$NAME),]
```

```
##          POP           NAME fips  
## 1: 4903185      Alabama  01  
## 2: 731545       Alaska  02  
## 3: 7278717      Arizona  04  
## 4: 3017804     Arkansas  05  
## 5: 39512223    California  06  
## 6: 5758736     Colorado  08  
## 7: 3565287   Connecticut  09  
## 8: 973764     Delaware  10  
## 9: 705749 District of Columbia  11  
## 10: 21477737      Florida  12  
## 11: 10617423      Georgia  13  
## 12: 1415872       Hawaii  15
```

```

## 13: 1787065          Idaho  16
## 14: 12671821         Illinois 17
## 15: 6732219          Indiana 18
## 16: 3155070          Iowa   19
## 17: 2913314          Kansas  20
## 18: 4467673          Kentucky 21
## 19: 4648794          Louisiana 22
## 20: 1344212          Maine   23
## 21: 6045680          Maryland 24
## 22: 6892503          Massachusetts 25
## 23: 9986857          Michigan 26
## 24: 5639632          Minnesota 27
## 25: 2976149          Mississippi 28
## 26: 6137428          Missouri 29
## 27: 1068778          Montana 30
## 28: 1934408          Nebraska 31
## 29: 3080156          Nevada  32
## 30: 1359711          New Hampshire 33
## 31: 8882190          New Jersey 34
## 32: 2096829          New Mexico 35
## 33: 19453561         New York 36
## 34: 10488084         North Carolina 37
## 35: 762062           North Dakota 38
## 36: 11689100          Ohio   39
## 37: 3956971          Oklahoma 40
## 38: 4217737          Oregon  41
## 39: 12801989         Pennsylvania 42
## 40: 3193694          Puerto Rico 72
## 41: 1059361          Rhode Island 44
## 42: 5148714          South Carolina 45
## 43: 884659           South Dakota 46
## 44: 6829174           Tennessee 47
## 45: 28995881          Texas   48
## 46: 3205958           Utah   49
## 47: 623989            Vermont 50
## 48: 8535519            Virginia 51
## 49: 7614893            Washington 53
## 50: 1792147            West Virginia 54
## 51: 5822434            Wisconsin 55
## 52: 578759             Wyoming 56
##               POP           NAME fips
ggplot(dt2, aes(x=NAME,y=POP), fill=NAME) + geom_bar(stat="identity")

```



```
dt3 <- merge(dt,dt2, by="fips")
```

Now we can calculate deaths per million of population.

```
dt3[["dpm"]] <- dt3$death / dt3$POP * 1e6
dt3
```

```
##          fips      date state positive negative pending totalTestResults
## 1:    01 2020-09-18    AL     142863   910192     NA     1039010
## 2:    01 2020-09-17    AL     141757   903156     NA     1031253
## 3:    01 2020-09-16    AL     141087   899684     NA     1027207
## 4:    01 2020-09-15    AL     140160   892810     NA     1019623
## 5:    01 2020-09-14    AL     139459   888092     NA     1014391
##   ---
## 10378:  72 2020-03-20    PR       14     114      52      128
## 10379:  72 2020-03-19    PR       5      56      29      61
## 10380:  72 2020-03-18    PR       5      31      21      36
## 10381:  72 2020-03-17    PR       5      13       4      18
## 10382:  72 2020-03-16    PR       5       9      NA      14
##          hospitalizedCurrently hospitalizedCumulative inICuCurrently
## 1:                      744                  16227             NA
## 2:                      740                  16079             NA
## 3:                      722                  15942             NA
## 4:                      716                  15756             NA
## 5:                      792                  15756             NA
##   ---
## 10378:                     NA                  NA             NA
## 10379:                     NA                  NA             NA
```

```

## 10380: NA NA NA
## 10381: NA NA NA
## 10382: NA NA NA
##      inIcuCumulative onVentilatorCurrently onVentilatorCumulative recovered
## 1:      1638       NA             904   61232
## 2:      1631       NA             900   61232
## 3:      1629       NA             901   61232
## 4:      1622       NA             898   54223
## 5:      1611       NA             892   54223
## ---
## 10378: NA NA NA NA
## 10379: NA NA NA NA
## 10380: NA NA NA NA
## 10381: NA NA NA NA
## 10382: NA NA NA NA
##      dataQualityGrade lastUpdateEt dateModified checkTimeEt death
## 1:          A 9/18/2020 11:00 2020-09-18T11:00:00Z 09/18 07:00 2428
## 2:          A 9/17/2020 11:00 2020-09-17T11:00:00Z 09/17 07:00 2401
## 3:          A 9/16/2020 11:00 2020-09-16T11:00:00Z 09/16 07:00 2392
## 4:          B 9/15/2020 11:00 2020-09-15T11:00:00Z 09/15 07:00 2387
## 5:          B 9/14/2020 11:00 2020-09-14T11:00:00Z 09/14 07:00 2355
## ---
## 10378: 3/20/2020 13:00 2020-03-20T13:00:00Z 03/20 09:00 NA
## 10379: 3/19/2020 07:50 2020-03-19T07:50:00Z 03/19 03:50 NA
## 10380: 3/17/2020 22:00 2020-03-17T22:00:00Z 03/17 18:00 NA
## 10381: 3/17/2020 15:41 2020-03-17T15:41:00Z 03/17 11:41 NA
## 10382: 3/16/2020 15:44 2020-03-16T15:44:00Z 03/16 11:44 NA
##      hospitalized dateChecked totalTestsViral positiveTestsViral
## 1:      16227 2020-09-18 11:00:00 1039010 NA
## 2:      16079 2020-09-17 11:00:00 1031253 NA
## 3:      15942 2020-09-16 11:00:00 1027207 NA
## 4:      15756 2020-09-15 11:00:00 1019623 NA
## 5:      15756 2020-09-14 11:00:00 1014391 NA
## ---
## 10378: NA 2020-03-20 13:00:00 NA NA
## 10379: NA 2020-03-19 07:50:00 NA NA
## 10380: NA 2020-03-17 22:00:00 NA NA
## 10381: NA 2020-03-17 15:41:00 NA NA
## 10382: NA 2020-03-16 15:44:00 NA NA
##      negativeTestsViral positiveCasesViral deathConfirmed deathProbable
## 1:          NA           128818        2284     144
## 2:          NA           128097        2264     137
## 3:          NA           127523        2257     135
## 4:          NA           126813        2253     134
## 5:          NA           126299        2221     134
## ---
## 10378: NA NA NA NA
## 10379: NA NA NA NA
## 10380: NA NA NA NA
## 10381: NA NA NA NA
## 10382: NA NA NA NA
##      totalTestEncountersViral totalTestsPeopleViral totalTestsAntibody
## 1:                  NA             NA             NA
## 2:                  NA             NA             NA

```

```

##      3:          NA          NA          NA
##      4:          NA          NA          NA
##      5:          NA          NA          NA
##      ---
## 10378:          NA          NA          NA
## 10379:          NA          NA          NA
## 10380:          NA          NA          NA
## 10381:          NA          NA          NA
## 10382:          NA          NA          NA
##      positiveTestsAntibody negativeTestsAntibody totalTestsPeopleAntibody
##      1:              NA                  NA        56411
##      2:              NA                  NA        56181
##      3:              NA                  NA        55976
##      4:              NA                  NA        55856
##      5:              NA                  NA        55780
##      ---
## 10378:          NA          NA          NA
## 10379:          NA          NA          NA
## 10380:          NA          NA          NA
## 10381:          NA          NA          NA
## 10382:          NA          NA          NA
##      positiveTestsPeopleAntibody negativeTestsPeopleAntibody
##      1:                  NA                  NA
##      2:                  NA                  NA
##      3:                  NA                  NA
##      4:                  NA                  NA
##      5:                  NA                  NA
##      ---
## 10378:          NA          NA
## 10379:          NA          NA
## 10380:          NA          NA
## 10381:          NA          NA
## 10382:          NA          NA
##      totalTestsPeopleAntigen positiveTestsPeopleAntigen totalTestsAntigen
##      1:                  NA                  NA          NA
##      2:                  NA                  NA          NA
##      3:                  NA                  NA          NA
##      4:                  NA                  NA          NA
##      5:                  NA                  NA          NA
##      ---
## 10378:          NA          NA          NA
## 10379:          NA          NA          NA
## 10380:          NA          NA          NA
## 10381:          NA          NA          NA
## 10382:          NA          NA          NA
##      positiveTestsAntigen positiveIncrease negativeIncrease   total
##      1:                  NA                1106       7036 1053055
##      2:                  NA                 670       3472 1044913
##      3:                  NA                 927       6874 1040771
##      4:                  NA                701       4718 1032970
##      5:                  NA                704       3660 1027551
##      ---
## 10378:          NA                  9          58       180
## 10379:          NA                  0          25       90

```

```

## 10380:           NA          0         18        57
## 10381:           NA          0          4        22
## 10382:           NA          0          0        14
##      totalTestResultsSource totalTestResultsIncrease posNeg deathIncrease
## 1:                  posNeg                7757 1053055       27
## 2:                  posNeg                4046 1044913        9
## 3:                  posNeg                7584 1040771        5
## 4:                  posNeg                5232 1032970       32
## 5:                  posNeg                4164 1027551        4
## ---
## 10378:           posNeg          67        128        0
## 10379:           posNeg          25         61        0
## 10380:           posNeg          18         36        0
## 10381:           posNeg          4          18        0
## 10382:           posNeg          0         14        0
##      hospitalizedIncrease commercialScore negativeRegularScore negativeScore
## 1:                 148          0            0            0
## 2:                 137          0            0            0
## 3:                 186          0            0            0
## 4:                  0          0            0            0
## 5:                 229          0            0            0
## ---
## 10378:                 0          0            0            0
## 10379:                 0          0            0            0
## 10380:                 0          0            0            0
## 10381:                 0          0            0            0
## 10382:                 0          0            0            0
##      positiveScore score grade    POP      NAME      dpm
## 1:          0     0    0 4903185 Alabama 495.1883
## 2:          0     0    0 4903185 Alabama 489.6817
## 3:          0     0    0 4903185 Alabama 487.8462
## 4:          0     0    0 4903185 Alabama 486.8264
## 5:          0     0    0 4903185 Alabama 480.3000
## ---
## 10378:          0     0 3193694 Puerto Rico      NA
## 10379:          0     0 3193694 Puerto Rico      NA
## 10380:          0     0 3193694 Puerto Rico      NA
## 10381:          0     0 3193694 Puerto Rico      NA
## 10382:          0     0 3193694 Puerto Rico      NA

```

Now lets, for each fips code, find the earliest day where dpm is ≥ 1 and then what is the dpm 21 days after that point.

```

state_df <- data.frame(
  state=character(0),
  location_name=character(0),
  date1m=character(0),
  dpm21d=numeric(0)
)
str(state_df)

## 'data.frame': 0 obs. of 4 variables:
## $ state      : chr
## $ location_name: chr
## $ date1m     : chr

```

```

## $ dpm21d      : num
for (code in levels(dt3$fips)) {
  if (length(dt3[dt3$fips == code,]$date) == 0) {
    break
  }
  print(code)
  #print(dt3[dt3$fips == code,]$date)

  by_state <- dt3[dt3$fips == code,]
  date_order <- order(by_state$date)
  by_state_ordered_by_date <- by_state[date_order,]
  a <- setnafill(by_state_ordered_by_date, type="locf", cols=c("dpm"))
  b <- setnafill(by_state_ordered_by_date, type="const", fill=0, cols=c("dpm"))

  k <- Position(function(x) x > 1, by_state_ordered_by_date$dpm)
  k21 <- k + 21
  print(by_state_ordered_by_date[k,]$date)
  obs <- list(
    state=by_state_ordered_by_date[k,]$state,
    location_name=by_state_ordered_by_date[k,]$NAME,
    date1m=as.character(by_state_ordered_by_date[k,]$date),
    dpm21d= by_state_ordered_by_date[k21,]$dpm
  )
  state_df <- rbind(state_df,obs)
}

## [1] "01"
## [1] "2020-03-30"
## [1] "02"
## [1] "2020-03-25"
## [1] "04"
## [1] "2020-03-26"
## [1] "05"
## [1] "2020-03-28"
## [1] "06"
## [1] "2020-03-24"
## [1] "08"
## [1] "2020-03-23"
## [1] "09"
## [1] "2020-03-21"
## [1] "10"
## [1] "2020-03-24"
## [1] "11"
## [1] "2020-03-20"
## [1] "12"
## [1] "2020-03-25"
## [1] "13"
## [1] "2020-03-20"
## [1] "15"
## [1] "2020-04-03"
## [1] "16"
## [1] "2020-03-27"
## [1] "17"
## [1] "2020-03-24"

```

```
## [1] "18"
## [1] "2020-03-23"
## [1] "19"
## [1] "2020-03-29"
## [1] "20"
## [1] "2020-03-25"
## [1] "21"
## [1] "2020-03-27"
## [1] "22"
## [1] "2020-03-18"
## [1] "23"
## [1] "2020-03-29"
## [1] "24"
## [1] "2020-03-26"
## [1] "25"
## [1] "2020-03-21"
## [1] "26"
## [1] "2020-03-19"
## [1] "27"
## [1] "2020-03-29"
## [1] "28"
## [1] "2020-03-26"
## [1] "29"
## [1] "2020-03-25"
## [1] "30"
## [1] "2020-03-30"
## [1] "31"
## [1] "2020-03-28"
## [1] "32"
## [1] "2020-03-21"
## [1] "33"
## [1] "2020-03-28"
## [1] "34"
## [1] "2020-03-19"
## [1] "35"
## [1] "2020-03-31"
## [1] "36"
## [1] "2020-03-20"
## [1] "37"
## [1] "2020-04-02"
## [1] "38"
## [1] "2020-03-28"
## [1] "39"
## [1] "2020-03-26"
## [1] "40"
## [1] "2020-03-25"
## [1] "41"
## [1] "2020-03-23"
## [1] "42"
## [1] "2020-03-26"
## [1] "44"
## [1] "2020-03-29"
## [1] "45"
## [1] "2020-03-25"
```

```

## [1] "46"
## [1] "2020-03-18"
## [1] "47"
## [1] "2020-03-29"
## [1] "48"
## [1] "2020-03-29"
## [1] "49"
## [1] "2020-03-30"
## [1] "50"
## [1] "2020-03-20"
## [1] "51"
## [1] "2020-03-25"
## [1] "53"
## [1] "2020-03-01"
## [1] "54"
## [1] "2020-04-02"
## [1] "55"
## [1] "2020-03-25"
## [1] "56"
## [1] "2020-04-13"

state_df <- state_df[complete.cases(state_df),]
state_dt <- data.table(state_df)
state_dt

```

	state	location_name	date1m	dpm21d
## 1:	AL	Alabama	2020-03-30	34.059494
## 2:	AK	Alaska	2020-03-25	12.302729
## 3:	AZ	Arizona	2020-03-26	20.608027
## 4:	AR	Arkansas	2020-03-28	12.591938
## 5:	CA	California	2020-03-24	19.183937
## 6:	CO	Colorado	2020-03-23	52.789362
## 7:	CT	Connecticut	2020-03-21	138.558270
## 8:	DE	Delaware	2020-03-24	61.616572
## 9:	DC	District of Columbia	2020-03-20	53.843505
## 10:	FL	Florida	2020-03-25	28.354943
## 11:	GA	Georgia	2020-03-20	39.180882
## 12:	HI	Hawaii	2020-04-03	8.475342
## 13:	ID	Idaho	2020-03-27	22.942646
## 14:	IL	Illinois	2020-03-24	68.498442
## 15:	IN	Indiana	2020-03-23	51.988802
## 16:	IA	Iowa	2020-03-29	23.771263
## 17:	KS	Kansas	2020-03-25	26.087130
## 18:	KY	Kentucky	2020-03-27	28.874092
## 19:	LA	Louisiana	2020-03-18	140.251429
## 20:	ME	Maine	2020-03-29	25.293629
## 21:	MD	Maryland	2020-03-26	82.538275
## 22:	MA	Massachusetts	2020-03-21	137.250575
## 23:	MI	Michigan	2020-03-19	175.831095
## 24:	MN	Minnesota	2020-03-29	23.760416
## 25:	MS	Mississippi	2020-03-26	43.344604
## 26:	MO	Missouri	2020-03-25	23.951401
## 27:	MT	Montana	2020-03-30	9.356480
## 28:	NE	Nebraska	2020-03-28	12.406897
## 29:	NV	Nevada	2020-03-21	40.582360

```

## 30: NH      New Hampshire 2020-03-28 27.211665
## 31: NJ      New Jersey 2020-03-19 251.739717
## 32: NM      New Mexico 2020-03-31 27.660815
## 33: NY      New York 2020-03-20 403.216666
## 34: NC      North Carolina 2020-04-02 24.122614
## 35: ND      North Dakota 2020-03-28 11.810063
## 36: OH      Ohio 2020-03-26 33.278867
## 37: OK      Oklahoma 2020-03-25 31.084382
## 38: OR      Oregon 2020-03-23 12.565980
## 39: PA      Pennsylvania 2020-03-26 55.225793
## 40: RI      Rhode Island 2020-03-29 154.810305
## 41: SC      South Carolina 2020-03-25 20.781888
## 42: SD      South Dakota 2020-03-18 6.782274
## 43: TN      Tennessee 2020-03-29 21.671728
## 44: TX      Texas 2020-03-29 16.450612
## 45: UT      Utah 2020-03-30 8.733739
## 46: VT      Vermont 2020-03-20 38.462216
## 47: VA      Virginia 2020-03-25 22.845711
## 48: WA      Washington 2020-03-01 16.546523
## 49: WV      West Virginia 2020-04-02 16.181708
## 50: WI      Wisconsin 2020-03-25 31.258405
## 51: WY      Wyoming 2020-04-13 12.094844
##     state    location_name    date1m      dpm21d
data_dir <- paste(getwd(), "data", sep='/')
temp <- tempfile()
imhe_source <- "https://ihmecovid19storage.blob.core.windows.net/latest/ihme-covid19.zip"
download.file(imhe_source, temp, mode="wb")

data_file <- paste(data_dir, "Summary_stats_all_locs.csv", sep='/')
unzip(temp, exdir=data_dir, junkpaths=TRUE)
dd <- read.table(data_file, sep=",", header=T)
unlink(temp)

#dd_ss <- dd[,c("location_name", "any_business_start_date", "all_non_ess_business_start_date")]
dd_ss <- dd[,c("location_name", "any_business_start_date")]
dd_ss <- dd
state_dt2 <- merge(state_dt, dd_ss, by="location_name")
#head(by_state_ordered_by_date)
state_dt2$days_ld <- as.numeric(as.Date(state_dt2$any_business_start_date, '%Y-%m-%d') - as.Date(state_dt2$date1m))
state_dt2

##          location_name state    date1m      dpm21d location_id
## 1:           Alabama   AL 2020-03-30 34.059494      523
## 2:           Alaska   AK 2020-03-25 12.302729      524
## 3:           Arizona   AZ 2020-03-26 20.608027      525
## 4:           Arkansas  AR 2020-03-28 12.591938      526
## 5:        California  CA 2020-03-24 19.183937      527
## 6:          Colorado  CO 2020-03-23 52.789362      528
## 7: Connecticut  CT 2020-03-21 138.558270      529
## 8:       Delaware  DE 2020-03-24 61.616572      530
## 9: District of Columbia DC 2020-03-20 53.843505      531
## 10:         Florida  FL 2020-03-25 28.354943      532
## 11:         Georgia  GA 2020-03-20 39.180882       35
## 12:         Georgia  GA 2020-03-20 39.180882      533

```

```

## 13:          Hawaii HI 2020-04-03 8.475342      534
## 14:          Idaho ID 2020-03-27 22.942646      535
## 15:        Illinois IL 2020-03-24 68.498442      536
## 16:        Indiana IN 2020-03-23 51.988802      537
## 17:          Iowa IA 2020-03-29 23.771263      538
## 18:        Kansas KS 2020-03-25 26.087130      539
## 19:        Kentucky KY 2020-03-27 28.874092      540
## 20:      Louisiana LA 2020-03-18 140.251429      541
## 21:          Maine ME 2020-03-29 25.293629      542
## 22:        Maryland MD 2020-03-26 82.538275      543
## 23:    Massachusetts MA 2020-03-21 137.250575      544
## 24:        Michigan MI 2020-03-19 175.831095      545
## 25:        Minnesota MN 2020-03-29 23.760416      546
## 26:      Mississippi MS 2020-03-26 43.344604      547
## 27:        Missouri MO 2020-03-25 23.951401      548
## 28:        Montana MT 2020-03-30 9.356480      549
## 29:        Nebraska NE 2020-03-28 12.406897      550
## 30:        Nevada NV 2020-03-21 40.582360      551
## 31:    New Hampshire NH 2020-03-28 27.211665      552
## 32:    New Jersey NJ 2020-03-19 251.739717      553
## 33:    New Mexico NM 2020-03-31 27.660815      554
## 34:    New York NY 2020-03-20 403.216666      555
## 35:    North Carolina NC 2020-04-02 24.122614      556
## 36:    North Dakota ND 2020-03-28 11.810063      557
## 37:          Ohio OH 2020-03-26 33.278867      558
## 38:    Oklahoma OK 2020-03-25 31.084382      559
## 39:        Oregon OR 2020-03-23 12.565980      560
## 40:    Pennsylvania PA 2020-03-26 55.225793      561
## 41:    Rhode Island RI 2020-03-29 154.810305      562
## 42:    South Carolina SC 2020-03-25 20.781888      563
## 43:    South Dakota SD 2020-03-18 6.782274      564
## 44:    Tennessee TN 2020-03-29 21.671728      565
## 45:        Texas TX 2020-03-29 16.450612      566
## 46:        Utah UT 2020-03-30 8.733739      567
## 47:        Vermont VT 2020-03-20 38.462216      568
## 48:        Virginia VA 2020-03-25 22.845711      569
## 49:    Washington WA 2020-03-01 16.546523      570
## 50:    West Virginia WV 2020-04-02 16.181708      571
## 51:    Wisconsin WI 2020-03-25 31.258405      572
## 52:        Wyoming WY 2020-04-13 12.094844      573
##           location_name state      date1m      dpm21d location_id
## peak_bed_day_mean peak_bed_day_lower peak_bed_day_upper
##  1:            2021-01-15      2020-07-26      2021-01-21
##  2:            2020-08-28      2020-08-28      2020-09-23
##  3:            2020-12-23      2020-07-23      2020-12-25
##  4:            2020-12-07      2020-09-03      2021-03-19
##  5:            2020-12-17      2020-12-12      2021-03-09
##  6:            2020-12-30      2020-04-25      2021-01-02
##  7:            2020-04-23      2020-04-23      2020-12-28
##  8:            2020-12-31      2020-05-06      2021-01-01
##  9:            2020-05-02      2020-05-02      2020-12-16
## 10:            2020-11-17      2020-08-07      2021-05-02
## 11:            2020-05-01      2020-05-01      2020-05-01
## 12:            2020-12-21      2020-08-23      2020-12-23

```

```

## 13: 2021-03-13 2020-09-04 2021-04-07
## 14: 2020-12-29 2020-08-08 2021-04-28
## 15: 2020-12-21 2020-05-10 2020-12-23
## 16: 2020-12-27 2020-05-01 2020-12-29
## 17: 2020-12-05 2020-05-22 2021-03-06
## 18: 2020-11-19 2020-11-15 2021-12-26
## 19: 2020-12-05 2020-12-01 2021-05-28
## 20: 2020-04-16 2020-04-16 2020-12-30
## 21: 2021-02-07 2020-04-19 2021-02-09
## 22: 2020-12-19 2020-04-29 2020-12-22
## 23: 2020-04-27 2020-04-27 2020-12-02
## 24: 2020-04-18 2020-04-18 2021-01-16
## 25: 2020-12-20 2020-05-29 2021-12-26
## 26: 2021-01-23 2020-08-11 2021-01-25
## 27: 2020-12-17 2020-05-06 2021-05-11
## 28: 2021-01-06 2020-09-09 2021-05-04
## 29: 2020-11-23 2020-06-14 2021-12-26
## 30: 2020-12-24 2020-08-16 2020-12-30
## 31: 2021-02-07 2020-05-14 2021-02-09
## 32: 2020-04-23 2020-04-23 2020-11-23
## 33: 2020-12-24 2020-12-19 2021-03-02
## 34: 2020-04-13 2020-04-13 2020-12-19
## 35: 2020-12-11 2020-12-08 2021-02-23
## 36: 2020-12-04 2020-12-01 2020-12-05
## 37: 2020-12-20 2020-12-17 2020-12-22
## 38: 2021-01-13 2020-08-23 2021-01-16
## 39: 2021-01-11 2021-01-07 2021-01-15
## 40: 2020-12-25 2020-05-02 2020-12-27
## 41: 2020-11-25 2020-05-21 2021-12-26
## 42: 2020-12-14 2020-07-31 2020-12-15
## 43: 2021-01-01 2020-05-11 2021-01-02
## 44: 2020-11-18 2020-08-22 2021-05-08
## 45: 2020-12-29 2020-08-13 2020-12-30
## 46: 2021-01-21 2021-01-17 2021-01-23
## 47: 2021-03-10 2020-04-15 2021-03-15
## 48: 2020-12-14 2020-12-10 2021-12-26
## 49: 2021-01-04 2020-12-28 2021-01-14
## 50: 2020-12-19 2020-08-31 2021-03-11
## 51: 2020-12-20 2020-12-17 2020-12-22
## 52: 2020-08-23 2020-08-23 2020-08-23

## peak_bed_day_mean peak_bed_day_lower peak_bed_day_upper
## peak_icu_bed_day_mean peak_icu_bed_day_lower peak_icu_bed_day_upper
## 1: 2021-01-13 2020-07-24 2021-01-15
## 2: 2020-08-27 2020-08-27 2020-09-25
## 3: 2020-12-22 2020-07-21 2020-12-24
## 4: 2020-12-07 2020-09-02 2021-03-19
## 5: 2020-12-10 2020-12-09 2021-03-08
## 6: 2020-12-28 2020-04-23 2020-12-30
## 7: 2020-04-21 2020-04-21 2020-12-27
## 8: 2020-12-30 2020-05-05 2021-01-01
## 9: 2020-05-01 2020-05-01 2020-12-15
## 10: 2020-11-17 2020-08-06 2021-05-02
## 11: 2020-04-30 2020-04-30 2020-04-30
## 12: 2020-12-20 2020-08-22 2020-12-23

```

```

## 13:      2021-03-12      2020-09-03      2021-04-07
## 14:      2020-12-28      2020-08-06      2021-04-26
## 15:      2020-12-20      2020-05-08      2020-12-22
## 16:      2020-12-27      2020-04-30      2020-12-28
## 17:      2020-12-04      2020-05-20      2021-03-05
## 18:      2020-11-18      2020-11-14      2021-12-26
## 19:      2020-12-04      2020-12-01      2021-05-26
## 20:      2020-04-15      2020-04-15      2020-12-28
## 21:      2021-02-06      2020-04-17      2021-02-08
## 22:      2020-12-18      2020-04-27      2020-12-19
## 23:      2020-04-24      2020-04-24      2021-03-20
## 24:      2020-04-16      2020-04-16      2021-01-16
## 25:      2020-12-19      2020-05-28      2021-12-26
## 26:      2021-01-22      2020-08-08      2021-01-25
## 27:      2020-12-16      2020-05-04      2021-05-11
## 28:      2021-01-05      2020-09-09      2021-05-03
## 29:      2020-11-22      2020-06-14      2021-12-26
## 30:      2020-12-23      2020-08-15      2020-12-26
## 31:      2021-02-07      2020-05-11      2021-02-09
## 32:      2020-04-21      2020-04-21      2020-11-22
## 33:      2020-12-19      2020-12-17      2021-03-01
## 34:      2020-04-11      2020-04-11      2020-12-19
## 35:      2020-12-09      2020-12-07      2021-02-22
## 36:      2020-12-03      2020-12-01      2020-12-05
## 37:      2020-12-19      2020-12-17      2020-12-21
## 38:      2021-01-13      2020-08-22      2021-01-15
## 39:      2021-01-08      2021-01-06      2021-01-11
## 40:      2020-12-24      2020-05-01      2020-12-26
## 41:      2020-11-24      2020-05-21      2021-12-26
## 42:      2020-12-13      2020-07-30      2020-12-15
## 43:      2021-01-01      2020-05-10      2021-01-04
## 44:      2020-11-18      2020-08-21      2021-05-07
## 45:      2020-12-29      2020-08-12      2020-12-30
## 46:      2021-01-21      2021-01-19      2021-01-24
## 47:      2021-03-09      2020-04-14      2021-03-12
## 48:      2020-12-12      2020-12-09      2021-12-26
## 49:      2021-01-10      2020-12-26      2021-01-14
## 50:      2020-12-18      2020-08-30      2021-03-05
## 51:      2020-12-20      2020-12-17      2020-12-22
## 52:      2020-08-22      2020-08-22      2020-08-22

##      peak_icu_bed_day_mean peak_icu_bed_day_lower peak_icu_bed_day_upper
##      peak_vent_day_mean   peak_vent_day_lower   peak_vent_day_upper all_bed_capacity
## 1:      2021-01-13      2020-07-24      2021-01-15      17537
## 2:      2020-08-27      2020-08-27      2020-09-20      2034
## 3:      2020-12-22      2020-07-21      2020-12-24      16342
## 4:      2020-12-06      2020-09-02      2021-03-19      11243
## 5:      2020-12-10      2020-12-08      2021-03-08      85724
## 6:      2020-12-28      2020-04-22      2020-12-30      12485
## 7:      2020-04-21      2020-04-21      2020-12-27      8501
## 8:      2020-12-30      2020-05-04      2021-01-01      2633
## 9:      2020-05-01      2020-05-01      2020-12-14      3939
## 10:     2020-11-17      2020-08-05      2021-05-02      60546
## 11:     2020-04-30      2020-04-30      2020-04-30      11817
## 12:     2020-12-20      2020-08-22      2020-12-22      28928

```

	peak_vent_day_mean	peak_vent_day_lower	peak_vent_day_upper	all_bed_capacity
	icu_bed_capacity	all_bed_usage	icu_bed_usage	available_all_nbr
## 1:	1525	11793	1050	5744
## 2:	169	1351	115	683
## 3:	1440	10324	932	6018
## 4:	914	6237	519	5006
## 5:	6783	59070	4789	26654
## 6:	1484	7633	929	4852
## 7:	537	6762	437	1739
## 8:	166	1937	125	696
## 9:	256	2845	189	1094
## 10:	5351	40362	3655	20184
## 11:	285	4067	57	7750
## 12:	2182	20605	1592	8323

```

## 13:      173      2510      128      957
## 14:      338      2133      187     1818
## 15:     2910     21520     1779    14552
## 16:     1763     11965     1057     8485
## 17:      584      5569      337     4297
## 18:      678      6518      399     4811
## 19:     1215     9946      766     6210
## 20:     1242    10855      765     7205
## 21:      244      2752      180     1062
## 22:     1030     10389      764     3961
## 23:     1250     15348      973     4849
## 24:     2164    18145     1421    10155
## 25:     1140    10212      785     4984
## 26:      862      8272      521     5733
## 27:     1586    13642     1027     7933
## 28:      219      2475      134     1670
## 29:      569      4283      336     3130
## 30:      696      5758      513     2248
## 31:      263      2033      179     1019
## 32:     1643    18181     1177     7815
## 33:      331      3003      214     1753
## 34:     3787    49221     3069    13011
## 35:     2096    17587     1528     7126
## 36:      219      2234      132     1545
## 37:     3371    23060     2132    14291
## 38:     1166     7695      699     5458
## 39:      655      5242      445     2658
## 40:     3250    28263     2206    14395
## 41:      153     1962      111      795
## 42:     1244    9027      839     4680
## 43:      202     2927      128     1806
## 44:     1834    13972     1205     7812
## 45:     6378    48794     4118    28634
## 46:      428     3955      257     2771
## 47:      102      992       68      533
## 48:     1241    16689     912     6581
## 49:     1116    10328      775     4907
## 50:      568      5371      372     3032
## 51:      476     8867      303     5365
## 52:      105     1384       60     1069
##      icu_bed_capacity all_bed_usage icu_bed_usage available_all_nbr
##      available_icu_nbr travel_limit_start_date travel_limit_end_date
## 1:        475
## 2:        54          2020-03-28
## 3:        508
## 4:        395
## 5:      1994
## 6:        555
## 7:        100
## 8:        41
## 9:        67
## 10:      1696
## 11:      228          2020-03-24          2020-04-27
## 12:      590

```

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## 13:          45
## 14:         151
## 15:        1131
## 16:         706
## 17:         247
## 18:         279
## 19:         449
## 20:         477
## 21:          64
## 22:         266
## 23:         277
## 24:         743
## 25:         355
## 26:         341
## 27:         559
## 28:          85
## 29:         233
## 30:         183
## 31:          84
## 32:         466
## 33:         117
## 34:         718
## 35:         568
## 36:          87
## 37:        1239
## 38:         467
## 39:         210
## 40:        1044
## 41:          42
## 42:         405
## 43:          74
## 44:         629
## 45:        2260
## 46:         171
## 47:          34
## 48:         329
## 49:         341
## 50:         196
## 51:         173
## 52:          45
##   available_icu_nbr travel_limit_start_date travel_limit_end_date
##   stay_home_start_date stay_home_end_date educational_fac_start_date
## 1:           2020-04-04      2020-04-30      2020-03-19
## 2:           2020-03-28      2020-04-24      2020-03-16
## 3:           2020-03-30      2020-05-16      2020-03-16
## 4:                      2020-03-17
## 5:           2020-03-19      2020-03-19
## 6:           2020-03-26      2020-05-09      2020-03-23
## 7:                      2020-03-17
## 8:           2020-03-24      2020-06-01      2020-03-16
## 9:           2020-03-30      2020-05-29      2020-03-16
## 10:          2020-04-03      2020-05-18      2020-03-17
## 11:                      2020-03-02
## 12:          2020-04-03      2020-03-18

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## 13: 2020-03-25 2020-06-10 2020-03-19
## 14: 2020-03-25 2020-05-01 2020-03-23
## 15: 2020-03-21 2020-05-29 2020-03-17
## 16: 2020-03-25 2020-05-18 2020-03-19
## 17: 2020-03-30 2020-05-04 2020-04-04
## 18: 2020-03-23 2020-05-15 2020-03-17
## 19: 2020-04-02 2020-05-31 2020-03-20
## 20: 2020-03-30 2020-05-15 2020-03-16
## 21: 2020-04-03 2020-04-27 2020-03-19
## 22: 2020-04-06 2020-05-15 2020-03-23
## 23: 2020-03-26 2020-04-26 2020-03-15
## 24: 2020-03-24 2020-06-01 2020-03-16
## 25: 2020-03-28 2020-05-18 2020-03-18
## 26: 2020-03-31 2020-06-16 2020-03-18
## 27: 2020-03-21 2020-06-09 2020-03-13
## 28: 2020-03-22 2020-06-08 2020-03-18
## 29: 2020-03-30 2020-05-09 2020-03-16
## 30: 2020-03-27 2020-06-16 2020-03-16
## 31: 2020-03-21 2020-06-09 2020-03-18
## 32: 2020-03-23 2020-05-20 2020-03-16
## 33: 2020-03-22 2020-06-08 2020-03-17
## 34: 2020-03-30 2020-05-08 2020-03-14
## 35: 2020-03-28 2020-05-09 2020-03-16
## 36: 2020-04-07 2020-05-04 2020-03-16
## 37: 2020-03-23 2020-05-20 2020-03-16
## 38: 2020-03-23 2020-06-19 2020-03-16
## 39: 2020-04-01 2020-06-05 2020-03-17
## 40: 2020-03-28 2020-05-09 2020-03-16
## 41: 2020-04-07 2020-05-04 2020-03-16
## 42: 2020-03-24 2020-05-15 2020-03-16
## 43: 2020-03-30 2020-06-05 2020-03-16
## 44: 2020-03-23 2020-07-03 2020-03-13
## 45: 2020-03-25 2020-05-04 2020-03-14
## 46: 2020-03-25 2020-05-13 2020-03-18
## 47: 2020-03-24 2020-05-19 2020-03-19
## 48: 2020-03-30 2020-06-01 2020-03-24
## 49: 2020-03-23 2020-07-03 2020-03-30
## 50: 2020-03-25 2020-05-27 2020-03-27
## 51: 2020-03-25 2020-05-13 2020-03-19
## 52: 2020-03-24 2020-05-19 2020-03-19

## stay_home_start_date stay_home_end_date educational_fac_start_date
## educational_fac_end_date any_gathering_restrict_start_date
## 1: 2020-03-19
## 2: 2020-03-24
## 3: 2020-03-30
## 4: 2020-08-24 2020-03-27
## 5: 2020-03-11
## 6: 2020-03-19
## 7: 2020-03-12
## 8: 2020-03-16
## 9: 2020-03-13
## 10: 2020-04-03
## 11: 2020-03-23
## 12: 2020-03-24

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## 13: 2020-03-17
## 14: 2020-03-25
## 15: 2020-03-13
## 16: 2020-03-12
## 17: 2020-03-17
## 18: 2020-03-17
## 19: 2020-03-19
## 20: 2020-03-13
## 21: 2020-03-18
## 22: 2020-03-16
## 23: 2020-03-13
## 24: 2020-03-13
## 25: 2020-03-28
## 26: 2020-03-24
## 27: 2020-03-23
## 28: 2020-03-24
## 29: 2020-03-16
## 30: 2020-03-24
## 31: 2020-03-16
## 32: 2020-03-16
## 33: 2020-03-12
## 34: 2020-03-12
## 35: 2020-03-14
## 36:
## 37: 2020-03-12
## 38: 2020-03-24
## 39: 2020-03-12
## 40: 2020-04-01
## 41: 2020-03-17
## 42: 2020-03-18
## 43: 2020-04-06
## 44: 2020-03-23
## 45: 2020-03-21
## 46: 2020-03-19
## 47: 2020-03-13
## 48: 2020-03-15
## 49: 2020-03-11
## 50: 2020-03-24
## 51: 2020-03-17
## 52: 2020-03-20
##     educational_fac_end_date any_gathering_restrict_start_date
##     any_gathering_restrict_end_date any_business_start_date
## 1:                               2020-03-19
## 2:           2020-05-22      2020-03-17
## 3:           2020-05-16      2020-03-30
## 4:           2020-06-18      2020-03-19
## 5:                               2020-03-19
## 6:                               2020-03-17
## 7:                               2020-03-16
## 8:                               2020-03-16
## 9:                               2020-03-16
## 10:      2020-06-05      2020-03-17
## 11:                               2020-03-21
## 12:                               2020-03-24

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## 13:                               2020-03-17
## 14:           2020-05-01           2020-03-25
## 15:                               2020-03-16
## 16:                               2020-03-16
## 17:           2020-06-12           2020-03-17
## 18:           2020-05-22           2020-03-30
## 19:                               2020-03-16
## 20:           2020-05-15           2020-03-17
## 21:                               2020-03-18
## 22:           2020-06-10           2020-03-16
## 23:                               2020-03-17
## 24:                               2020-03-16
## 25:                               2020-03-17
## 26:                               2020-03-24
## 27:           2020-05-04           2020-03-23
## 28:           2020-06-01           2020-03-20
## 29:                               2020-03-19
## 30:                               2020-03-18
## 31:                               2020-03-16
## 32:                               2020-03-16
## 33:                               2020-03-16
## 34:                               2020-03-16
## 35:                               2020-03-17
## 36:                               2020-03-20
## 37:                               2020-03-15
## 38:           2020-05-24           2020-04-01
## 39:                               2020-03-17
## 40:           2020-09-14           2020-03-18
## 41:                               2020-03-17
## 42:                               2020-03-18
## 43:           2020-04-28
## 44:                               2020-03-23
## 45:           2020-06-04           2020-03-21
## 46:           2020-05-01           2020-03-19
## 47:                               2020-03-17
## 48:                               2020-03-17
## 49:                               2020-03-16
## 50:                               2020-03-18
## 51:                               2020-03-17
## 52:                               2020-03-19
##      any_gathering_restrict_end_date any_business_start_date
##      any_business_end_date all_non.ess_business_start_date
## 1:           2020-06-15           2020-03-28
## 2:           2020-05-22           2020-03-28
## 3:           2020-05-16
## 4:
## 5:                               2020-03-19
## 6:                               2020-03-26
## 7:                               2020-03-23
## 8:                               2020-03-24
## 9:                               2020-03-25
## 10:
## 11:                               2020-03-21
## 12:

```

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## 13:                               2020-03-25
## 14: 2020-06-13                           2020-03-25
## 15:                               2020-03-21
## 16:                               2020-03-24
## 17:                               2020-03-17
## 18: 2020-06-08                           2020-03-26
## 19: 2020-06-29                           2020-03-22
## 20:                               2020-03-25
## 21:                               2020-03-25
## 22:                               2020-03-23
## 23:                               2020-03-24
## 24:                               2020-03-23
## 25: 2020-06-10                           2020-04-03
## 26: 2020-06-01                           2020-03-26
## 27: 2020-06-16                           2020-03-21
## 28: 2020-06-01                           2020-03-28
## 29: 2020-07-06                           2020-03-24
## 30:                               2020-03-22
## 31: 2020-06-29                           2020-03-30
## 32:                               2020-03-21
## 33:                               2020-03-24
## 34:                               2020-03-22
## 35:                               2020-03-30
## 36:                               2020-03-23
## 37:                               2020-04-01
## 38: 2020-06-01                           2020-03-23
## 39:                               2020-03-28
## 40: 2020-07-03                           2020-03-21
## 41:                               2020-03-29
## 42: 2020-08-03                           2020-04-01
## 43:                               2020-03-27
## 44:                               2020-04-01
## 45:                               2020-03-25
## 46:                               2020-03-24
## 47:                               2020-03-25
## 48:                               2020-03-24
## 49:                               2020-03-25
## 50:                               2020-03-24
## 51:                               2020-03-25
## 52: 2020-05-15                           2020-03-25
##      any_business_end_date all_non.ess_business_start_date
##      all_non.ess_business_end_date days_ld
## 1: 2020-04-30      -11
## 2: 2020-04-24      -8
## 3:                               4
## 4:                               -9
## 5:                               -5
## 6: 2020-05-09      -6
## 7: 2020-05-20      -5
## 8: 2020-05-08      -8
## 9: 2020-05-29      -4
## 10:                               -8
## 11: 2020-04-27      1
## 12:                               4

```

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## 13:           2020-05-01      -17
## 14:           2020-05-01       -2
## 15:           2020-05-01      -8
## 16:           2020-05-18      -7
## 17:           2020-05-08     -12
## 18:                   5
## 19:           2020-05-11     -11
## 20:           2020-05-01      -1
## 21:           2020-05-01     -11
## 22:           2020-05-15     -10
## 23:           2020-05-18      -4
## 24:           2020-05-07      -3
## 25:                   -12
## 26:           2020-04-27      -2
## 27:                   -2
## 28:           2020-05-01     -10
## 29:                   -9
## 30:           2020-05-09      -3
## 31:           2020-05-11     -12
## 32:           2020-05-02      -3
## 33:           2020-05-15     -15
## 34:           2020-06-08      -4
## 35:           2020-05-08     -16
## 36:                   -8
## 37:           2020-05-04     -11
## 38:           2020-04-24       7
## 39:                   -6
## 40:           2020-05-08      -8
## 41:                   -12
## 42:                   -7
## 43:                   NA
## 44:           2020-05-26      -6
## 45:                   -8
## 46:                   -11
## 47:           2020-05-04      -3
## 48:           2020-05-15      -8
## 49:           2020-07-03     15
## 50:           2020-05-04     -15
## 51:           2020-05-11      -8
## 52:                   -25
##   all_non.ess_business_end_date days_ld
ggplot(state_dt2, aes(x=days_ld, y=dpm21d)) + geom_point(shape=1)

## Warning: Removed 1 rows containing missing values (geom_point).

```

