```
-------------------------------------------------------------------------------------------------
      name:  donaldan
       log:  L:\Stats Courses\AHA 2019-2020 Data\HLM_2019-2020_data_analysis_final_draft.log
  log type:  text
 opened on:

. use "\\appsstorage.bc.edu\donaldan\Stats Courses\AHA 2019-2020 Data\AHA_2019-2020_HLM_with_missing.dta", clear

. merge m:1 stcd using "L:\Stats Courses\AHA 2019-2020 Data\12-31-20_states-deaths-hosp-cases-pop.dta"

    Result                      Number of obs
    -----------------------------------------
    Not matched                             0
    Matched                            12,183  (_merge==3)
    -----------------------------------------

. **Since the state codes (stcd) are listed as the US Census's numeric codes for each state, I'm relabeling them to make
them easier to read

. la de stcdlabel 11"Maine" 12 "New Hampshire" 13 "Vermont" 14 "Masssachusetts" 15 "Rhode Island" 16 "Connecticut" 21
"New York" 22 "New Jersey" 23 "Pennsylvania" 31 "Delaware" 32 "Maryland" 33 "District of Columbia" 34 "Virginia" 35 "West
Virginia" 36 "North Carolina" 37 "South Carolina" 38 "Georgia" 39 "Florida" 41 "Ohio" 42 "Indiana" 43 "Illinois" 44
"Michigan" 45 "Wisconsin" 51 "Kentucky" 52 "Tennessee" 53 "Alabama" 54 "Mississippi" 61 "Minnesota" 62 "Iowa" 63 "Missouri"
64 "North Dakota" 65 "South Dakota" 66 "Nebraska" 67 "Kansas" 71 "Arkansas" 72 "Louisiana" 73 "Oklahoma" 74 "Texas" 81
"Montana" 82 "Idaho" 83 "Wyoming" 84 "Colorado" 85 "New Mexico" 86 "Arizona" 87 "Utah" 88 "Nevada" 91 "Washington" 92
"Oregon" 93 "California" 94 "Alaska" 95 "Hawaii" 3 "Marshall Islands" 4 "Puerto Rico" 5 "Virgin Islands" 6 "Guam" 7
"American Samoa" 8 "Northern Mariana Islands", modify

. label values stcd stcdlabel

. **Dropping US territories - such as Guam, American Samoa, Puerto Rice, etc. - because there's too much missing data

. drop if stcd<9

(9 observations deleted)

. lab define mapp20label 1 “Yes” 2 “No”

. label value mapp20 mapp20label
```

```
. gen year19 = 0 if year==2019

(6,093 missing values generated)

. replace year19 = 1 if year==2020

(6,093 real changes made)

. tab year19

     year19 |      Freq.     Percent        Cum.
------------+-----------------------------------
          0 |      6,090       49.99       49.99
          1 |      6,093       50.01      100.00
------------+-----------------------------------
      Total |     12,183      100.00

. egen tag19=tag(stcd) if year19==0

. egen tag20=tag(stcd) if year19==1

. **Creating beds that are related to COVID/beds that COVID patients might need as one combined variable: general medical
and surgical (adult) beds, medical/surgical intensive care beds, cardiac ICU beds, acute long term care and other long
term care beds

. **Creating this non-COVID related beds variable for 2019 and 2020

. gen covbds19 = (genbd + msicbd + cicbd + acultbd + othlbd94) if year19==0

(8,016 missing values generated)

. codebook covbds19

-------------------------------------------------------------------------------------------------------------------------

covbds19                                                                                                  (unlabeled)

-------------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (float)

                 Range: [0,1531]                      Units: 1
```

```
         Unique values: 503                       Missing .: 8,016/12,183

                  Mean: 98.2981

             Std. dev.: 135.001

           Percentiles:     10%       25%       50%       75%       90%

                              0        18        42       131       261
```

```
. gen covbds20 = (genbd + msicbd + cicbd + acultbd + othlbd94) if year19==1

(8,118 missing values generated)

. codebook covbds20
```

---

covbds20 (unlabeled)

```
                  Type: Numeric (float)

                 Range: [0,1666]                      Units: 1

         Unique values: 516                       Missing .: 8,118/12,183

                  Mean: 100.165

             Std. dev.: 139.671

           Percentiles:     10%       25%       50%       75%       90%

                              0        18        40       134       270
```

```
. **Creating beds that are not related to COVID/beds that COVID patients likley would not need as one combined variable: alcohol/drug abuse or dependency inpatient care beds, general and medical surgical (pediatric) beds, obstetric care beds, neonatal ICU beds, neonatal intermediate care beds, pediatric ICU beds, burn care beds, other special care beds, other ICU beds, physical rehabilitation care beds, psychiatric care beds, skilled nursing care beds, intermediate nursing care beds

. **Creating this non-COVID related beds variable for 2019 and 2020

. gen noncovbds19 = (alchbd + pedbd + obbd + nicbd + nintbd + pedicbd + brnbd + spcicbd + othicbd + rehabbd + psybd + snbd88 + icfbd88) if year19==0

(8,016 missing values generated)
```

```
. codebook noncovbds19

-------------------------------------------------------------------------------------------------------------------------------
noncovbds19                                                                                                     (unlabeled)
-------------------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (float)

                 Range: [0,2493]                      Units: 1

         Unique values: 406                        Missing .: 8,016/12,183

                  Mean: 68.8548

             Std. dev.:  108.39

           Percentiles:     10%       25%       50%       75%       90%

                              0         4        35        90       178

. gen noncovbds20 = (alchbd + pedbd + obbd + nicbd + nintbd + pedicbd + brnbd + spcicbd + othicbd + rehabbd + psybd +
snbd88 + icfbd88) if year19==1

(8,118 missing values generated)

. codebook noncovbds20

-------------------------------------------------------------------------------------------------------------------------------
noncovbds20                                                                                                     (unlabeled)
-------------------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (float)

                 Range: [0,1707]                      Units: 1

         Unique values: 391                        Missing .: 8,118/12,183

                  Mean:   67.89

             Std. dev.: 102.114

           Percentiles:     10%       25%       50%       75%       90%

                              0         4        35        90       175
```

```
. **Generating COVID severity measures: proportion of cases per state, proportion of hospitalizations per state, proportion of deaths per state

. gen covsevcases = (cases / statepop) if year19==1

(6,090 missing values generated)

. gen covsevhosp = (hospitalizations / statepop) if year19==1

(6,090 missing values generated)

. gen covsevdeaths = (death / statepop) if year19==1

(6,090 missing values generated)

. ***Missing Data

. ***There are some hospitals that have X number of 1 specific type of bed, but no other beds (e.g., 100 psychiatric beds, 0 other beds, and the total hospital beds are reported as 100). From here, it is safe to assume that those hospitals are specialized hospitals (psychiatric hospitals, pediatric hospitals), so they won't have a change in COVID-19 related beds and non-COVID-19 beds, which is why I'm omitting these hospitals from the dataset

. gen genbd_test=genbd

(3,951 missing values generated)

. gen pedbd_test=pedbd

(3,951 missing values generated)

. gen obbd_test=obbd

(3,951 missing values generated)

. gen msicbd_test=msicbd

(3,951 missing values generated)

. gen cicbd_test=cicbd

(3,951 missing values generated)

. gen nicbd_test=nicbd

(3,951 missing values generated)

. gen nintbd_test=nintbd
```

```
(3,951 missing values generated)
. gen pedicbd_test=pedicbd
(3,951 missing values generated)
. gen brnbd_test=brnbd
(3,951 missing values generated)
. gen spcicbd_test=spcicbd
(3,951 missing values generated)
. gen othicbd_test=othicbd
(3,951 missing values generated)
. gen rehabbd_test=rehabbd
(3,951 missing values generated)
. gen alchbd_test=alchbd
(3,951 missing values generated)
. gen psybd_test=psybd
(3,951 missing values generated)
. gen snbd88_test=snbd88
(3,951 missing values generated)
. gen icfbd88_test=icfbd88
(3,951 missing values generated)
. gen acultbd_test=acultbd
(3,951 missing values generated)
. gen othlbd94_test=othlbd94
(3,951 missing values generated)
. gen hospbd_test=hospbd
. ***Dropping observations where one type of bed equals the total number of beds in that hospital
```

```
. drop if genbd_test==hospbd_test
(945 observations deleted)
. drop if pedbd_test==hospbd_test
(24 observations deleted)
. drop if obbd_test==hospbd_test
(0 observations deleted)
. drop if msicbd_test==hospbd_test
(0 observations deleted)
. drop if cicbd_test==hospbd_test
(14 observations deleted)
. drop if nicbd_test==hospbd_test
(0 observations deleted)
. drop if nintbd_test==hospbd_test
(0 observations deleted)
. drop if pedicbd_test==hospbd_test
(0 observations deleted)
. drop if brnbd_test==hospbd_test
(2 observations deleted)
. drop if spcicbd_test==hospbd_test
(13 observations deleted)
. drop if othicbd_test==hospbd_test
(0 observations deleted)
. drop if rehabbd_test==hospbd_test
(332 observations deleted)
. drop if alchbd_test==hospbd_test
```

```
(11 observations deleted)

. drop if psybd_test==hospbd_test

(385 observations deleted)

. drop if snbd88_test==hospbd_test

(0 observations deleted)

. drop if icfbd88_test==hospbd_test

(2 observations deleted)

. drop if acultbd_test==hospbd_test

(225 observations deleted)

. drop if othlbd94_test==hospbd_test

(0 observations deleted)

. ***Dropping observations that only have total bed count

. drop if genbd_test==. & pedbd_test==. & obbd_test==. & msicbd_test==. & cicbd_test==. & nicbd_test==. & nintbd_test==.
& pedicbd_test==. & brnbd_test==. & spcicbd_test==. & othicbd_test==. & rehabbd_test==. & alchbd_test==. & psybd_test==.
& snbd88_test==. & icfbd88_test==. & acultbd_test==. & othlbd94_test==.

(3,951 observations deleted)

. codebook year19

-------------------------------------------------------------------------------------------------------------------------
year19                                                                                                      (unlabeled)
-------------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (float)

                 Range: [0,1]                         Units: 1

         Unique values: 2                         Missing .: 0/6,279

            Tabulation: Freq.  Value

                        3,193  0
```

```
                        3,086  1

. codebook id

-------------------------------------------------------------------------------------------------------------------------
id                                                                                                AHA Identification Number
-------------------------------------------------------------------------------------------------------------------------

                  Type: String (str8), but longest is str7
         Unique values: 3,424                     Missing "": 0/6,279
              Examples: "6360895"
                        "6440040"
                        "6630788"
                        "6742430"

. codebook year

-------------------------------------------------------------------------------------------------------------------------
year                                                                                                                 Year
-------------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)
                 Range: [2019,2020]                   Units: 1
         Unique values: 2                         Missing .: 0/6,279
            Tabulation: Freq.  Value
                        3,193  2019
                        3,086  2020

. codebook stcd

-------------------------------------------------------------------------------------------------------------------------
stcd                                                                                                      AHA State Code
-------------------------------------------------------------------------------------------------------------------------
```

```
                  Type: Numeric (double)
                 Label: stcdlabel
                 Range: [11,95]                       Units: 1
         Unique values: 51                         Missing .: 0/6,279
              Examples: 36    North Carolina
                        44    Michigan
                        63    Missouri
                        74    Texas

. codebook genbd
-------------------------------------------------------------------------------------------------------------------
genbd                                                                  General medical and surgical (adult) beds
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)
                 Range: [0,1407]                      Units: 1
         Unique values: 522                        Missing .: 0/6,279
                  Mean: 103.364
             Std. dev.: 123.649
           Percentiles:     10%       25%       50%       75%       90%
                             10        21        57       144       254

. codebook pedbd
-------------------------------------------------------------------------------------------------------------------
pedbd                                                                  General medical and surgical (pediatric) beds
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)
                 Range: [0,355]                       Units: 1
```

```
         Unique values: 142                       Missing .: 0/6,279

                  Mean: 7.37554

             Std. dev.: 23.6375

           Percentiles:     10%       25%       50%       75%       90%

                              0         0         0         6        18
```

```
. codebook obbd
```

```
-------------------------------------------------------------------------------------------------------------------------
obbd                                                                                                Obstetric care beds
-------------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)

                 Range: [0,243]                       Units: 1

         Unique values: 126                       Missing .: 0/6,279

                  Mean: 15.2887

             Std. dev.: 20.3533

           Percentiles:     10%       25%       50%       75%       90%

                              0         0         9        22        39
```

```
. codebook msicbd
```

```
-------------------------------------------------------------------------------------------------------------------------
msicbd                                                                                Medical/surgical intensive care beds
-------------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)

                 Range: [0,218]                       Units: 1

         Unique values: 126                       Missing .: 0/6,279

                  Mean: 14.7551

             Std. dev.: 19.4175
```

```
           Percentiles:     10%       25%       50%       75%       90%
                             0         2         9        20        36

. codebook cicbd

-------------------------------------------------------------------------------------------------------------------
cicbd                                                                                  Cardiac intensive care beds
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)
                 Range: [0,154]                       Units: 1
         Unique values: 72                         Missing .: 0/6,279
                  Mean: 4.44498
             Std. dev.:  10.685
           Percentiles:     10%       25%       50%       75%       90%
                             0         0         0         4        16

. codebook nicbd

-------------------------------------------------------------------------------------------------------------------
nicbd                                                                                  Neonatal intensive care beds
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)
                 Range: [0,253]                       Units: 1
         Unique values: 104                        Missing .: 0/6,279
                  Mean: 7.20019
             Std. dev.:  16.834
           Percentiles:     10%       25%       50%       75%       90%
                             0         0         0         6        26

. codebook nintbd
```

```
-------------------------------------------------------------------------------------------------------------------
nintbd                                                                          Neonatal intermediate care beds
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)

                 Range: [0,154]                       Units: 1

         Unique values: 63                        Missing .: 0/6,279

                  Mean: 2.13696

             Std. dev.: 7.36588

           Percentiles:     10%       25%       50%       75%       90%

                              0         0         0         0         8

. codebook pedicbd

-------------------------------------------------------------------------------------------------------------------
pedicbd                                                                        Pediatric intensive care beds
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)

                 Range: [0,120]                       Units: 1

         Unique values: 57                        Missing .: 0/6,279

                  Mean: 1.61666

             Std. dev.: 6.74824

           Percentiles:     10%       25%       50%       75%       90%

                              0         0         0         0         1

. codebook brnbd

-------------------------------------------------------------------------------------------------------------------
brnbd                                                                                          Burn care beds
-------------------------------------------------------------------------------------------------------------------
```

```
                  Type: Numeric (double)
                 Range: [0,70]                        Units: 1
         Unique values: 31                         Missing .: 0/6,279
                  Mean: .392419
             Std. dev.: 2.59742
           Percentiles:     10%       25%       50%       75%       90%
                              0         0         0         0         0
```

```
. codebook spcicbd
```

```
-------------------------------------------------------------------------------------------------------------------
spcicbd                                                                                  Beds-Other Special Care
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)
                 Range: [0,1205]                      Units: 1
         Unique values: 158                        Missing .: 0/6,279
                  Mean: 8.28046
             Std. dev.: 35.4968
           Percentiles:     10%       25%       50%       75%       90%
                              0         0         0         0        22
```

```
. codebook othicbd
```

```
-------------------------------------------------------------------------------------------------------------------
othicbd                                                                          Other intensive care beds
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)
                 Range: [0,122]                       Units: 1
         Unique values: 69                         Missing .: 0/6,279
```

```
                  Mean: 2.38191
             Std. dev.: 8.47258
           Percentiles:     10%       25%       50%       75%       90%
                              0         0         0         0         8
```

```
. codebook rehabbd
```

```
-------------------------------------------------------------------------------------------------------------------------
rehabbd                                                                                 Physical Rehabilitation care beds
-------------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)
                 Range: [0,120]                       Units: 1
         Unique values: 84                        Missing .: 0/6,279
                  Mean: 5.40564
             Std. dev.: 12.9159
           Percentiles:     10%       25%       50%       75%       90%
                              0         0         0         0        20
```

```
. codebook alchbd
```

```
-------------------------------------------------------------------------------------------------------------------------
alchbd                                                                  Alcohol/drug abuse or dependency inpatient care beds
-------------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)
                 Range: [0,185]                       Units: 1
         Unique values: 65                        Missing .: 0/6,279
                  Mean: 1.80602
             Std. dev.: 8.55907
```

```
           Percentiles:     10%       25%       50%       75%       90%
                              0         0         0         0         0

. codebook psybd

-------------------------------------------------------------------------------------------------------------------
psybd                                                                                    Psychiatric care beds
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)
                 Range: [0,827]                       Units: 1
         Unique values: 171                       Missing .: 0/6,279
                  Mean: 14.2496
             Std. dev.: 32.8706
           Percentiles:     10%       25%       50%       75%       90%
                              0         0         0        19        44

. codebook snbd88

-------------------------------------------------------------------------------------------------------------------
snbd88                                                                                  Skilled nursing care beds
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)
                 Range: [0,702]                       Units: 1
         Unique values: 166                       Missing .: 0/6,279
                  Mean:  9.5262
             Std. dev.: 34.9606
           Percentiles:     10%       25%       50%       75%       90%
                              0         0         0         0        25

. codebook icfbd88
```

```
-------------------------------------------------------------------------------------------------------------------
icfbd88                                                                          Intermediate nursing care beds
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)

                 Range: [0,1209]                      Units: 1

         Unique values: 91                         Missing .: 0/6,279

                  Mean: 2.55694

             Std. dev.: 25.0555

           Percentiles:     10%       25%       50%       75%       90%

                              0         0         0         0         0

. codebook acultbd

-------------------------------------------------------------------------------------------------------------------
acultbd                                                                      Acute long term care beds
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)

                 Range: [0,201]                       Units: 1

         Unique values: 57                         Missing .: 0/6,279

                  Mean: .859532

             Std. dev.: 7.94758

           Percentiles:     10%       25%       50%       75%       90%

                              0         0         0         0         0

. codebook othlbd94

-------------------------------------------------------------------------------------------------------------------
othlbd94                                                                     Other long-term care beds
-------------------------------------------------------------------------------------------------------------------
```

```
                  Type: Numeric (double)
                 Range: [0,625]                       Units: 1
         Unique values: 65                         Missing .: 0/6,279
                  Mean:  1.7025
             Std. dev.: 17.2158
           Percentiles:     10%       25%       50%       75%       90%
                              0         0         0         0         0

. codebook hospbd
-------------------------------------------------------------------------------------------------------------------
hospbd                                                                                    Total hospital beds
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)
                 Range: [5,3890]                      Units: 1
         Unique values: 810                        Missing .: 0/6,279
                  Mean: 205.239
             Std. dev.: 232.603
           Percentiles:     10%       25%       50%       75%       90%
                             25        52       129       277       475

. codebook ipdtot
-------------------------------------------------------------------------------------------------------------------
ipdtot                                                                          Total facility inpatient days
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)
                 Range: [28,775202]                   Units: 1
         Unique values: 6,011                      Missing .: 0/6,279
```

```
                  Mean: 48222.4
             Std. dev.: 63270.8
           Percentiles:     10%       25%       50%       75%       90%
                           2866      8118     26800     63338    117683

. codebook admh
-------------------------------------------------------------------------------------------------------------------------------
admh                                                                                                 Hospital Unit Admissions
-------------------------------------------------------------------------------------------------------------------------------
                  Type: Numeric (double)
                 Range: [0,80879]                     Units: 1
         Unique values: 840                       Missing .: 5,344/6,279
                  Mean: 5895.29
             Std. dev.: 9932.81
           Percentiles:     10%       25%       50%       75%       90%
                           174       431      1440      6554     18013

. *** hospital unit admissions can be dropped
. drop admh
. codebook ipdh
-------------------------------------------------------------------------------------------------------------------------------
ipdh                                                                                       Hospital unit inpatient days
-------------------------------------------------------------------------------------------------------------------------------
                  Type: Numeric (double)
                 Range: [10,447113]                   Units: 1
         Unique values: 916                       Missing .: 5,344/6,279
                  Mean: 31081.9
```

```
             Std. dev.: 55868.5
           Percentiles:     10%       25%       50%       75%       90%
                           1060      2318      7237     32074     93065
. *** individual hospital unit inpatient days can be dropped
. drop ipdh
. codebook suroptot
-------------------------------------------------------------------------------------------------------------------------
suroptot                                                                                  Total surgical operations
-------------------------------------------------------------------------------------------------------------------------
                  Type: Numeric (double)
                 Range: [0,171020]                    Units: 1
         Unique values: 4,770                      Missing .: 0/6,279
                  Mean: 7074.04
             Std. dev.: 9913.84
           Percentiles:     10%       25%       50%       75%       90%
                            157      1365      4135      9142     16996
. codebook opra
-------------------------------------------------------------------------------------------------------------------------
opra                                                                                      Number of Operating Rooms
-------------------------------------------------------------------------------------------------------------------------
                  Type: Numeric (double)
                 Range: [0,230]                       Units: 1
         Unique values: 93                         Missing .: 251/6,279
                  Mean: 11.1619
             Std. dev.: 13.7653
```

```
           Percentiles:     10%       25%       50%       75%       90%
                              1         3         7        14        25

. di 251/6279
.03997452
. *** = 0.03997452 so about 4% of the data for number of operating rooms is missing; listwise deletion OK
. codebook vem
-------------------------------------------------------------------------------------------------------------------------
vem                                                                                          Emergency room visits
-------------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)
                 Range: [0,594079]                   Units: 1
         Unique values: 5,638                        Missing .: 0/6,279
                  Mean: 34761.7
             Std. dev.: 37097.1
           Percentiles:     10%       25%       50%       75%       90%
                           1717      9098     25181     49337     77952

. codebook voth
-------------------------------------------------------------------------------------------------------------------------
voth                                                                                        Other outpatient visits
-------------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)
                 Range: [0,7969388]                  Units: 1
         Unique values: 6,087                        Missing .: 0/6,279
                  Mean: 173569
             Std. dev.: 310895
```

```
           Percentiles:    10%       25%       50%       75%       90%
                          11154     30229     73603    190399    421927

. codebook vtot

-------------------------------------------------------------------------------------------------------------------
vtot                                                                                  Total outpatient visits
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)
                 Range: [0,8091607]                   Units: 1
         Unique values: 6,104                      Missing .: 0/6,279
                  Mean: 208331
             Std. dev.: 329885
           Percentiles:    10%       25%       50%       75%       90%
                          18346     46801    104378    236042    496461

. codebook gfeet

-------------------------------------------------------------------------------------------------------------------
gfeet                                                                 Total gross square feet of your physical plant
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)
                 Range: [1569,14129002]               Units: 1
         Unique values: 3,594                      Missing .: 1,079/6,279
                  Mean:  649391
             Std. dev.:  999163
           Percentiles:     10%       25%       50%       75%       90%
                         70616.5    133695    339405    769313   1.5e+06

. di 1079/6279
```

```
.17184265

. *** = 0.17184265 so about 17% of the data for total gross square feet of your physical plant is missing; listwise
deletion NOT OK

. *** data from gfeet not MCAR because some missing gfeet observations line up with missing opra observations

. drop if opra==. & gfeet==.

(211 observations deleted)

. codebook opra

-------------------------------------------------------------------------------------------------------------------------
opra                                                                                    Number of Operating Rooms
-------------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)

                 Range: [0,230]                       Units: 1

         Unique values: 93                        Missing .: 40/6,068

                  Mean: 11.1619

             Std. dev.: 13.7653

           Percentiles:     10%       25%       50%       75%       90%

                             1         3         7        14        25

. codebook gfeet

-------------------------------------------------------------------------------------------------------------------------
gfeet                                                                  Total gross square feet of your physical plant
-------------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)

                 Range: [1569,14129002]               Units: 1

         Unique values: 3,594                     Missing .: 868/6,068

                  Mean:  649391
```

```
              Std. dev.:  999163

            Percentiles:     10%       25%       50%       75%       90%
                          70616.5    133695    339405    769313   1.5e+06

. di 868/6068

.14304548

. *** = 0.14304548 so about 14% of the data for total gross square feet of your physical plant is missing; listwise
deletion NOT OK

. codebook adjadm

-------------------------------------------------------------------------------------------------------------------------
adjadm                                                                                          Adjusted Admissions
-------------------------------------------------------------------------------------------------------------------------

                   Type: Numeric (double)


                  Range: [5,249140]                    Units: 1
          Unique values: 5,587                         Missing .: 0/6,068
                   Mean: 19010.1
             Std. dev.: 20710.2
            Percentiles:     10%       25%       50%       75%       90%
                             1996      4851   12600.5     25951     43748

. codebook eipdtot

-------------------------------------------------------------------------------------------------------------------------
eipdtot                                                                    (Estimation Flag) Inpatient Days
-------------------------------------------------------------------------------------------------------------------------

                   Type: Numeric (double)
                  Range: [0,2]                         Units: 1
```

```
         Unique values: 2                         Missing .: 0/6,068

            Tabulation: Freq.  Value
                        6,056  0
                           12  2

. codebook eadmh

-------------------------------------------------------------------------------------------------------------------------
eadmh                                                                                (Est Flag) Hospital Unit Admissions
-------------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)
                 Range: [0,2]                          Units: 1
         Unique values: 2                         Missing .: 0/6,068
            Tabulation: Freq.  Value
                        6,067  0
                            1  2

. codebook eipdh

-------------------------------------------------------------------------------------------------------------------------
eipdh                                                                  (Estimation Flag) Hospital Unit Inpatient Days
-------------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)
                 Range: [0,2]                          Units: 1
         Unique values: 2                         Missing .: 0/6,068
            Tabulation: Freq.  Value
                        6,067  0
                            1  2
```

```
. codebook esuropto
-------------------------------------------------------------------------------------------------------------------
esuropto                                                        (Estimation Flag) Surgical Operations Total
-------------------------------------------------------------------------------------------------------------------

                 Type: Numeric (double)

                Range: [0,2]                          Units: 1

        Unique values: 3                      Missing .: 0/6,068

           Tabulation: Freq.  Value
                       5,823  0
                         235  1
                          10  2

. codebook evtot
-------------------------------------------------------------------------------------------------------------------
evtot                                                             (Estimation Flag) Outpatient Visits Total
-------------------------------------------------------------------------------------------------------------------

                 Type: Numeric (double)

                Range: [0,2]                          Units: 1

        Unique values: 3                      Missing .: 0/6,068

           Tabulation: Freq.  Value
                       5,868  0
                         189  1
                          11  2

. codebook mapp20
-------------------------------------------------------------------------------------------------------------------
mapp20                                                                          Sole Community Provider
```

```
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)

                 Label: mapp20label

                 Range: [1,2]                          Units: 1

         Unique values: 2                          Missing .: 0/6,068

            Tabulation: Freq.   Numeric  Label

                          440         1  Yes

                        5,628         2  No

. codebook vtotl

-------------------------------------------------------------------------------------------------------------------

vtotl                                                                    Total facility personnel - vacancies

-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)

                 Range: [0,3503]                       Units: 1

         Unique values: 604                        Missing .: 1,640/6,068

                  Mean: 126.241

             Std. dev.:  244.12

           Percentiles:     10%       25%       50%       75%       90%

                              1        14        50       139       299

. *** total facility personnel - vacancies, could be dropped because it was going to be used to help parse out whether
missing bed data was missing when it should have been 0 or missing when it was actually missing

. drop vtotl

. codebook tecar

-------------------------------------------------------------------------------------------------------------------
```

```
tecar                           Primary care (general practitioner, general internal medicine, family practice,
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)

                 Range: [0,889]                       Units: 1

         Unique values: 253                       Missing .: 898/6,068

                  Mean: 25.5242

             Std. dev.: 60.1886

           Percentiles:     10%       25%       50%       75%       90%

                              0         0         6        22        64
```

. *** primary care (general practitioner, general internal medicine, family practice), could be dropped because it was going to be used to help parse out whether missing bed data was missing when it should have been 0 or missing when it was actually missing

. drop tecar

. codebook tetot

```
-------------------------------------------------------------------------------------------------------------------
tetot                                                                                 Total - Total Employed
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (double)

                 Range: [0,5562]                      Units: 1

         Unique values: 695                       Missing .: 898/6,068

                  Mean: 130.883

             Std. dev.: 316.268

           Percentiles:     10%       25%       50%       75%       90%

                              0         2        22       121       334
```

```
. *** total employed can be dropped because it was going to be used to help parse out whether missing bed data was missing
when it should have been 0 or missing when it was missing; but it ended up not being necessary

. drop tetot

. drop teob

. codebook state

-------------------------------------------------------------------------------------------------------------------------
state                                                                                                       (unlabeled)
-------------------------------------------------------------------------------------------------------------------------

                  Type: String (str20)

         Unique values: 51                        Missing "": 0/6,068

              Examples: "Georgie"
                        "Massachusetts"
                        "New York"
                        "Tennessee"

               Warning: Variable has embedded blanks.

. codebook death

-------------------------------------------------------------------------------------------------------------------------
death                                                                                                       (unlabeled)
-------------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (int)

                 Range: [136,30040]                   Units: 1

         Unique values: 51                        Missing .: 0/6,068

                  Mean: 11818.7

             Std. dev.: 9568.06

           Percentiles:     10%       25%       50%       75%       90%
```

```
                          1488      3891      7488     19042     27437

. codebook hospitalizations

-------------------------------------------------------------------------------------------------------------------
hospitalizations                                                                                      (unlabeled)
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (long)
                 Range: [44,63741]                    Units: 1
         Unique values: 51                         Missing .: 0/6,068
                  Mean: 16288.7
             Std. dev.: 15168.3
           Percentiles:     10%       25%       50%       75%       90%
                            2069      5220     12268     21449     38334

. codebook cases

-------------------------------------------------------------------------------------------------------------------
cases                                                                                                 (unlabeled)
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (long)
                 Range: [7412,2245379]                Units: 1
         Unique values: 51                         Missing .: 0/6,068
                  Mean: 713528
             Std. dev.: 620759
           Percentiles:    10%       25%       50%       75%       90%
                        142864    265262    520438    963389   1.8e+06

. codebook statepop

-------------------------------------------------------------------------------------------------------------------
```

```
statepop                                                                                                                state pop
-------------------------------------------------------------------------------------------------------------------------------
                  Type: Numeric (long)
                 Range: [576851,39538223]             Units: 1
         Unique values: 51                         Missing .: 0/6,068
                  Mean: 1.2e+07
             Std. dev.: 1.1e+07
           Percentiles:     10%       25%       50%       75%       90%
                         2.9e+06   4.2e+06   7.2e+06   1.3e+07   2.9e+07

. codebook year19
-------------------------------------------------------------------------------------------------------------------------------
year19                                                                                                                (unlabeled)
-------------------------------------------------------------------------------------------------------------------------------
                  Type: Numeric (float)
                 Range: [0,1]                          Units: 1
         Unique values: 2                          Missing .: 0/6,068
            Tabulation: Freq.  Value
                        3,100  0
                        2,968  1

. label define year19label 0 "2019" 1 "2020"

. label value year19 year19label

. codebook year19
-------------------------------------------------------------------------------------------------------------------------------
year19                                                                                                                (unlabeled)
-------------------------------------------------------------------------------------------------------------------------------
```

```
                 Type: Numeric (float)
                Label: year19label
                Range: [0,1]                         Units: 1
        Unique values: 2                          Missing .: 0/6,068
           Tabulation: Freq.   Numeric  Label
                       3,100         0  2019
                       2,968         1  2020

. codebook tag19
-------------------------------------------------------------------------------------------------------------------
tag19                                                                                                  tag(stcd)
-------------------------------------------------------------------------------------------------------------------

                 Type: Numeric (byte)
                Range: [0,1]                         Units: 1
        Unique values: 2                          Missing .: 0/6,068
           Tabulation: Freq.  Value
                       6,042  0
                          26  1

. codebook tag20
-------------------------------------------------------------------------------------------------------------------
tag20                                                                                                  tag(stcd)
-------------------------------------------------------------------------------------------------------------------

                 Type: Numeric (byte)
                Range: [0,1]                         Units: 1
        Unique values: 2                          Missing .: 0/6,068
           Tabulation: Freq.  Value
```

```
                        6,042  0
                           26  1

. codebook covbds19

-------------------------------------------------------------------------------------------------------------------
covbds19                                                                                            (unlabeled)
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (float)
                 Range: [0,1531]                      Units: 1
         Unique values: 500                        Missing .: 2,968/6,068
                  Mean: 124.463
             Std. dev.: 145.827
           Percentiles:     10%       25%       50%       75%       90%
                             15        25        73       172       302

. codebook covbds20

-------------------------------------------------------------------------------------------------------------------
covbds20                                                                                            (unlabeled)
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (float)
                 Range: [0,1666]                      Units: 1
         Unique values: 514                        Missing .: 3,100/6,068
                  Mean: 128.443
             Std. dev.: 151.815
           Percentiles:     10%       25%       50%       75%       90%
                             14        25        74       180       314

. codebook noncovbds19
```

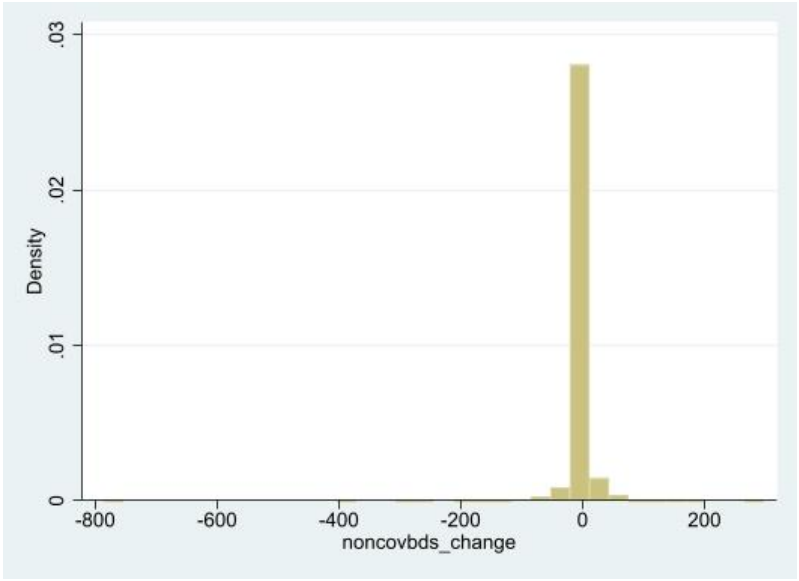
```
-------------------------------------------------------------------------------------------------------------------
noncovbds19                                                                                          (unlabeled)
-------------------------------------------------------------------------------------------------------------------

                 Type: Numeric (float)
                Range: [0,2493]                      Units: 1
        Unique values: 390                        Missing .: 2,968/6,068
                 Mean: 78.9642
            Std. dev.: 113.839

          Percentiles:     10%       25%       50%       75%       90%
                             2      10.5        44       102       196

. ***3086/6068 missing because there are 3193 hospitals for 2020

. codebook noncovbds20

-------------------------------------------------------------------------------------------------------------------
noncovbds20                                                                                          (unlabeled)
-------------------------------------------------------------------------------------------------------------------

                 Type: Numeric (float)
                Range: [0,1707]                      Units: 1
        Unique values: 381                        Missing .: 3,100/6,068
                 Mean: 79.2601
            Std. dev.: 110.128
          Percentiles:     10%       25%       50%       75%       90%
                             2        11        43       104       196

. *** 3193/6068 missing because there are 3086 hospitals for 2019

. codebook covsevcases
```

```
-------------------------------------------------------------------------------------------------------------------
covsevcases                                                                                          (unlabeled)
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (float)
                 Range: [.01152584,.11872123]         Units: 1.000e-09
         Unique values: 51                         Missing .: 3,100/6,068
                  Mean: .062241
             Std. dev.: .015388
           Percentiles:     10%       25%       50%       75%       90%
                            .048225   .053369   .060255   .073481   .075712

. *** 3193/6068 missing because COVID severity measures were not applied to 2019 hospitals

. codebook covsevhosp

-------------------------------------------------------------------------------------------------------------------
covsevhosp                                                                                           (unlabeled)
-------------------------------------------------------------------------------------------------------------------

                  Type: Numeric (float)
                 Range: [.00006842,.00680376]         Units: 1.000e-12
         Unique values: 51                         Missing .: 3,100/6,068
                  Mean: .002041
             Std. dev.: .001732
           Percentiles:     10%       25%       50%       75%       90%
                            .000377   .000444   .001891   .003249   .004312

. *** 3193/6068 missing because COVID severity measures were not applied to 2019 hospitals

. codebook covsevdeaths

-------------------------------------------------------------------------------------------------------------------
```

```
covsevdeaths                                                                                                    (unlabeled)
-------------------------------------------------------------------------------------------------------------------------
                  Type: Numeric (float)

                 Range: [.0001979,.00204995]          Units: 1.000e-11
         Unique values: 51                         Missing .: 3,100/6,068

                  Mean: .001029
             Std. dev.: .000371

           Percentiles:     10%       25%       50%       75%       90%
                         .000629   .000763   .000941   .001229   .001608
. *** 3193/6068 missing because COVID severity measures were not applied to 2019 hospitals
. ***6068 total values, not 6279 because drop if opra==. & gfeet==. deleted 211 observations
. gen year20 = year19==1
. codebook year20
-------------------------------------------------------------------------------------------------------------------------
year20                                                                                                          (unlabeled)
-------------------------------------------------------------------------------------------------------------------------
                  Type: Numeric (float)

                 Range: [0,1]                         Units: 1
         Unique values: 2                          Missing .: 0/6,068

            Tabulation: Freq.  Value
```

```
                        3,100  0

                        2,968  1

. drop if year19==. & year20==.

(0 observations deleted)

. ***Plan for Model 0 (before running diagnostics):

. **Outcome: Change in Non-COVID-19 Beds (noncovbds_change_tbc)

. **Predictors: COVID-19 Severity Measures (per State Population): Cases, Hospitalizations, Deaths

. **Controls: Total Facility Inpatient Days (ipdtot), Total Surgical Operations (suroptot), Number of Operating Rooms
(opra), Total Gross Square Feet of Physical Location (gfeet), Sole Community Provider Status(mapp20)

. ****ipdtot ///0 missing - suroptot ///0 missing - opra ///34/5496 missing - gfeet ///647/5496 missing: 11.7% - mapp20
///0 missing

. ##############

. ***Diagnostics

. **Normality Diagnostics: Outcome - Change in Non-COVID-19 Beds

. *** Need to keep pairs of hospitals and drop hospitals that only have one set of data (e.g., had too much missing data
for 2019, but enough for 2020 so there is only data for that hospital for 2020)

. duplicates report id

Duplicates in terms of id

--------------------------------------

   Copies | Observations       Surplus

----------+---------------------------

        1 |          572             0

        2 |         5496          2748

--------------------------------------

. duplicates tag id, generate(hosp_id_duplicates)

Duplicates in terms of id
```

```
. **hosp_id_duplicates = 1 if there is a second value for a hospital, and = 0 if there is only one value for a hospital
(e.g., the hospitals that don't have both 2019 and 2020 data)

. drop if hosp_id_duplicates==0

(572 observations deleted)

. gen noncovbds_change_try = 1, after(noncovbds20)

. replace noncovbds_change_try = noncovbds19 in 1/5496

(5,495 real changes made, 2,748 to missing)

. replace noncovbds_change_try=covbds20 if noncovbds_change_try==. in 1/5496

(2,748 real changes made)

. bysort id: gen noncovbds_change=cnonovbds_change_try-noncovbds_change_try[_n-1], after(noncovbds_change_try)

(2,748 missing values generated)


. ****generating variable for the change in beds not related to COVID-19 from 2019 to 2020

. gen noncovbds_change_try = noncovbds19 in 1/5496, after(noncovbds20)

(3,277 missing values generated)

. replace noncovbds_change_try=noncovbds20 if noncovbds_change_try==. in 1/5496

(2,705 real changes made)

. bysort id: gen noncovbds_change=noncovbds_change_try-noncovbds_change_try[_n-1], after(noncovbds_change_try)

(3,567 missing values generated)

. histogram noncovbds_change

(bin=33, start=-786, width=32.848485)
```



. graph box noncovbds_change

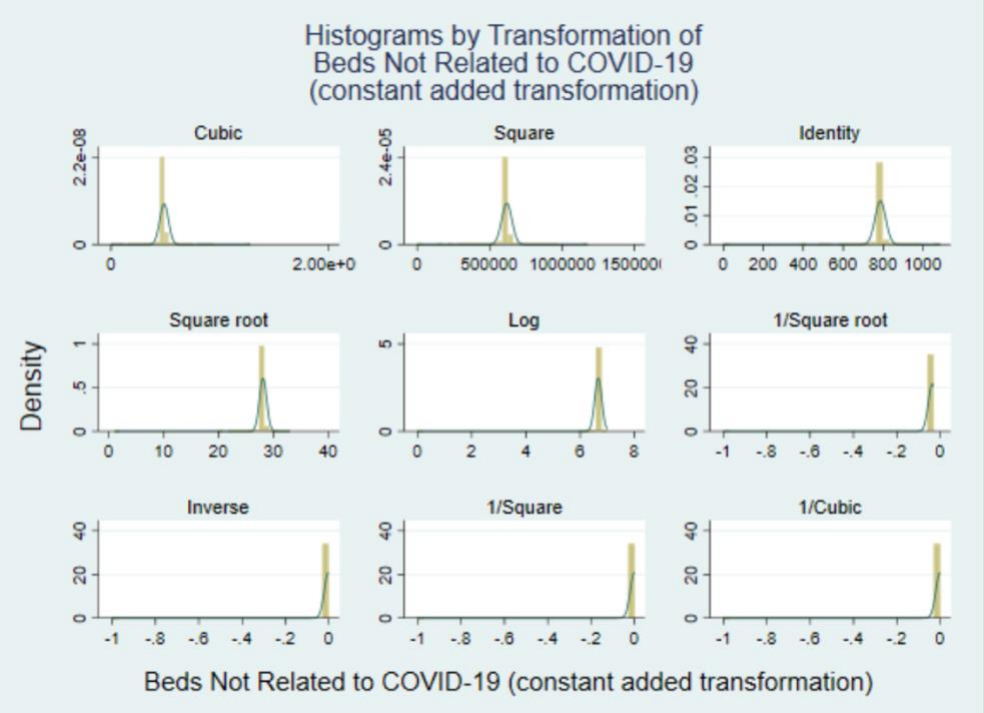
```
. sum noncovbds_change, detail

                      noncovbds_change
-------------------------------------------------------------
      Percentiles      Smallest
 1%          -67           -786
 5%          -18           -384
10%           -7           -305       Obs               2,501
25%            0           -255       Sum of wgt.       2,501

50%            0                      Mean           -.8480608
                        Largest       Std. dev.      27.06938
75%            0            156
90%            6            173       Variance       732.7513
95%           15            186       Skewness      -11.78663
99%           50            298       Kurtosis       326.8899
. *** 1%:-67, 5%:-18, 95%:15, 99%:50
. ********5% is actually -18 and 95% is actually 15*******
. ladder noncovbds_change
Transformation         Formula              chi2(2)  Prob > chi2
-----------------------------------------------------------------
Cubic                  nonco~ge^3                .           .
Square                 nonco~ge^2                .           .
Identity               nonco~ge                  .           .
Square root            sqrt(nonco~ge)            .           .
Log                    log(nonco~ge)             .           .
```

```
1/(Square root)        1/sqrt(nonco~ge)           .            .

Inverse                1/nonco~ge                 .            .

1/Square               1/(nonco~ge^2)             .            .

1/Cubic                1/(nonco~ge^3)             .            .

. **since noncovbds_change contains ZERO and NEGATIVE values, need to add constant to before looking at transformations
(and before top/bottom coding)

. sum noncovbds_change, detail

                     noncovbds_change

-------------------------------------------------------------

      Percentiles      Smallest

 1%          -68           -786

 5%          -18           -348

10%           -7           -305       Obs               2,748

25%            0           -255       Sum of wgt.       2,748

50%            0                      Mean          -.9574236

                        Largest       Std. dev.      26.64465

75%            0            156

90%            5            173       Variance       709.9374

95%           15            186       Skewness      -11.43115

99%           50            298       Kurtosis       318.7941


. gen noncovbds_change_cons=noncovbds_change+787

. ***trying noncovbds_change_cons=noncovbds_change-r(min)+1 just deleted all values (2,748 missing values generated)

. sum noncovbds_change_cons

------------------------------------------------------------------------------
```

```
       Variable |          Obs       Mean    Std. Dev.       Min        Max
----------------+---------------------------------------------------------------
noncovbds_~s  . |        2,748    786.0426    26.64465          1       1085
-------------------------------------------------------------------------------
```

```
. ladder noncovbds_change_cons
```

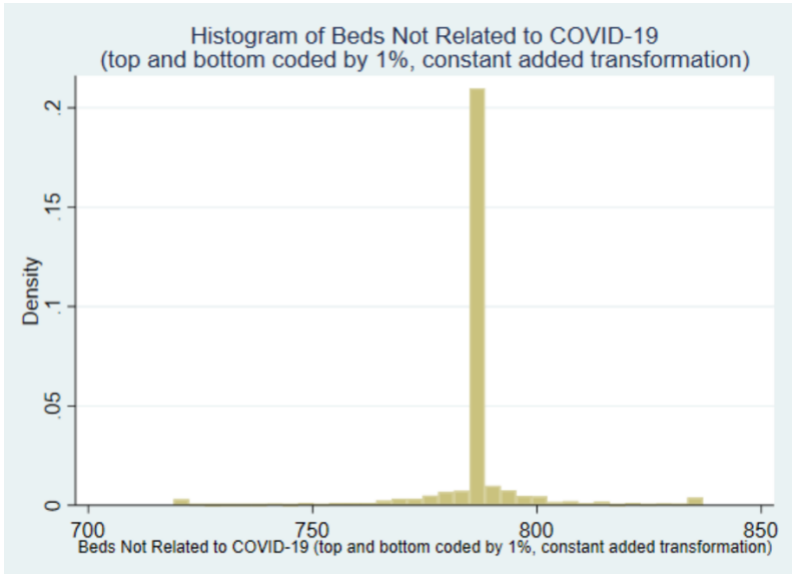
```
. gladder noncovbds_change_cons
```




```
. sum noncovbds_change_cons, detail
```

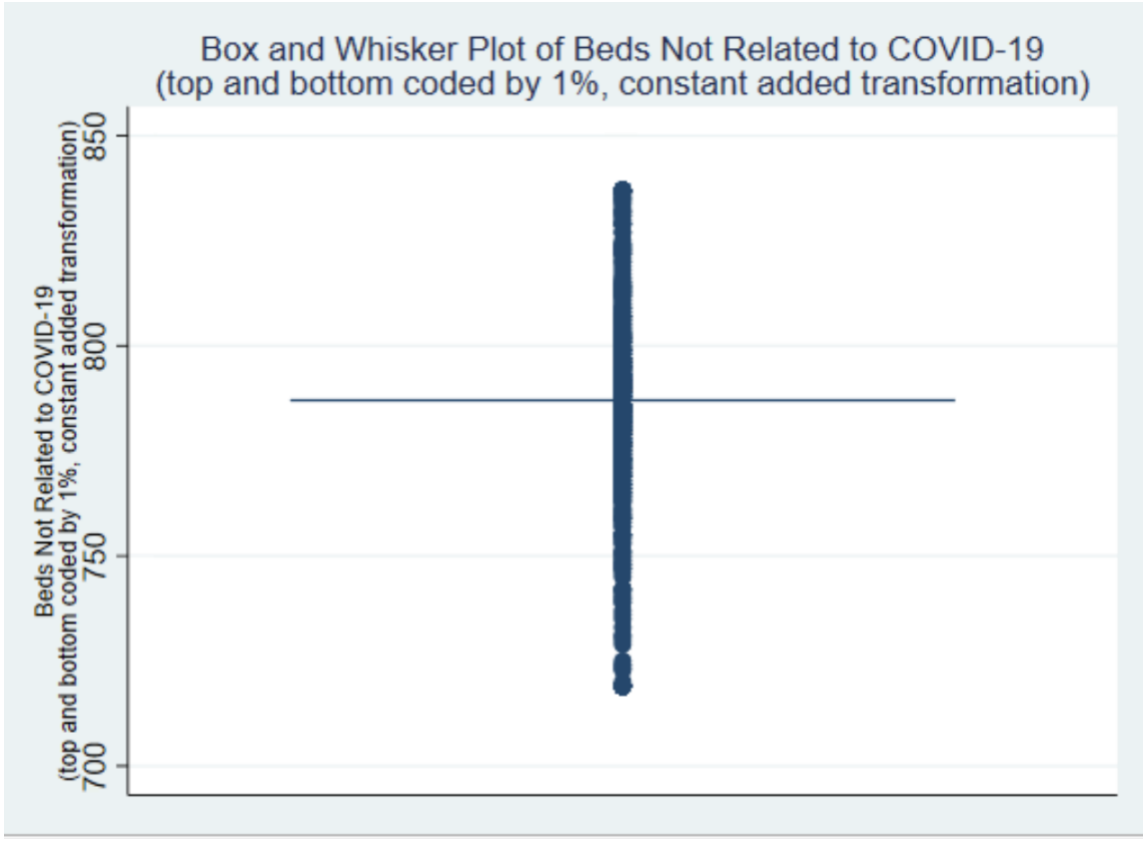
```
                    noncovbds_change_cons
-------------------------------------------------------------
      Percentiles      Smallest
```

```
 1%          719              1
 5%          769            403
10%          780            482       Obs                2,748
25%          787            532       Sum of wgt.        2,748
50%          787                      Mean           786.0426
                        Largest       Std. dev.      26.64465
75%           787            943
90%           792            960       Variance       709.9374
95%           802            973       Skewness      -11.43115
99%           837           1085       Kurtosis       318.7941

. ***1%:719, 5%:769, 95%:802, 99%:837
. gen noncovbds_change_cons_tbc1=clip(noncovbds_change_cons, 719, 837)
. hist noncovbds_change_cons_tbc1
(bin=34, start=719, width=3.4705882)
```



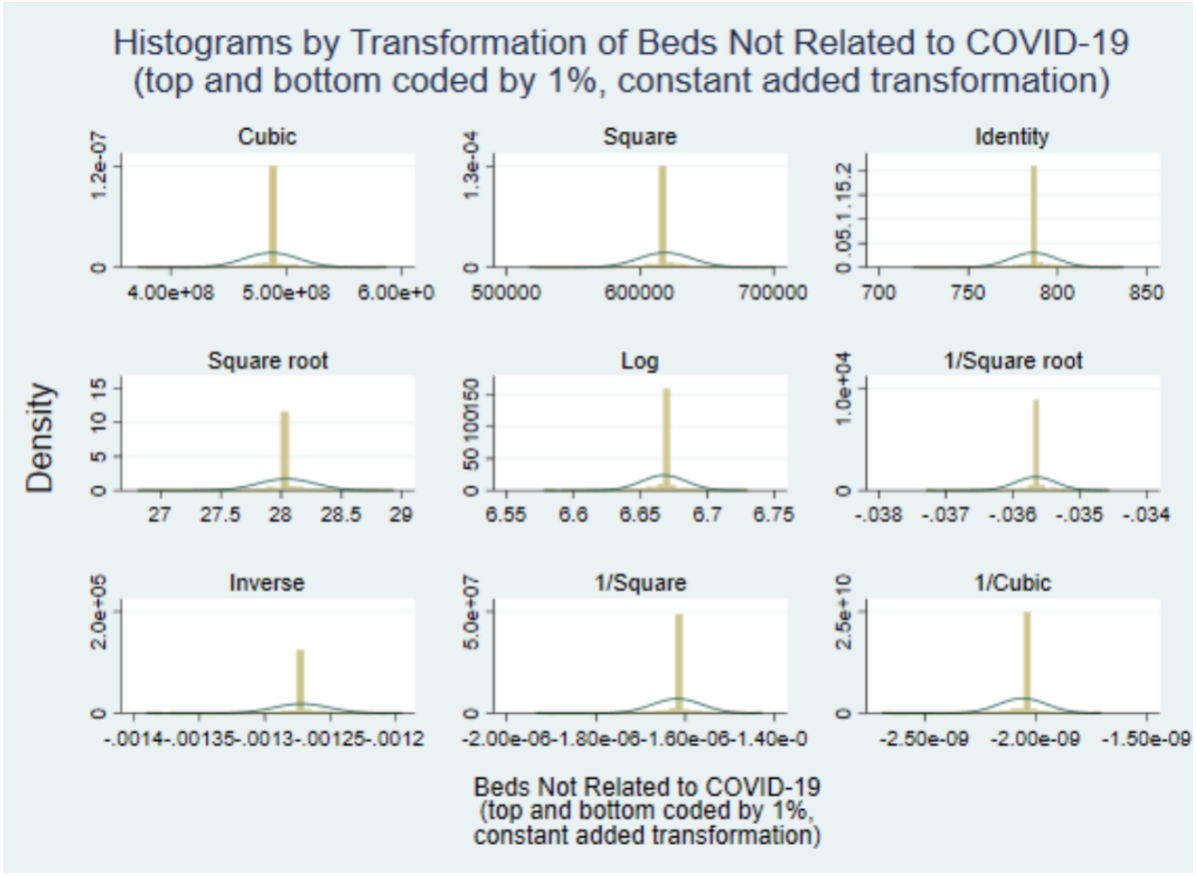
.

. graph box noncovbds_change_cons_tbc1



.

```
. gladder noncovbds_change_cons_tbc1
```



.

```
. ladder noncovbds_change_cons_tbc1

Transformation         Formula              chi2(2)   Prob > chi2
----------------------------------------------------------------
Cubic                  n~s_tbc1^3            486.99        0.000
Square                 n~s_tbc1^2            600.04        0.000
Identity               n~s_tbc1              730.33        0.000
Square root            sqrt(n~s_tbc1)        797.59        0.000
```

Log	log(n~s_tbc1)	864.92	0.000
1/(Square root)	1/sqrt(n~s_tbc1)	931.75	0.000
Inverse	1/n~s_tbc1	997.66	0.000
1/Square	1/(n~s_tbc1^2)	.	.
1/Cubic	1/(n~s_tbc1^3)	.	.

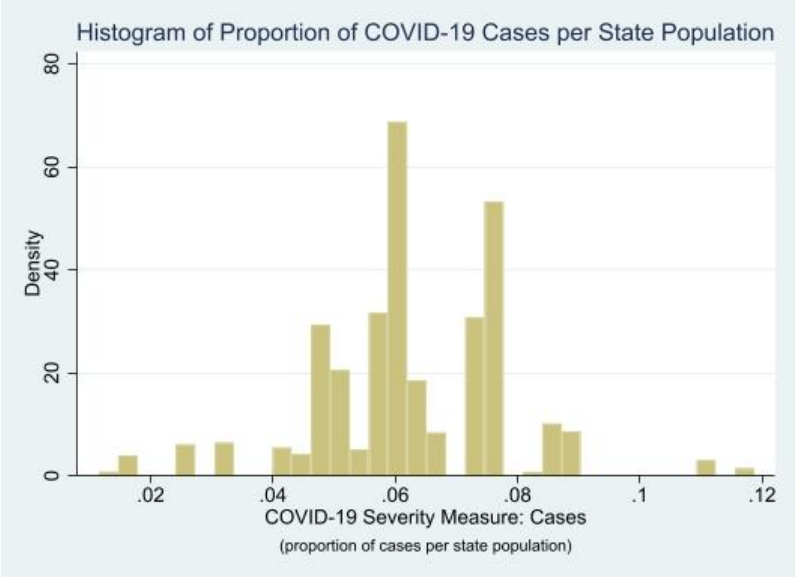
. ***after adding the constant to the data (shifting the negative and zero values to positive values), most of these transformations (including identity) could work, so I'm just going to leave it alone/pick identity

. ###############

. **Normality Diagnostics: Predictor - COVID Severity Measure: Case Count (covsevcases)

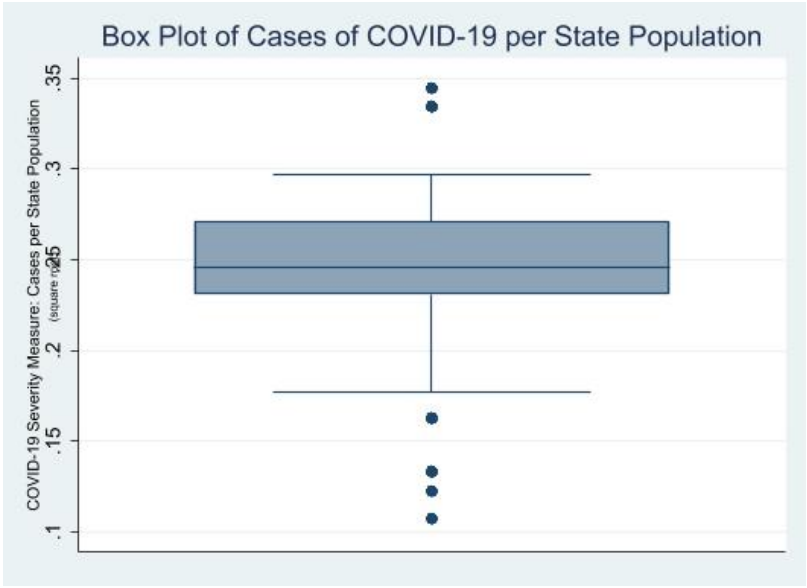
. hist covsevcases

(bin=34, start=.01152584, width=.00315281)



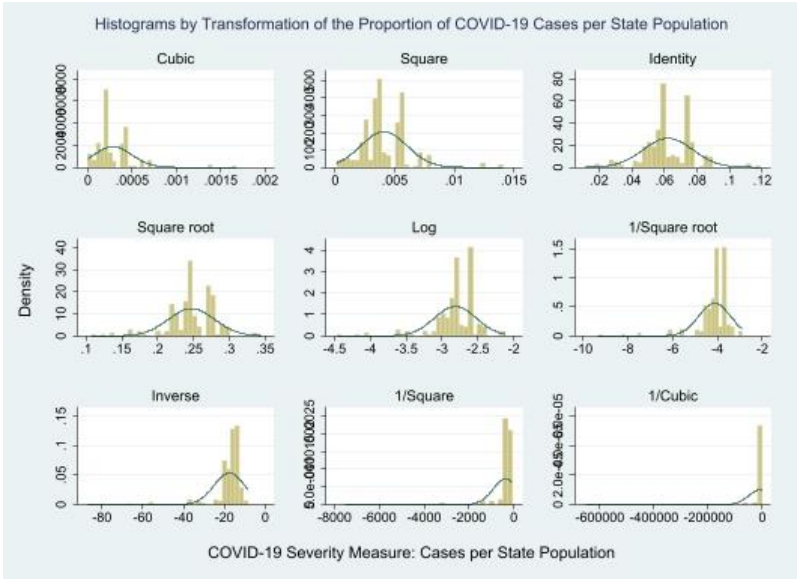
.

. graph box covsevcases



.

. gladder covsevcases

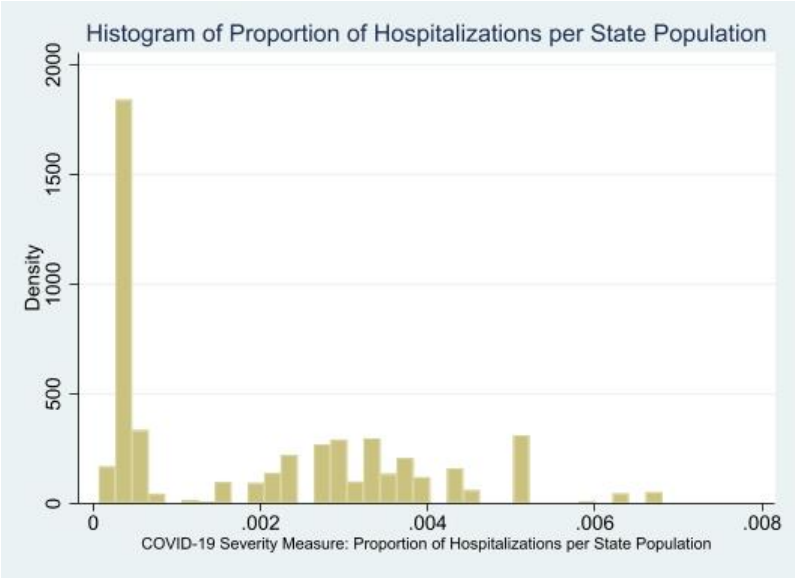


.

. ladder covsevcases

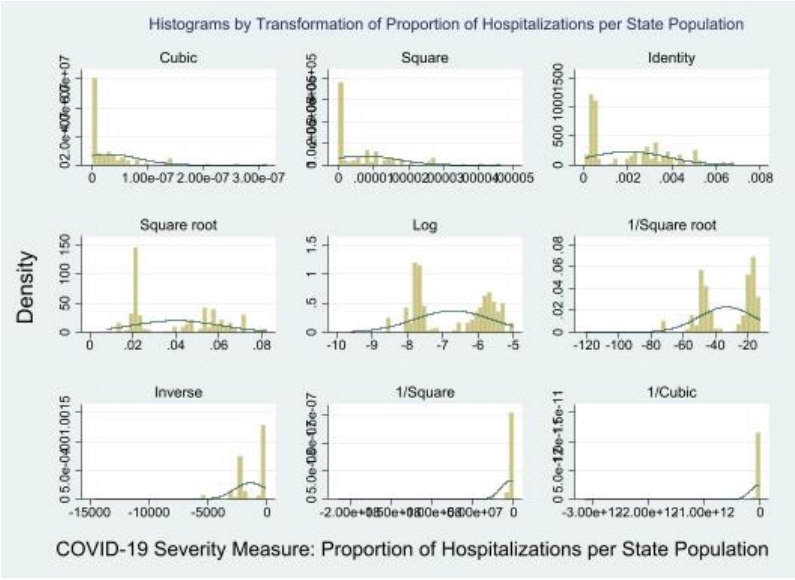
Transformation	Formula	chi2(2)	Prob > chi2
Cubic	covse~es^3	.	.
Square	covse~es^2	600.04	0.000
Identity	covse~es	730.33	0.000
Square root	sqrt(covse~es)	797.59	0.000
Log	log(covse~es)	864.92	0.000
1/(Square root)	1/sqrt(covse~es)	.	.
Inverse	1/covse~es	.	.
1/Square	1/(covse~es^2)	.	.
1/Cubic	1/(covse~es^3)	.	.

```
. *** most of these transformations (including identity) could work, so I'm just going to leave it alone/pick identity
. sum covsevcases, detail

                          covsevcasess
-------------------------------------------------------------
      Percentiles      Smallest
 1%      .017764       .0115258
 5%     .0319616       .0115258
10%     .0482254       .0115258       Obs               2,748
25%     .0533688       .0115258       Sum of wgt.       2,748
50%     .0602553                      Mean           .0621851
                        Largest       Std. dev.      .0151988
75%      .0734807       .1187212
90%      .0757121       .1187212       Variance        .000231
95%      .0849104       .1187212       Skewness      -.0359228
99%      .1118391       .1187212       Kurtosis        4.87203
. **covsevcases isn't skewed: -.0359228
. ***note: symmetrical range is -0.5 - 0.5, moderately skewed is 0.5 - 1 or -0.5 - -1, highly skewed is > 1 or < -1
. **covsevcases is appropriately symmetrical: 4.87203
. ***note: acceptable range for kurtosis is between -3 and 3, appropriate range is between -10 and 10
. **don't necessarily need to top/bottom code
. ###############
. **Normality Diagnostics: Predictor - COVID Severity Measure: Hospitalization Count (covsevhosp)
. hist covsevhosp
(bin=34, start=.00006842, width=.0001981)
```



.

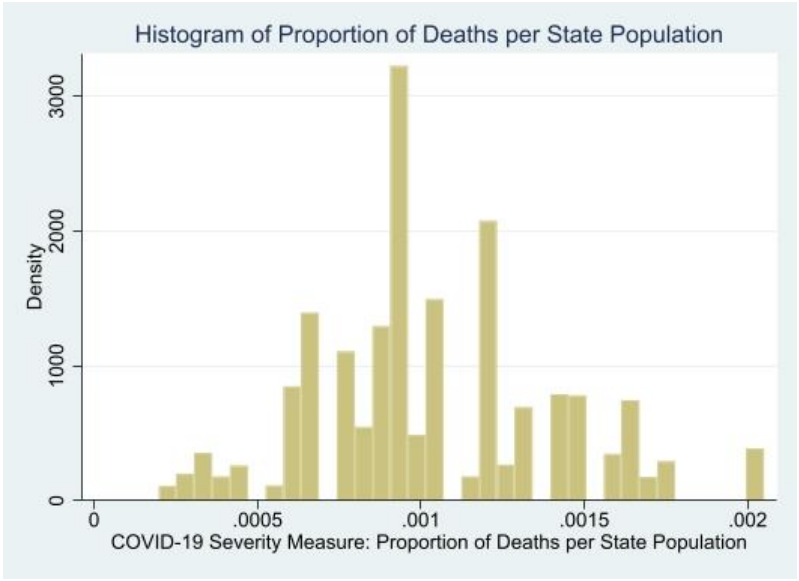
. gladder covsevhosp



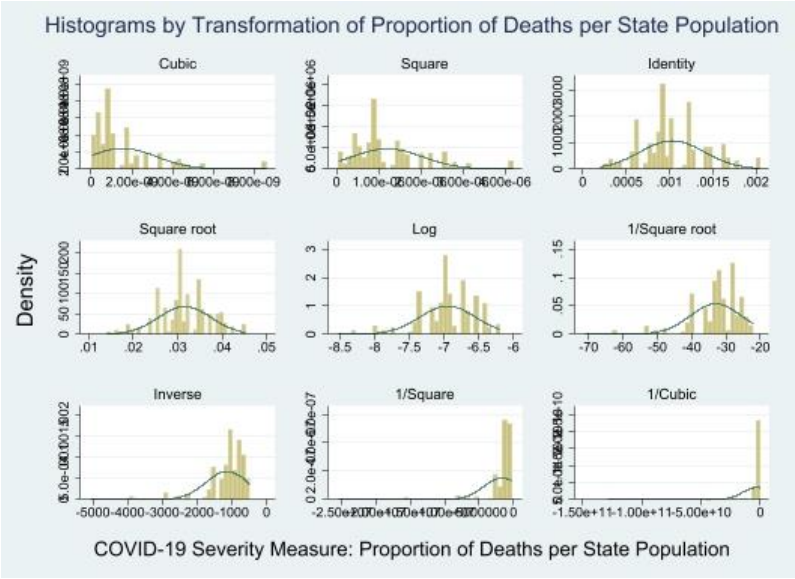
.

```
. ladder covsevhosp

Transformation         Formula              chi2(2)  Prob > chi2
----------------------------------------------------------------
Cubic                  covsev~p^3                 .            .
Square                 covsev~p^2            729.28        0.000
Identity               covsev~p               231.49        0.000
Square root            sqrt(covsev~p)             .            .
Log                    log(covsev~p)              .            .
1/(Square root)        1/sqrt(covsev~p)       141.26        0.000
Inverse                1/covsev~p                 .            .
1/Square               1/(covsev~p^2)             .            .
1/Cubic                1/(covsev~p^3)             .            .
. *** most of these transformations (including identity) could work, so I'm just going to leave it alone/pick identity
. sum covsevhosp, detail

                        covsevhosp
-------------------------------------------------------------
      Percentiles      Smallest
 1%     .0001881       .0000684
 5%     .0003366       .0000684
10%     .0003774       .0000684       Obs               2,748
25%     .0004293       .0000684       Sum of wgt.       2,748
50%      .001891                      Mean           .0020162
                        Largest       Std. dev.      .0017369
75%     .0032488       .0068038
90%      .004312       .0068038       Variance       3.02e-06
```

```
95%     .0051579       .0068038       Skewness        .646084
99%     .0068038       .0068038       Kurtosis       2.325881
. ***1%:.0001881, 5%:.0003366, 95%:.0051579, 99%:.0068038
. **covsevhosp is acceptably symmetrical: 2.325881
. **covsevhosp is moderately skewed: .646084
. ###############
**Normality Diagnostics: Predictor - COVID Severity Measure: Death Count (covsevdeaths)
. hist covsevdeaths
(bin=34, start=.0001979, width=.00005447)
```




```
.
. gladder covsevdeaths
```

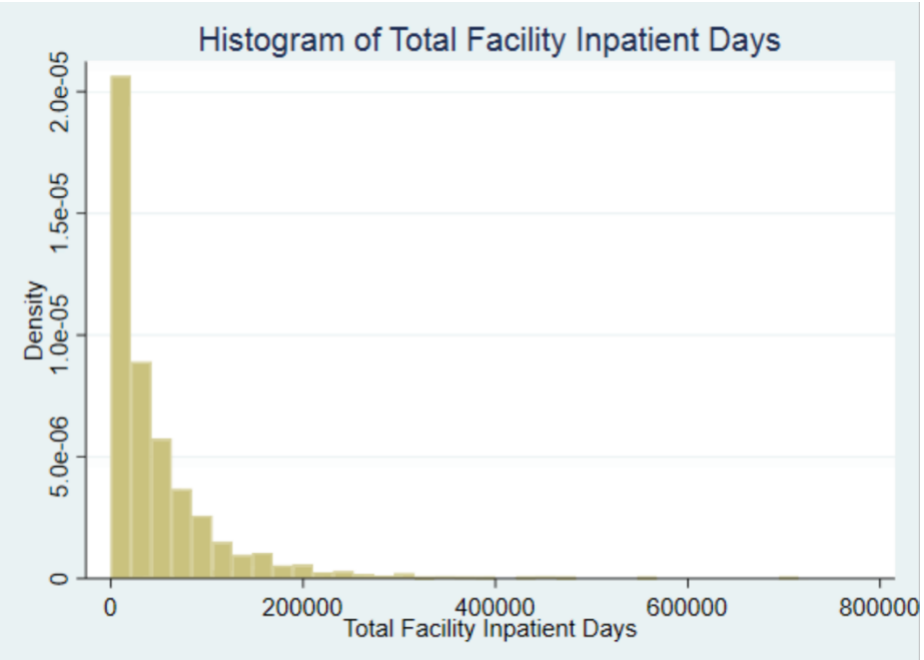


.

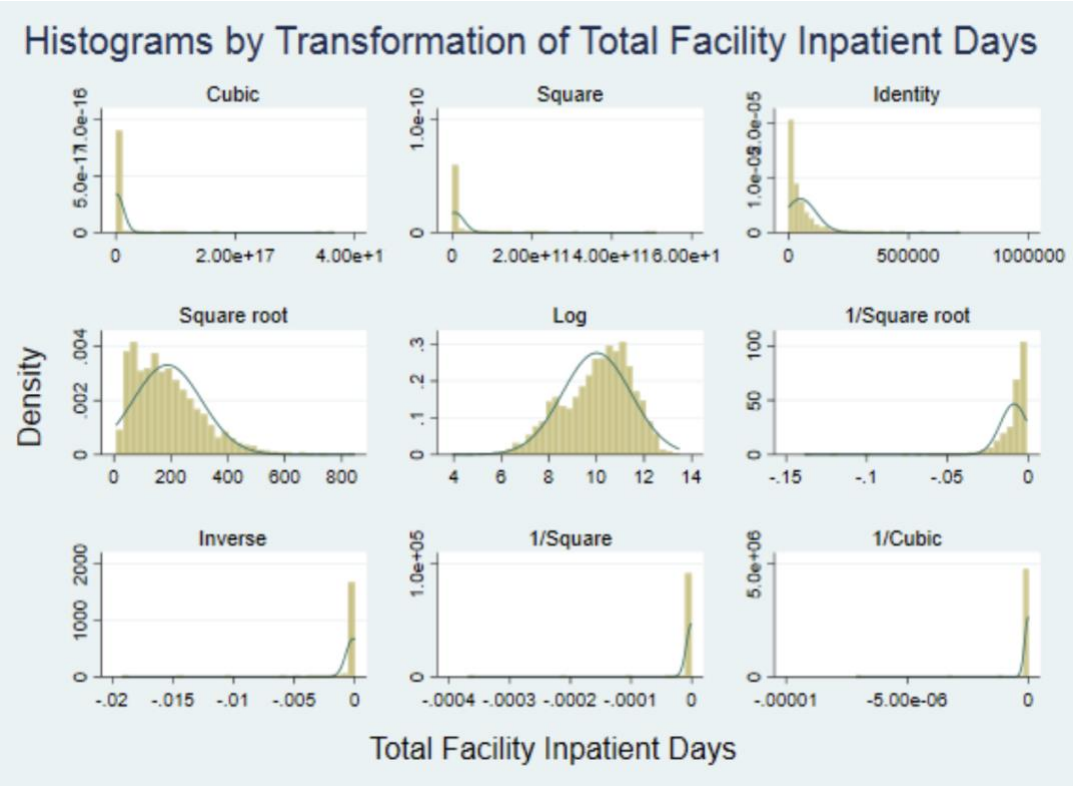
. ladder covsevdeaths

Transformation	Formula	chi2(2)	Prob > chi2
Cubic	covse~hs^3	967.80	0.000
Square	covse~hs^2	494.10	0.000
Identity	covse~hs	58.36	0.000
Square root	sqrt(covse~hs)	20.21	0.000
Log	log(covse~hs)	321.56	0.000
1/(Square root)	1/sqrt(covse~hs)	854.64	0.000
Inverse	1/covse~hs	.	.
1/Square	1/(covse~hs^2)	.	.
1/Cubic	1/(covse~hs^3)	.	.

```
. *** most of these transformations (including identity) could work, so I'm just going to leave it alone/pick identity
. ##############
**Normality Diagnostics: Control/Predictor – Total Inpatient Facility Days (ipdtot)
. sum ipdtot,detail
                  Total facility inpatient days
-------------------------------------------------------------
      Percentiles      Smallest
 1%           657             52
 5%          1690             68
10%          2897             96       Obs               2,748
25%          8260            168       Sum of wgt.       2,748
50%       27630.5                      Mean           49540.22
                        Largest       Std. dev.      64383.19
75%         65094          482140
90%        121423          555529       Variance       4.15e+09
95%        171856          694941       Skewness       3.096994
99%        302147          715202       Kurtosis       18.71845
. ***1%:657, 5%:1690, 95%:171856, 99%:302147
. hist ipdtot
(bin=34, start=52, width=21033.824)
```

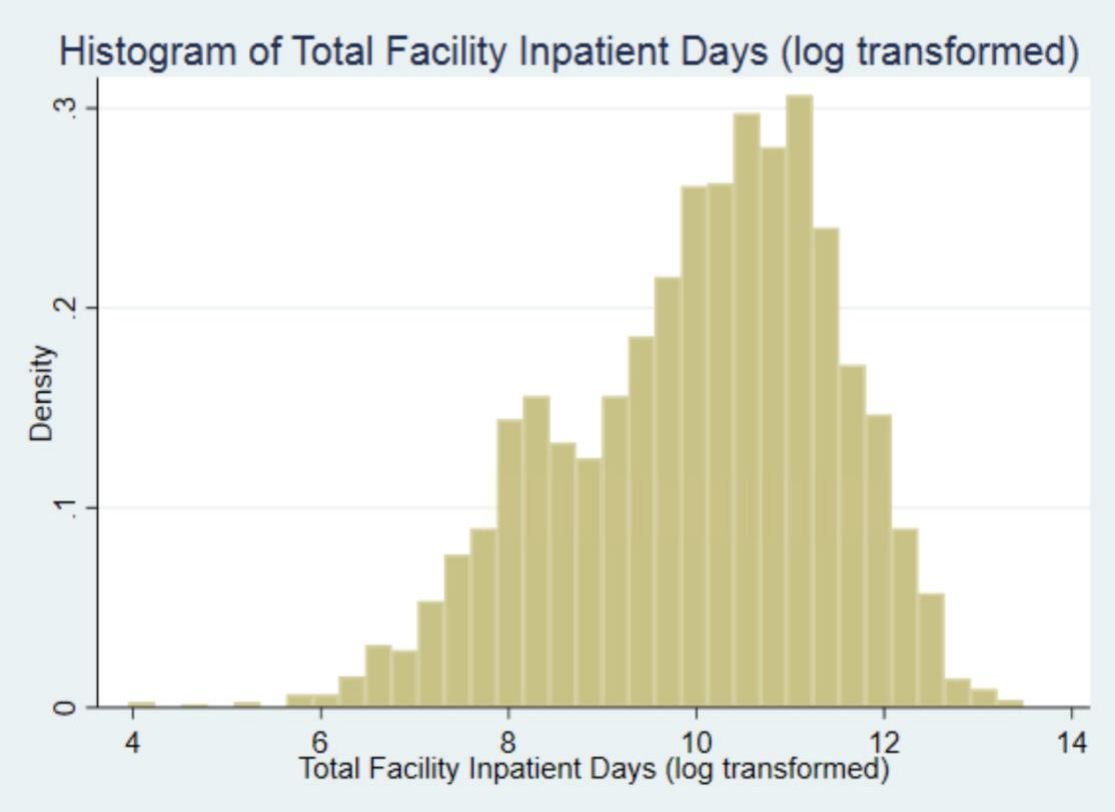



```
. gladder ipdtot
```



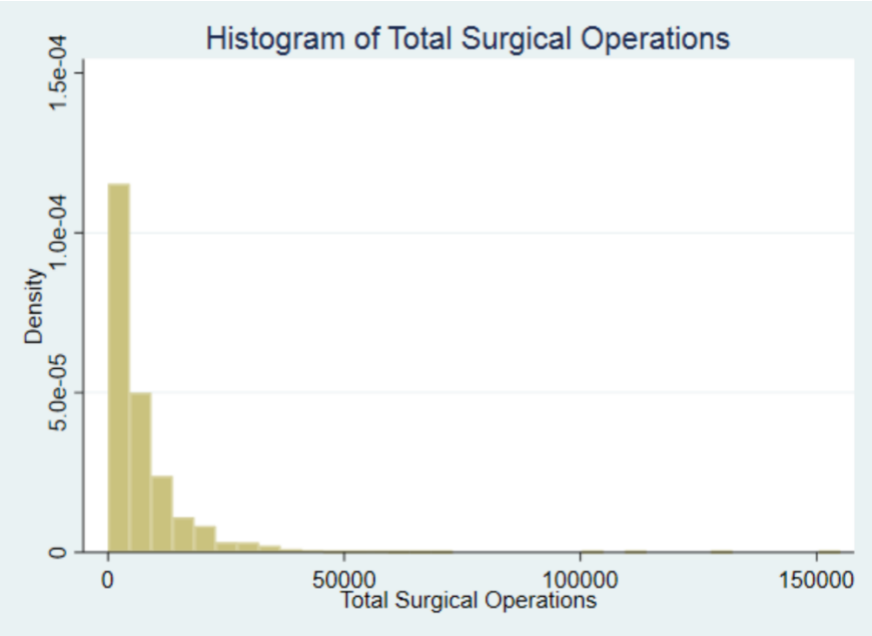

```
. ladder ipdtot

Transformation          Formula               chi2(2)   Prob > chi2
----------------------------------------------------------------------
Cubic                   ipdtot^3                    .            .
Square                  ipdtot^2                    .            .
Identity                ipdtot                      .            .
Square root             sqrt(ipdtot)           354.27        0.000
Log                     log(ipdtot)             88.11        0.000
1/(Square root)         1/sqrt(ipdtot)              .            .
```

```
Inverse                 1/ipdtot                .           .

1/Square                1/(ipdtot^2)            .           .

1/Cubic                 1/(ipdtot^3)            .           .

. ***log transformation makes the most sense

. gen ipdtot_log=log(ipdtot)

. hist ipdtot_log

(bin=34, start=3.9512436, width=.28026695)
```




```
. **normally distributed enough to not need top/bottom coding
```

```
. ** Variable name for opra after Normality Diagnostics: ipdtot_log
. ##############
**Normality Diagnostics: Control/Predictor – Total Surgical Operations (suroptot)
. sum suroptot, detail
                  Total surgical operations
-------------------------------------------------------------
      Percentiles      Smallest
 1%            0              0
 5%            0              0
10%          199              0       Obs               2,748
25%       1413.5              0       Sum of wgt.       2,748
50%         4171                      Mean            7009.03
                        Largest       Std. dev.      9717.337
75%       9005.5         101852
90%        17139         112643       Variance        9.44e+07
95%        23026         130406       Skewness        5.063144
99%        40039         154961       Kurtosis        51.43589
. ***1%:0, 5%:0, 95%:23026, 99%:40039
. hist suroptot
(bin=34, start=0, width=4557.6765)
```

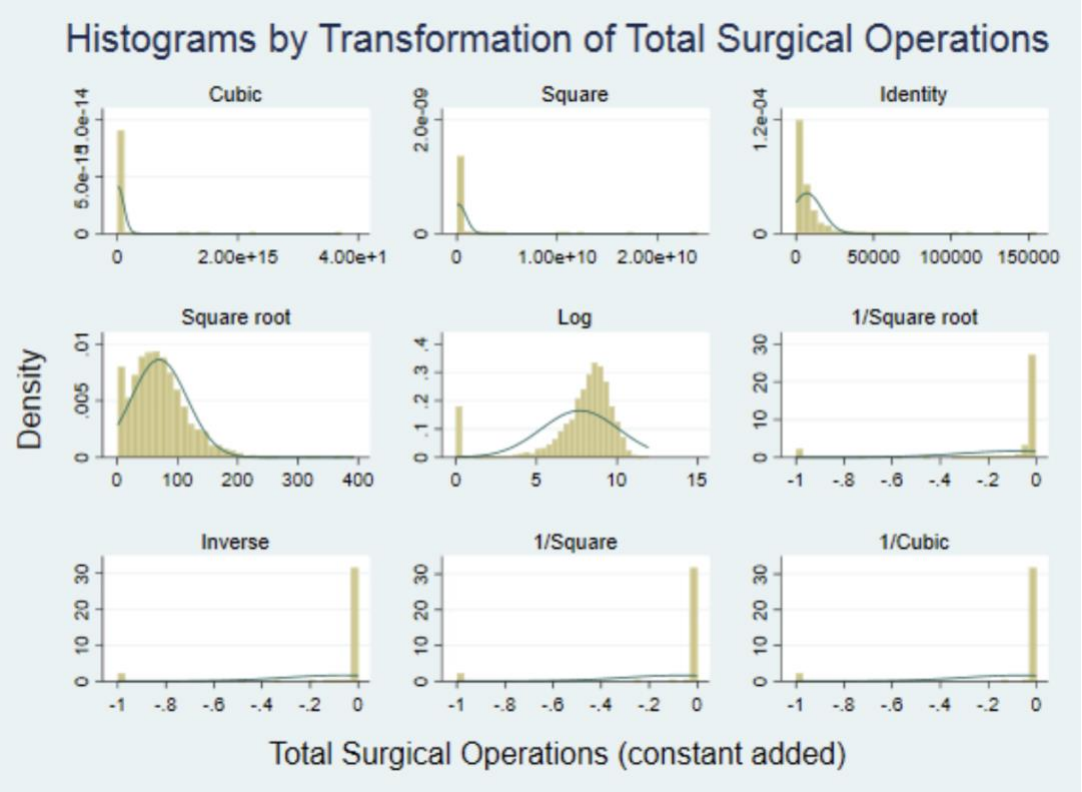



```
. gen suroptot_cons=suroptot+1

. ladder suroptot_cons
```

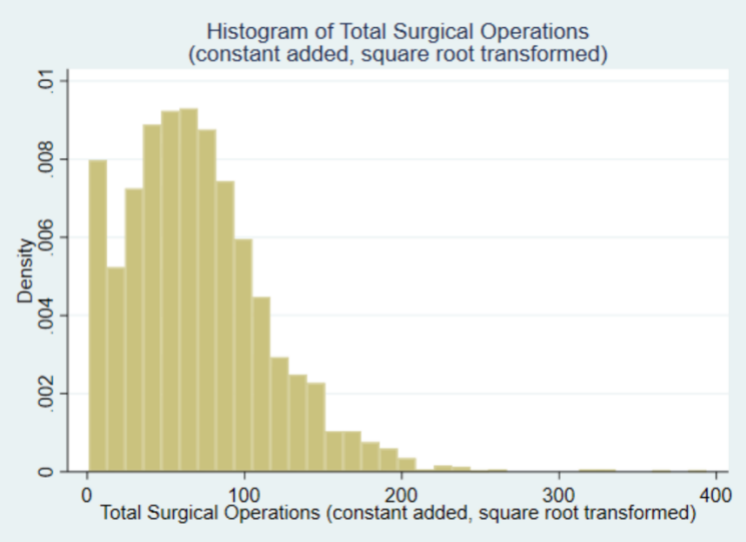
Transformation	Formula	chi2(2)	Prob > chi2
Cubic	suropt~s^3	.	.
Square	suropt~s^2	.	.
Identity	suropt~s	.	.
Square root	sqrt(suropt~s)	447.86	0.000
Log	log(suropt~s)	854.95	0.000
1/(Square root)	1/sqrt(suropt~s)	.	.
Inverse	1/suropt~s	.	.
1/Square	1/(suropt~s^2)	.	.

1/Cubic 1/(suropt~s^3) . .

```
. gladder suroptot_cons
```

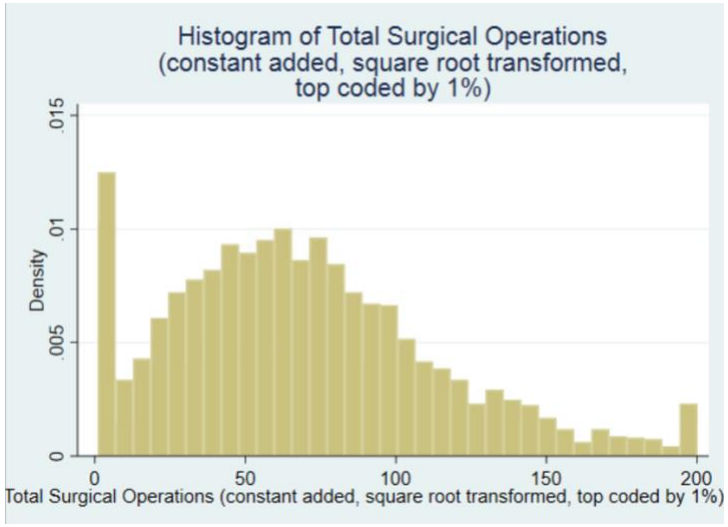



```
. gen suroptot_cons_sqrt=sqrt(suroptot_cons)

. hist suroptot_cons_sqrt
(bin=34, start=1, width=11.548592)
```



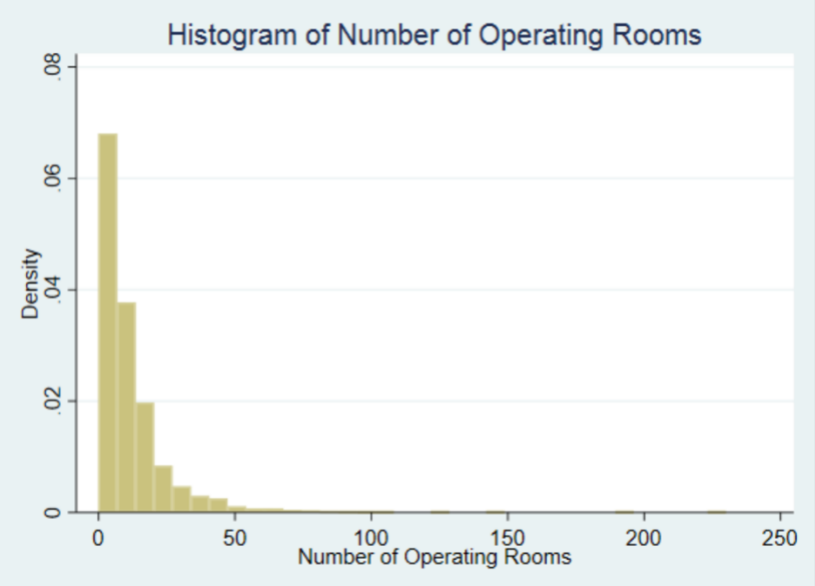

```
. **could try top coding to help normalize the distribution

. sum suroptot_cons_sqrt, detail

                    suroptot_cons_sqrt
-------------------------------------------------------------
      Percentiles      Smallest
 1%           1              1
 5%           1              1
10%    14.14214              1       Obs                2,748
25%    37.60983              1       Sum of wgt.        2,748
50%    64.59102                      Mean            69.77805
                       Largest       Std. dev.       46.27994
75%    94.90258        332.946
90%    130.9198       335.6248       Variance        2141.833
```

```
95%      151.7465       361.1191       Skewness        1.088104
99%         200.1       393.6521       Kurtosis        5.931279

. gen suroptot_cons_sqrt_tc1=clip(suroptot_cons_sqrt, ., 200.1)
. hist suroptot_cons_sqrt_tc1
(bin=34, start=1, width=5.8558825)
```

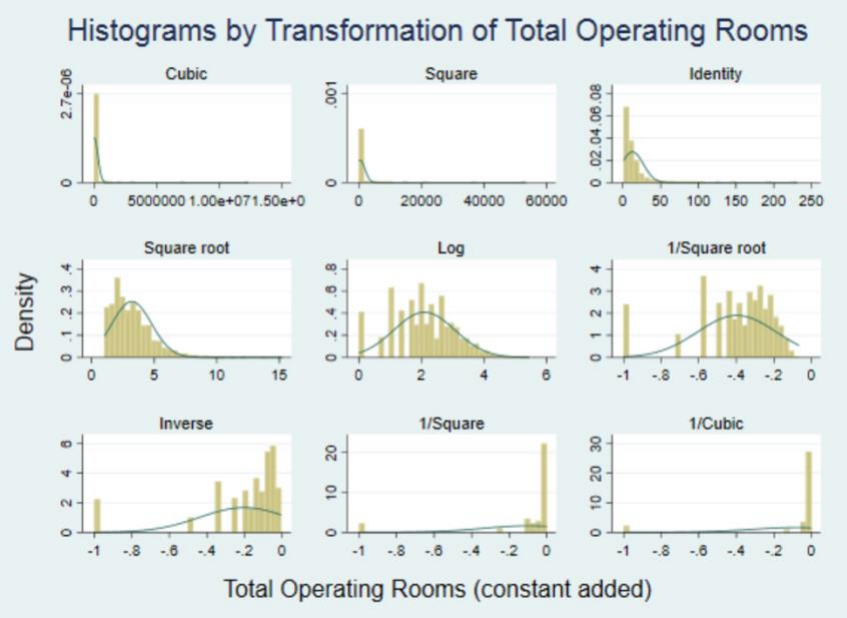



```
. **pretty normalized
. ** Variable name for suroptot after Normality Diagnostics: suroptot_cons_sqrt_tc1
. ###############
**Normality Diagnostics: Control/Predictor - Total Operating Rooms (opra)
. sum opra, detail
                          opra
-------------------------------------------------------------
      Percentiles      Smallest
```

```
 1%              0              0
 5%              0              0
10%              2              0       Obs                 2,727
25%              3              0       Sum of wgt.         2,727
50%              7                      Mean            11.71654
                        Largest         Std. dev.       14.34183
75%             15            124
90%             26            147       Variance         205.6881
95%             39            192       Skewness         4.282519
99%             66            230       Kurtosis         40.45709
. ***1%:0, 5%:0, 95%:39, 99%:66
. hist opra
(bin=34, start=0, width=6.7647059)
```



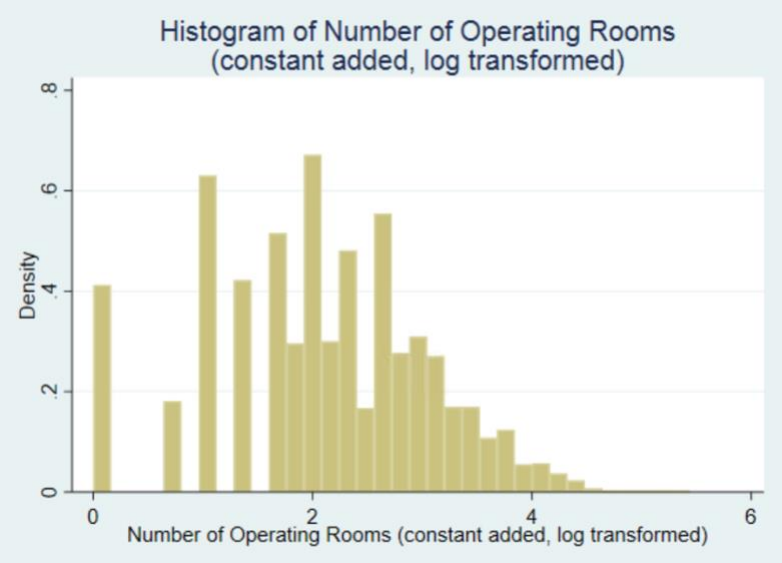
```
. gen opra_cons=opra+1

. gladder opra_cons
```




```
. ladder opra_cons
```

Transformation	Formula	chi2(2)	Prob > chi2
Cubic	opra_c~s^3	.	.
Square	opra_c~s^2	.	.
Identity	opra_c~s	.	.
Square root	sqrt(opra_c~s)	579.38	0.000
Log	log(opra_c~s)	14.40	0.001
1/(Square root)	1/sqrt(opra_c~s)	527.42	0.000
Inverse	1/opra_c~s	1040.25	0.000

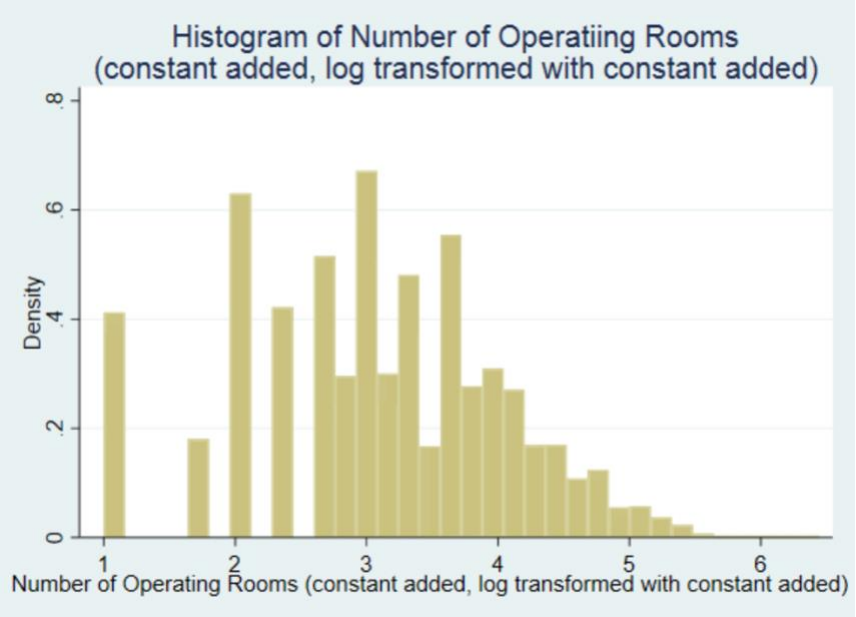
```
1/Square                1/(opra_c~s ^2)             .             .
1/Cubic                 1/(opra_c~s ^3)             .             .
. **picking log
. gen opra_cons_log=log(opra_cons)
. hist opra_cons_log
(bin=34, start=0, width=.16007111)
```




```
. **it's still off with the 0
. gen opra_cons_log_cons=opra_cons_log+1
. codebook opra_cons_log_cons
-------------------------------------------------------------------------------------------------------------------------
opra_cons_log_cons                                                                                        (unlabeled)
-------------------------------------------------------------------------------------------------------------------------
                  Type: Numeric (float)
```

```
                  Range: [1,6.4424176]                 Units: 1.000e-07
          Unique values: 84                        Missing .: 21/2,748
                   Mean: 3.09211
              Std. dev.: .977726
            Percentiles:     10%       25%       50%       75%       90%
                          2.09861   2.38629   3.07944   3.77259   4.29584
```

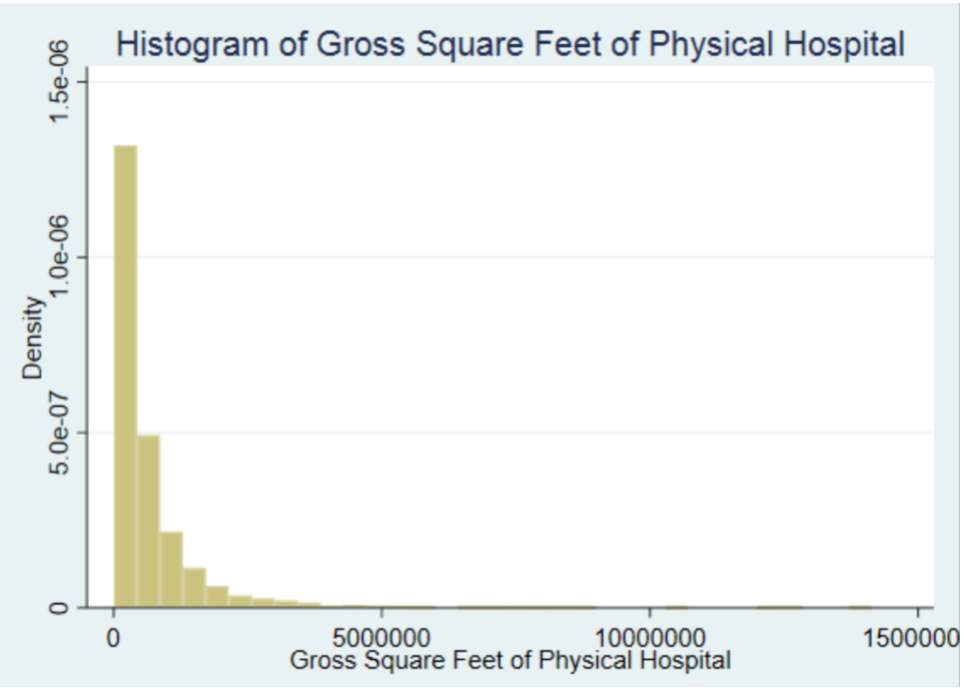
```
. hist opra_cons_log_cons
(bin=34, start=1, width=.16007111)
```



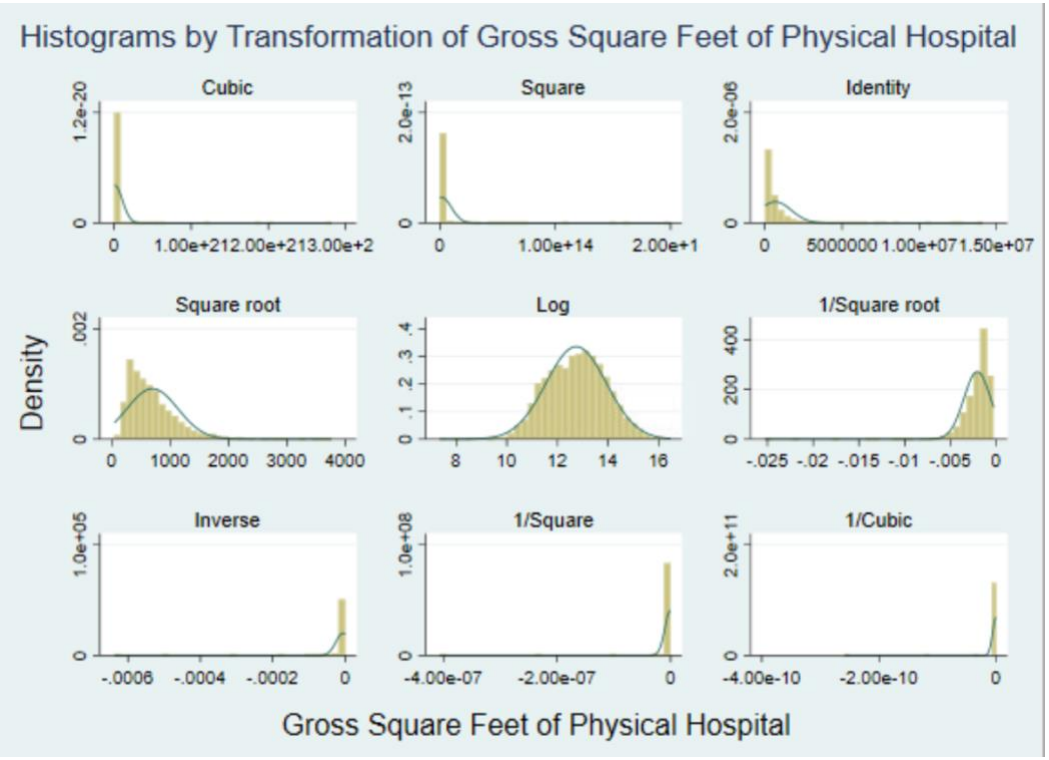

```
. **looks approximately normally distributed
. ** Variable name for opra after Normality Diagnostics: opra_cons_log_cons

. ##############
```

**Normality Diagnostics: Control/Predictor – Total Gross Square Feet of Physical Hospital (gfeet)

```
. sum gfeet, detail

         Total gross square feet of your physical plant
-------------------------------------------------------------
      Percentiles      Smallest
 1%        26823           1569
 5%        52478           2050
10%        73497           3184       Obs               2,420
25%       142597           5386       Sum of wgt.       2,420
50%     351633.5                      Mean           671256.3
                        Largest       Std. dev.       1034957
75%       780187       1.23e+07
90%      1527461       1.27e+07       Variance       1.07e-12
95%      2335003       1.27e+07       Skewness       5.385704
99%      4724314       1.41e+07       Kurtosis       48.78388
. ***1%:26823, 5%:52478, 95%:2335003, 99%:4724314
. hist gfeet
(bin=33, start=1569, width=428104.03)
```

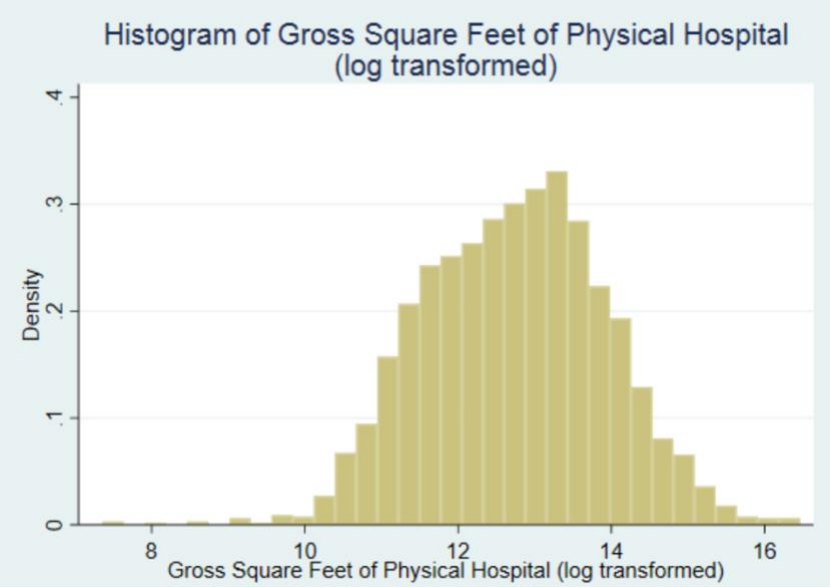



```
. gladder gfeet
```




```
. ladder gfeet

Transformation         Formula               chi2(2)   Prob > chi2
-----------------------------------------------------------------
Cubic                  gfeet^3                     .            .
Square                 gfeet^2                     .            .
Identity               gfeet                       .            .
Square root            sqrt(gfeet)            749.85        0.000
Log                    log(gfeet)               3.23        0.199
1/(Square root)        1/sqrt(gfeet)               .            .
```

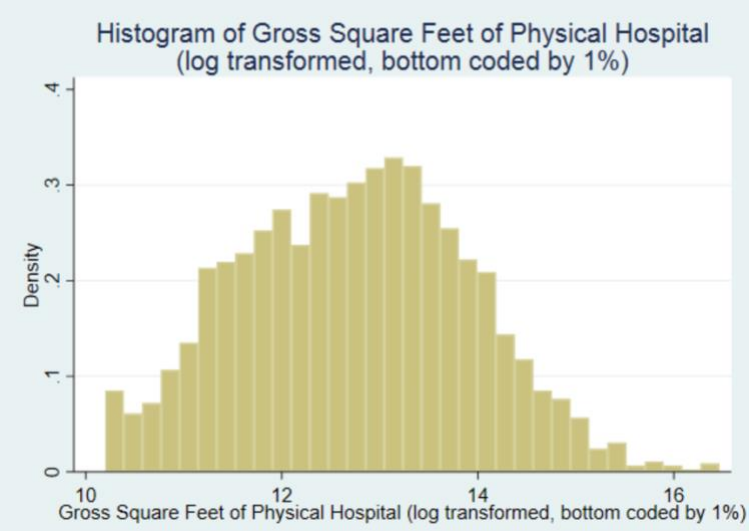
```
Inverse                 1/gfeet                     .           .

1/Square                1/(gfeet^2)                 .           .

1/Cubic                 1/(gfeet^3)                 .           .

. **the log of gfeet is better graphically, even though its Prob > chi2: 0.199

. gen gfeet_log=log(gfeet)

. hist gfeet_log

(bin=33, start=7.3581939, width=.27592562)
```




```
. **could bottom code to make it more normally distributed

. sum gfeet_log, detail

                        gfeet_log

-------------------------------------------------------------

      Percentiles      Smallest

 1%     10.19701       7.358194
```

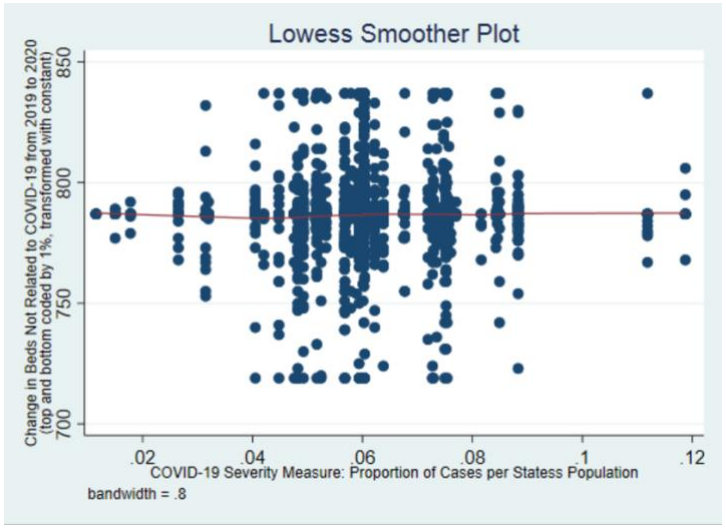
5%	10.86815	7.625595		
10%	11.205	8.065893	Obs	2,420
25%	11.86778	8.591558	Sum of wgt.	2,420
50%	12.77034		Mean	12.73596
		Largest	Std. dev.	1.190495
75%	13.56729	16.32594		
90%	14.23912	16.35483	Variance	1.417278
95%	14.66352	16.35812	Skewness	-.0844023
99%	15.36823	16.46374	Kurtosis	3.053204

```
. gen gfeet_log_bc1=clip(gfeet_log, 10.19701, .)
. hist gfeet_log_bc1
(bin=33, start=10.19701, width=.18990089)
```



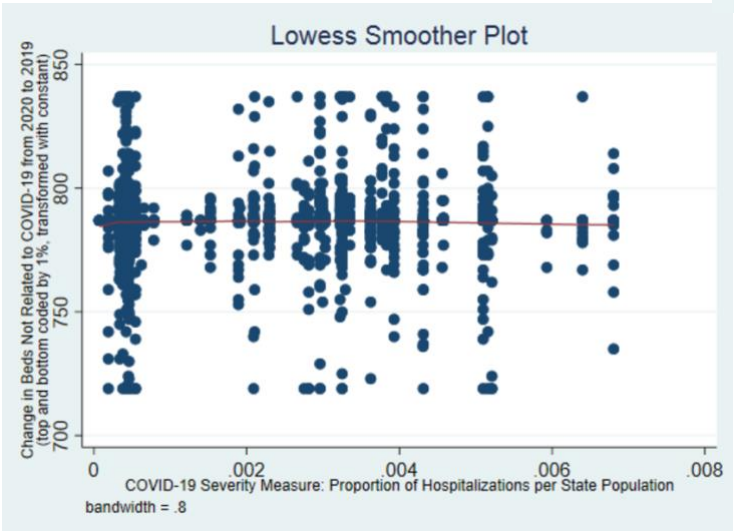

```
. **looks normally distributed enough
```

```
. **Names for normalized variables: noncovbds_change_cons_tbc1, covsevcases, covsevhosp, covsevdeaths, gfeet_log_bc1, opra_cons_log_cons, suroptot_cons_sqrt_tc1, ipdtot_log

. **Renaming normalized variables so they are shorter ("t" on end of variable means it has been transformed)

. rename noncovbds_change_cons_tbc1 noncovbds_change_t

. rename ipdtot_log ipdtot_t

. rename suroptot_cons_sqrt_tc1 suroptot_t

. rename opra_cons_log_cons opra_t

. rename gfeet_log_bc1 gfeet_t

. ***Plan for Model 0 after Normality Diagnostics:

. **Outcome: Change in Non-COVID-19 Beds (noncovbds_change_tbc1)

. **Predictors: COVID-19 Severity Measures (per State Population): Cases (covsevcases_sqrt_tbc), Hospitalizations (covsevhosp_log), Deaths (covsevdeaths_sqrt)

. **Controls: Total Facility Inpatient Days (ipdtot), Total Surgical Operations (suroptot), Number of Operating Rooms (opra), Total Gross Square Feet of Physical Location (gfeet), Sole Community Provider Status(mapp20)

. **Linearity Diagnostics

. lowess noncovbds_change_t covsevcases
```



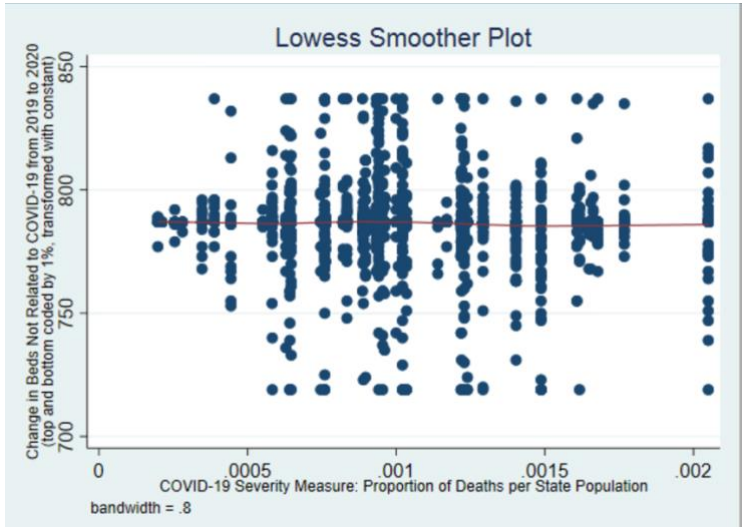
.

. lowess noncovbds_change_t covsevhosp



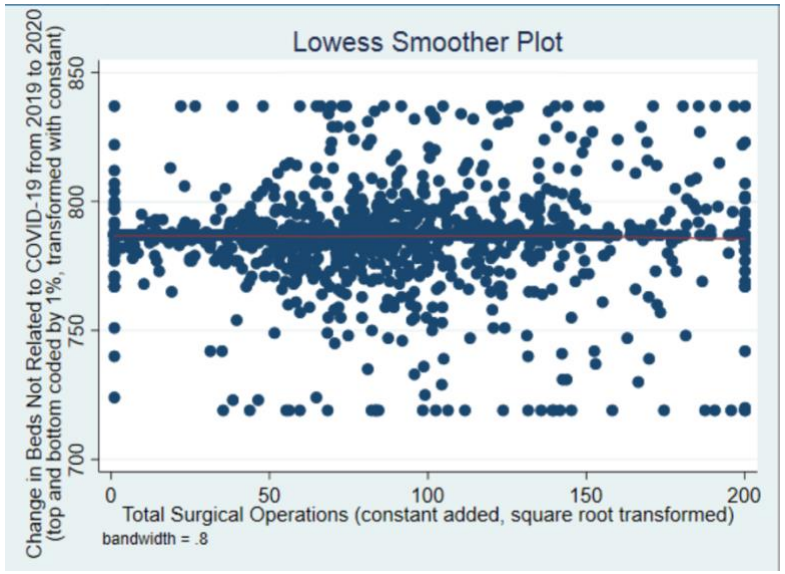
.

. lowess noncovbds_change_t covsevdeaths

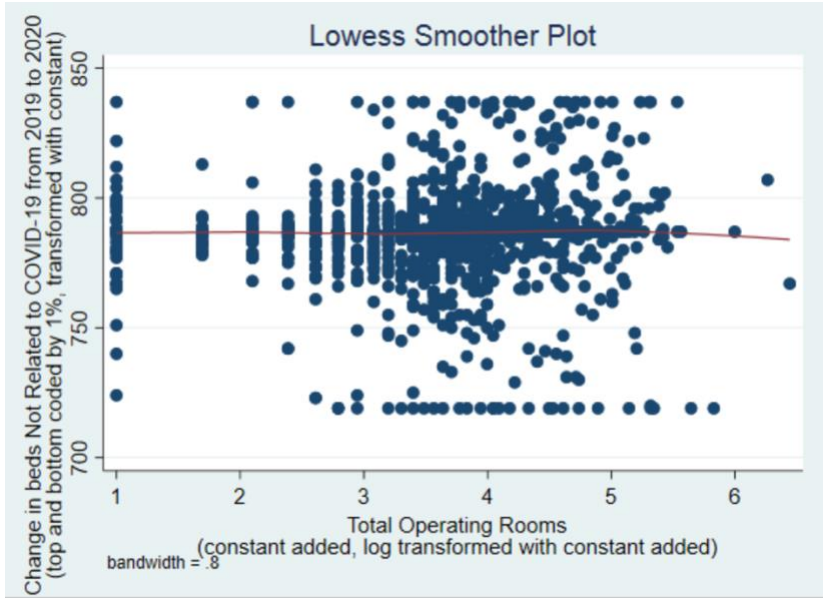


. lowess noncovbds_change_t ipdtot_t

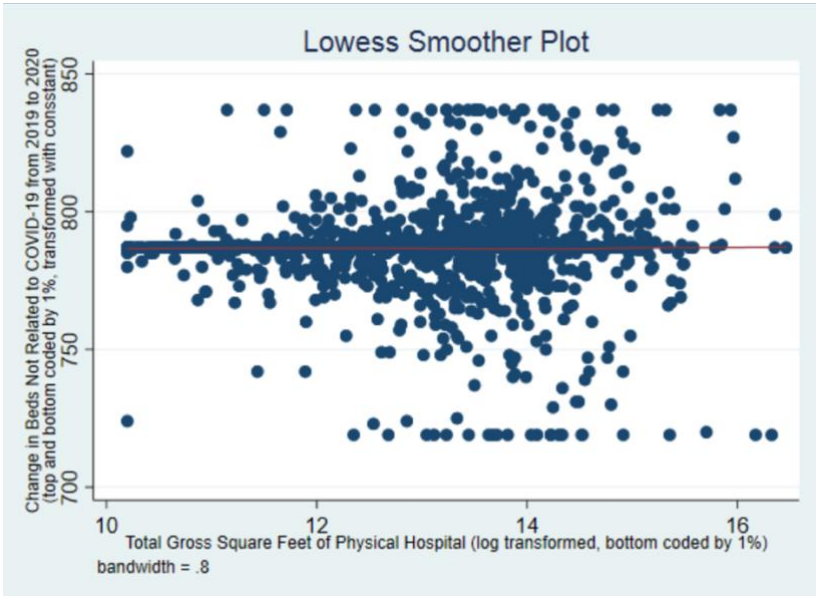
. lowess noncovbds_change_t suroptot_t




```
. lowess noncovbds_change_t opra_t
```



. lowess noncovbds_change_t gfeet_t



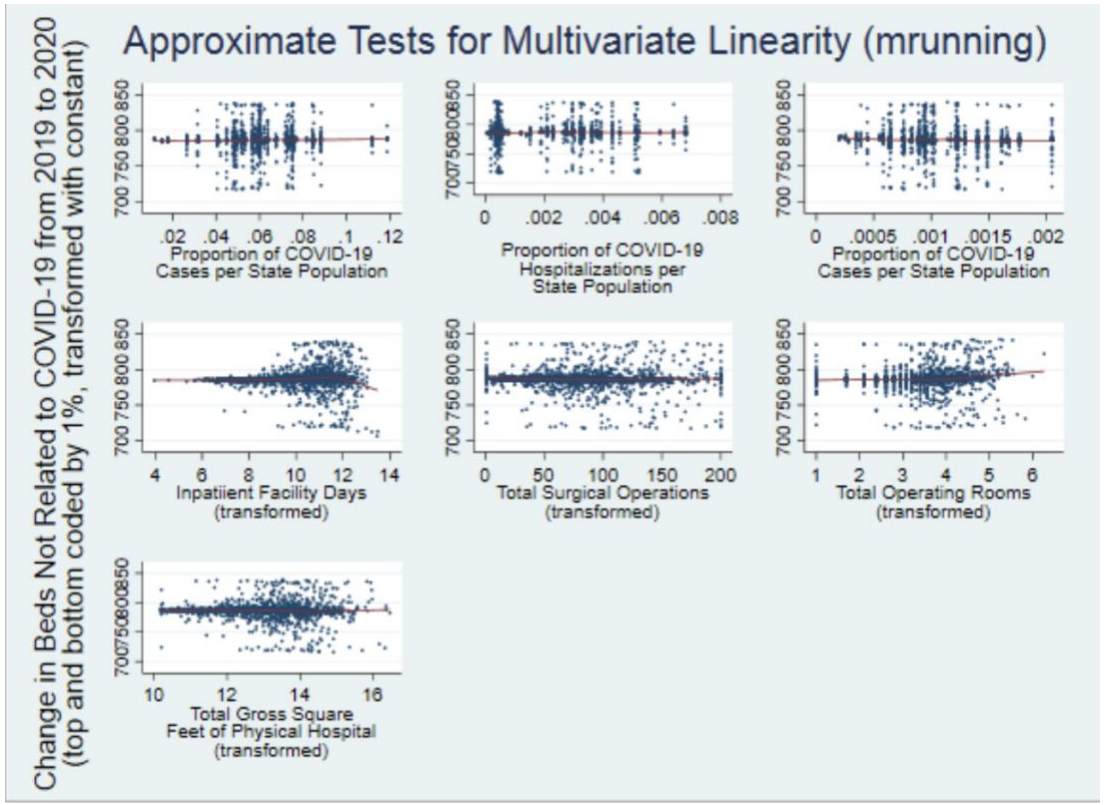
.

. **Names for variables: noncovbds_change_t, covsevcases, covsevhosp, covsevdeaths, ipdtot_t, suroptot_t, opra_t, gfeet_t, mapp20

. **Approximate test for multivariate linearity (based on OLS)

. mrunning noncovbds_change_t covsevcases covsevhosp covsevdeaths ipdtot_t suroptot_t opra_t gfeet_t

2399 observations, R-sq = 0.0314



. ***The total operating rooms is the most non-linear plot, but it's not really not bad (especially considering how non-linear it was before it was accurately transformed) because accurately top and bottom coding (and transforming) helped with the linearity overall

.

. **Names for variables: noncovbds_change_t covsevcases covsevhosp covsevdeaths ipdtot_t suroptot_t opra_t gfeet_t, mapp20

. **Multicollinearity

. pwcorr noncovbds_change_t covsevcases covsevhosp covsevdeaths ipdtot_t suroptot_t opra_t gfeet_t mapp20

```
             | nonco~_t covse~es covsev~p covse~hs ipdtot_t surop~_t   opra_t
-------------+------------------------------------------------------------------
noncovbds_~t |   1.0000
 covsevcases |   0.0306   1.0000
  covsevhosp |   0.0059   0.4056   1.0000
covsevdeaths |  -0.0387   0.3107   0.0951   1.0000
    ipdtot_t |  -0.0024  -0.1674  -0.0409   0.1051   1.0000
  suroptot_t |  -0.0075  -0.1697  -0.0381   0.0067   0.7391   1.0000
      opra_t |   0.0033  -0.1289  -0.0307   0.0083   0.6938   0.9119   1.0000
     gfeet_t |  -0.0102  -0.1285  -0.0295   0.0713   0.7875   0.8251   0.8225
      mapp20 |   0.0108  -0.0145   0.0119   0.0270   0.1623   0.1216   0.0973

             |  gfeet_t   mapp20
-------------+------------------
     gfeet_t |   1.0000
      mapp20 |   0.1221   1.0000

. reg noncovbds_change_t covsevcases covsevhosp covsevdeaths ipdtot_t suroptot_t opra_t gfeet_t mapp20

      Source |       SS           df       MS      Number of obs   =     2,399
-------------+----------------------------------   F(8, 2390)      =      1.61
       Model |  2131.10282         8  266.387853   Prob > F        =    0.1172
    Residual |  395880.297     2,390  165.640292   R-squared       =    0.0054
-------------+----------------------------------   Adj R-squared   =    0.0020
       Total |    398011.4     2,398  165.976397   Root MSE        =     12.87
```

noncovbds_~t	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
covsevcases	33.16235	20.09134	1.65	0.099	-6.235906	72.56061
covsevhosp	-67.18056	164.5407	-0.41	0.683	-389.8378	255.4766
covsevdeaths	-2031.162	758.4314	-2.68	0.007	-3518.413	-543.9104
ipdtot_t	.4712258	.3121586	1.51	0.131	-.1409038	1.083355
suroptot_t	-.0210006	.0160481	-1.31	0.191	-.0524702	.010469
opra_t	1.166848	.7021378	1.66	0.097	-.2100144	2.54371
gfeet_t	-.6368841	.4695945	-1.36	0.175	-1.557739	.2839704
mapp20	.3035329	1.001833	0.30	0.762	-1.661019	2.268085
_cons	787.5078	4.975595	158.27	0.000	777.7508	797.2647

. **one significant variable: covsevdeaths (0.007)

. **some insignificant variables: covsevcases (0.099), covsevhosp (0.683), ipdtot_t (0.131), suroptot_t (0.191), opra_t (0.097), gfeet_t (0.175), mapp20 (0.762), _cons (0.762)

. **high standard errors: ~20 (covsevcases), ~164 (covsevhosp), ~758 (covsevdeaths)

. vif

Variable	VIF	1/VIF
suroptot_t	7.32	0.136645
opra_t	6.79	0.147229
gfeet_t	4.36	0.229523

```
    ipdtot_t |      2.98    0.335194
 covsevcases |      1.35    0.741700
  covsevhosp |      1.18    0.847190
covsevdeaths |      1.15    0.870434
      mapp20 |      1.03    0.966620
-------------+----------------------
    Mean VIF |      3.27
```

. **mean vif: 3.27, so model is okay, but opra, ipdtot, and suroptot are greater than 4, so there are some multicollinearity issues associated with those variables

```
. estat ic

Akaike's information criterion and Bayesian information criterion

------------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df        AIC        BIC
-------------+----------------------------------------------------------------
           . |      2,399  -9535.192  -9528.752       9    19075.5   19127.55
------------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.

. pwcorr noncovbds_change_t covsevcases covsevhosp covsevdeaths

             | nonco~_t covse~es covsev~p covse~hs
-------------+------------------------------------
noncovbds_~t |   1.0000
 covsevcases |   0.0306   1.0000
  covsevhosp |   0.0059   0.4056   1.0000
```

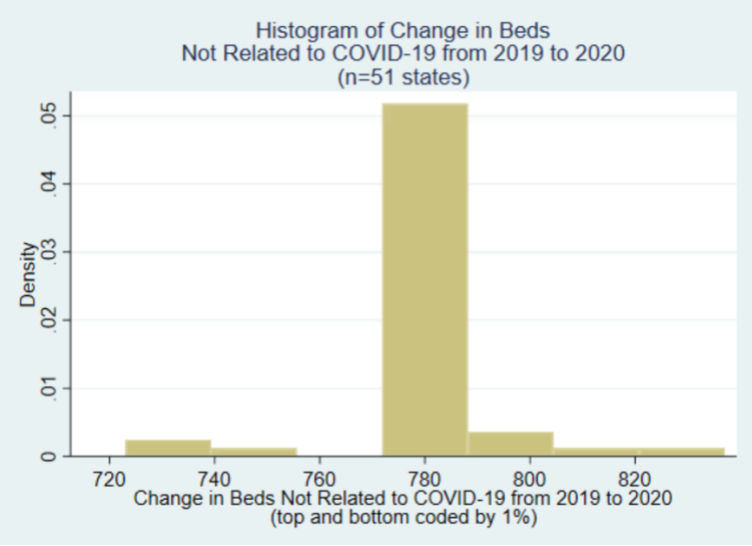
```
covsevdeaths |  -0.0387   0.3107   0.0951   1.0000

. reg noncovbds_change_t covsevcases covsevhosp covsevdeaths

. reg noncovbds_change_t covsevcases covsevhosp covsevdeaths

      Source |       SS           df       MS      Number of obs   =     2,748
-------------+----------------------------------   F(3, 2744)      =      3.29
       Model |  1673.81516         3  557.938387   Prob > F        =    0.0198
    Residual |  464997.176     2,744  169.459612   R-squared       =    0.0036
-------------+----------------------------------   Adj R-squared   =    0.0025
       Total |  466670.991     2,747   169.88387   Root MSE        =    13.018

------------------------------------------------------------------------------
noncovbds_~t | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
 covsevcases |   43.97417   18.73526     2.35   0.019     7.237535    80.71081
  covsevhosp |  -73.58118   156.5424    -0.47   0.638     -380.534    233.3716
covsevdeaths |   -1893.82   708.1212    -2.67   0.008    -3282.324   -505.3149
       _cons |   785.8725   1.126184   697.82   0.000     783.6642    788.0807
------------------------------------------------------------------------------

. **overall reg OLS model significant: Prob > F = 0.0198

. **significant variables: covsevcases (0.019), covsevdeaths (0.008), _cons (0.000)

. **insignificant variables: covsevhosp (0.638)

. **high standard errors: ~708 (covsevdeaths), ~156 (covsevhosp)

. vif

    Variable |       VIF       1/VIF
```

```
-------------+----------------------
 covsevcases |      1.31    0.760799
  covsevhosp |      1.20    0.834470
covsevdeaths |      1.11    0.902323
-------------+----------------------
    Mean VIF |      1.21

. **mean vif: 1.21, all 3 variables vif < 1.31, so it's good
. estat ic
Akaike's information criterion and Bayesian information criterion

------------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df        AIC        BIC
-------------+----------------------------------------------------------------
           . |      2,748  -10954.39  -10949.45       4   21906.91   21930.58
------------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.
. bysort stcd: egen noncovbds_change_t_m=mean(noncovbds_change_t)
. reg noncovbds_change_t_m covsevcases covsevhosp covsevdeaths
      Source |       SS           df       MS      Number of obs   =     2,748
-------------+----------------------------------   F(3, 2744)      =    150.75
       Model |  1673.80805         3  557.936018   Prob > F        =    0.0000
    Residual |  10155.6954     2,744  3.70105518   R-squared       =    0.1415
-------------+----------------------------------   Adj R-squared   =    0.1406
       Total |  11829.5035     2,747  4.30633544   Root MSE        =    1.9238
```

```
------------------------------------------------------------------------------
noncovbd~t_m | Coefficient  Std. err.      t    P>|t|     [95% conf. interval]
-------------+----------------------------------------------------------------
 covsevcases |   43.97384   2.768786    15.88   0.000     38.54473    49.40296
  covsevhosp |   -73.5799   23.13458    -3.18   0.001    -118.9428   -28.21695
covsevdeaths |  -1893.822   104.6495   -18.10   0.000    -2099.022   -1688.623
       _cons |   785.8725   .1664329  4721.86   0.000     785.5461    786.1988
------------------------------------------------------------------------------
. **overall reg OLS model that checked level 2 separately by using means of DV as an outcome significant: Prob > F =
0.0000
. **ALL variables significant: covsevcases (0.000), covsevhosp (0.001), covsevdeaths (0.000), _cons (0.000)
. **still high standard errors : ~23 (covsevhosp), ~104 (covsevdeaths)
. vif
    Variable |       VIF       1/VIF
-------------+----------------------
 covsevcases |      1.31    0.760799
  covsevhosp |      1.20    0.834470
covsevdeaths |      1.11    0.902323
-------------+----------------------
    Mean VIF |      1.21
. **mean vif: 1.21 and all individual variables have vifs less than 1.31
. estat ic
Akaike's information criterion and Bayesian information criterion
```

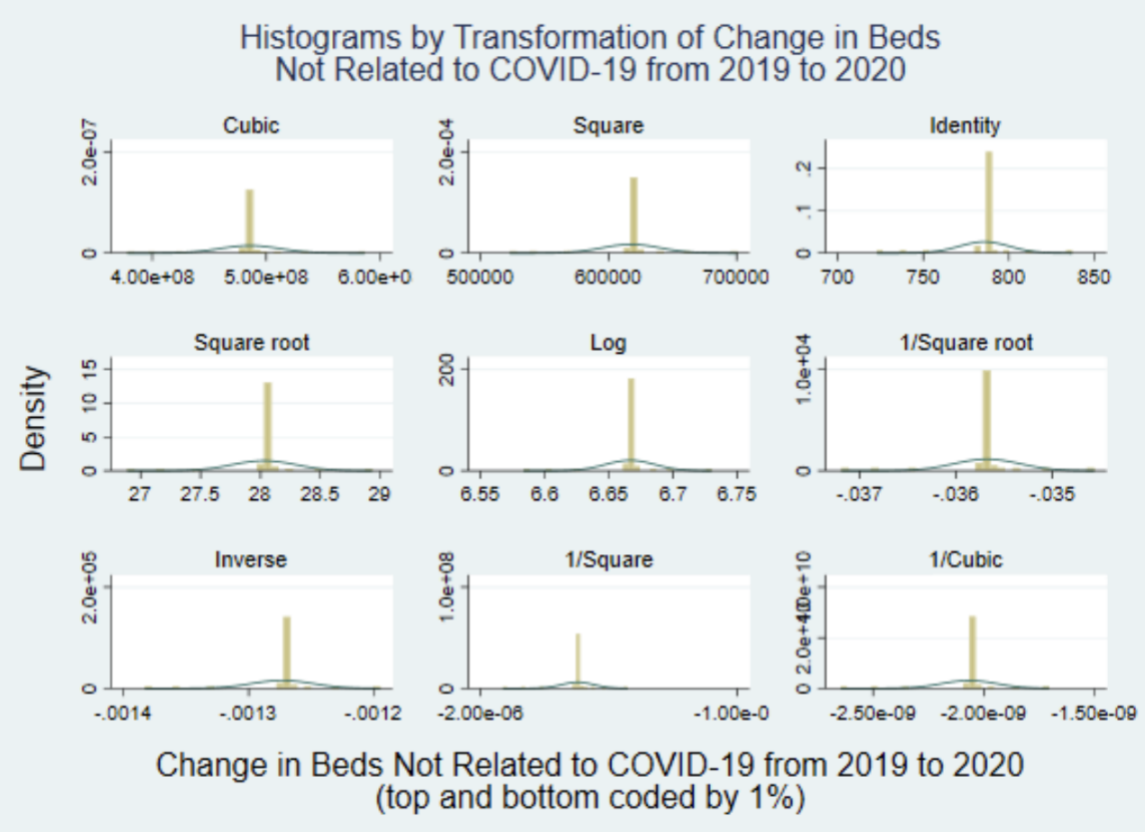
```
------------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df        AIC        BIC
-------------+----------------------------------------------------------------
           . |      2,748  -5904.903  -5695.283       4   11398.57   11422.24
------------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.

. ***Additional Normality Testing

. codebook noncovbds_change_t

-------------------------------------------------------------------------------------------
noncovbds_change_t                                                          (unlabeled)
-------------------------------------------------------------------------------------------

                  Type: Numeric (float)

                 Range: [719,837]                     Units: 1

         Unique values: 105                       Missing .: 0/2,748

                  Mean: 786.502

             Std. dev.:  13.034

           Percentiles:     10%       25%       50%       75%       90%

                            780       787       787       787       792

. egen tag3=tag(stcd)

. codebook tag3

-------------------------------------------------------------------------------------------
tag3                                                                          tag(stcd)
-------------------------------------------------------------------------------------------

                  Type: Numeric (byte)

                 Range: [0,1]                         Units: 1
```

```
         Unique values: 2                         Missing .: 0/2,748

            Tabulation: Freq.  Value
                        2,697  0
                           51  1

. **tag3 was generated by state codes, so tag3==1 has 51 and tag3==0 has 2697

. hist noncovbds_change_t if tag3==1

(bin=7, start=723, width=16.285714)
```



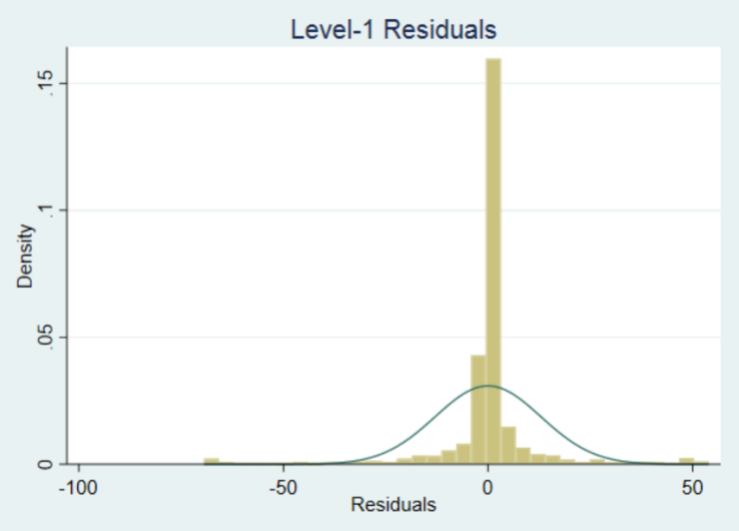

```
. ladder noncovbds_change_t if tag3==1

Transformation         Formula              chi2(2)   Prob > chi2
-----------------------------------------------------------------
Cubic                  nonco~_t^3             20.81        0.000
Square                 nonco~_t^2             23.33        0.000
Identity               nonco~_t               25.90        0.000
```

```
Square root             sqrt(nonco~_t)          27.17         0.000
Log                     log(nonco~_t)           28.42         0.000
1/(Square root)         1/sqrt(nonco~_t)        29.64         0.000
Inverse                 1/nonco~_t              30.83         0.000
1/Square                1/(nonco~_t^2)          33.12         0.000
1/Cubic                 1/(nonco~_t^3)          35.27         0.000
. **transformation options: all of them
. gladder noncovbds_change_t if tag3==1
```

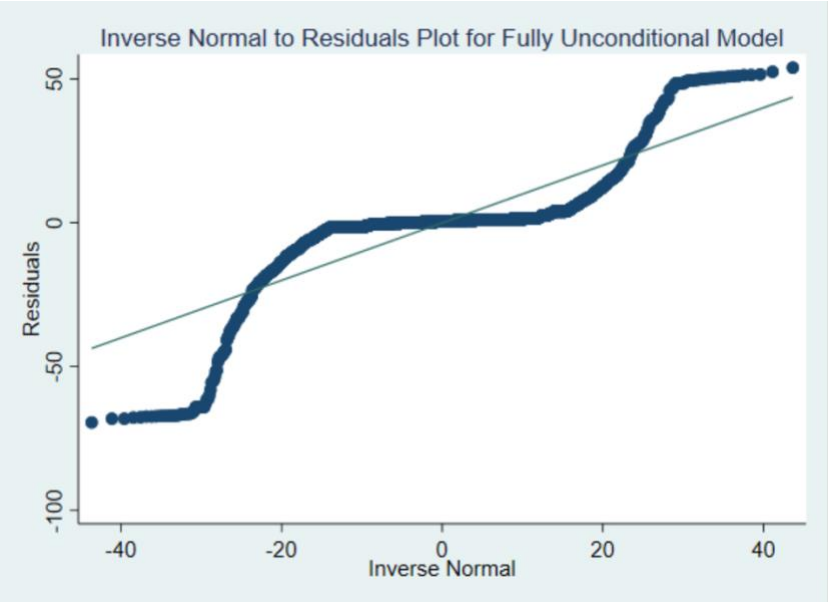


```
. **since this not normally distributed, it won't work for HLM

. **The DV is not normally distributed. It can't be made normally distributed through transformations/top and bottom
coding. I am going to check the residuals to see if they are normally distributed.

. ***variable names: noncovbds_change_t covsevcases covsevhosp covsevdeaths ipdtot_t suroptot_t opra_t gfeet_t mapp20

. **Estimating model to get residuals

. mixed noncovbds_change_t covsevcases covsevhosp covsevdeaths || stcd:

Performing EM optimization ...


Performing gradient-based optimization:

Iteration 0:   log likelihood = -10945.028

Iteration 1:   log likelihood = -10945.024

Iteration 2:   log likelihood = -10945.024


Computing standard errors ...


Mixed-effects ML regression                     Number of obs     =      2,748
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          5
                                                              avg =       53.9
                                                              max =        301
                                                Wald chi2(3)      =       5.26
Log likelihood = -10945.024                     Prob > chi2       =     0.1538

------------------------------------------------------------------------------
```

```
noncovbds_change_t | Coefficient  Std. err.      z    P>|z|     [95% conf. interval]
-------------------+------------------------------------------------------------------
       covsevcases |   38.79121   21.85633     1.77   0.076    -4.046403    81.62883
        covsevhosp |  -43.67876   194.9548    -0.22   0.823    -425.7831    338.4255
      covsevdeaths |  -1612.908   849.1184    -1.90   0.057     -3277.15     51.3332
             _cons |   785.7746   1.289849   609.20   0.000     783.2466    788.3027
------------------------------------------------------------------------------------


------------------------------------------------------------------------------
  Random-effects parameters  |   Estimate   Std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Identity               |
                  var(_cons) |    1.21791   .6642943      .4181554    3.547258
-----------------------------+------------------------------------------------
               var(Residual) |   167.7178   4.544137      159.0438    176.8649
------------------------------------------------------------------------------
LR test vs. linear model: chibar2(01) = 8.86          Prob >= chibar2 = 0.0015
. predict llresid, resid
. hist llresid, normal
(bin=34, start=-69.407555, width=3.6272489)
```




```
. **It's still not normally distributed at all

. qnorm llresid
```



. **The inverse normal to residuals graph isn't linear

. **Since there are problems with normality of residuals and they can't be fixed with simple transformations or top/bottomcoding, must try robust option or bootstrapping

**Names for variables: noncovbds_change_t covsevcases covsevhosp covsevdeaths ipdtot_t suroptot_t opra_t gfeet_t mapp20

. mixed noncovbds_change_t covsevcases covsevhosp covsevdeaths ipdtot_t suroptot_t opra_t gfeet_t mapp20|| stcd:

Performing EM optimization ...

Performing gradient-based optimization:

Iteration 0: log likelihood = -9526.0012

Iteration 1: log likelihood = -9525.9802

Iteration 2: log likelihood = -9525.9801

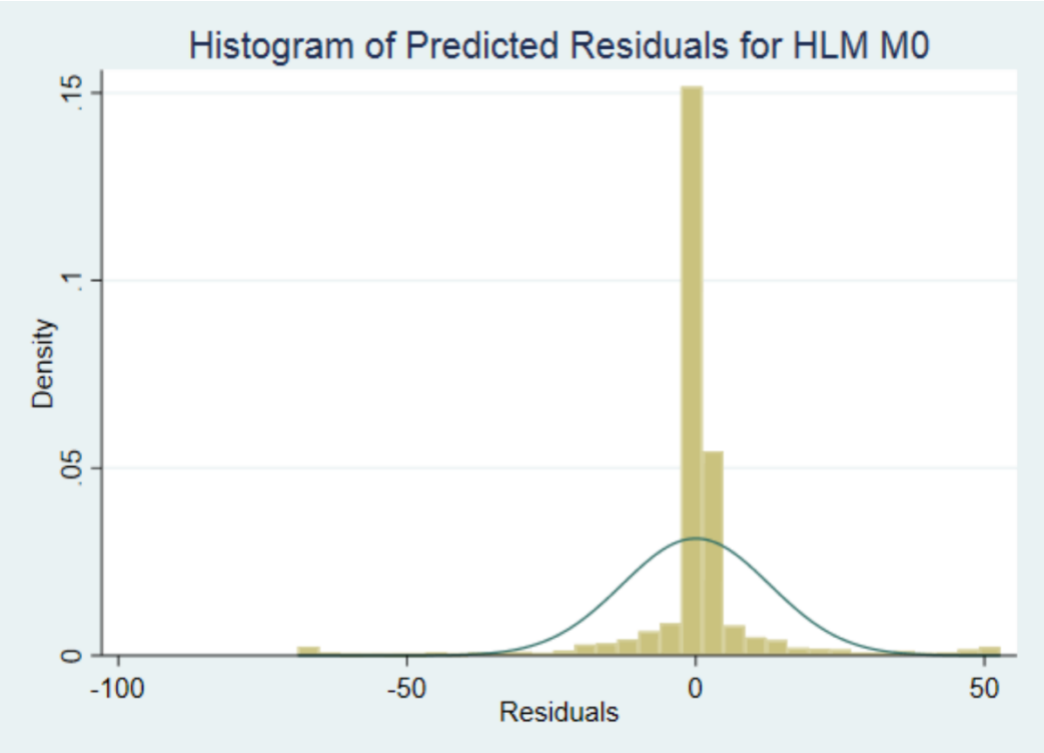
Computing standard errors ...

```
Mixed-effects ML regression                     Number of obs     =      2,399
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          4
                                                              avg =       47.0
                                                              max =        291
                                                Wald chi2(8)      =       9.49
Log likelihood = -9525.9801                     Prob > chi2       =     0.3025
```

noncovbds_change_t	Coefficient	Std. err.	z	P>|z|	[95% conf.	interval]
covsevcases	29.9915	22.44545	1.34	0.181	-14.00078	73.98378
covsevhosp	-23.33634	195.8245	-0.12	0.905	-407.1452	360.4725
covsevdeaths	-1838.288	866.506	-2.12	0.034	-3536.609	-139.9679
ipdtot_t	.4818871	.316656	1.52	0.128	-.1387472	1.102521
suroptot_t	-.0188478	.0160604	-1.17	0.241	-.0503256	.01263
opra_t	1.100784	.7027305	1.57	0.117	-.2765426	2.478111
gfeet_t	-.6049714	.4717172	-1.28	0.200	-1.52952	.3195773
mapp20	.3852508	1.000263	0.39	0.700	-1.575228	2.34573
_cons	786.7134	5.02119	156.68	0.000	776.872	796.5547

Random-effects parameters	Estimate	Std. err.	[95% conf.	interval]

```
------------------------------+------------------------------------------------
stcd: Identity                |
                  var(_cons) |   .9785306   .6384985      .2723698    3.515522
------------------------------+------------------------------------------------
               var(Residual) |    163.835   4.751132      154.7826    173.4167
------------------------------------------------------------------------------
LR test vs. linear model: chibar2(01) = 5.54          Prob >= chibar2 = 0.0093

. predict llresid_full, resid
(349 missing values generated)

. hist llresid_full, normal
(bin=33, start=-68.90461, width=3.6857983)

. qnorm llresid_full
```



. **The quantile plot is distinctly leptokurtic (somewhat linear in the center with big dips on either side)

. **Plan for Model 0 after Linearity Diagnostics:

. **Outcome: Change in Non-COVID-19 Beds (noncovbds_change_t)

. **Predictors: COVID-19 Severity Measures (per State Population): Cases (covsevcases), Hospitalizations (covsevhosp), Deaths (covsevdeaths)

. **Controls: Total Facility Inpatient Days (ipdtot_t), Total Surgical Operations (suroptot_t), Number of Operating Rooms (opra_t), Total Gross Square Feet of Physical Location (gfeet_t), Sole Community Provider Status(mapp20)

. ***Level 1: hospitals, so Level-1 variables: noncovbds_change_t, ipdtot_t, suroptot_t, opra_t, gfeet_t, mapp20

. ***Level 2: states, so Level-2 variables: covsevcases, covsevhosp, covsevdeaths

. ***Level-1 Predictors have meaningful zeros (change in non-COVID-19 related beds from 2019 to 2020, non-COVID-19 related beds from 2019, and non-COVID-19 related beds from 2020)

. ***Level-1 Predictors all have meaningful zeros (inpatient days, surgical operations, operating rooms, square feet, dichotomous variable of sole community provider status)

. ***Level-1 hospital code: id

. ***Level-2 state code: stcd

. **one hospital from each state (plus DC) has been assigned a tag, so 0=5445 1=51

. ***Names of variables: noncovbds_change_t covsevcases covsevhosp covsevdeaths ipdtot_t suroptot_t opra_t gfeet_t mapp20

. ***Aggregates of Level 1 Variables

. ***mean inpatient days would indicate average inpatient days in the states and standard deviation inpatient days (within-state standard deviation) would indicate how different each state is in terms of inpatient days

. bysort stcd: egen ipdtot_t_m=mean(ipdtot_t)

. bysort stcd: egen ipdtot_t_sd=sd(ipdtot_t)

. ***mean surgical operations would indicate average surgical operations in the states and standard deviation inpatient days (within-state standard deviation) would indicate how different each state is in terms of surgical operations

. bysort stcd: egen suroptot_t_m=mean(suroptot_t)

. bysort stcd: egen suroptot_t_sd=sd(suroptot_t)

. ***mean operating rooms would indicate average operating rooms in the states and standard deviation inpatient days (within-state standard deviation) would indicate how different each state is in terms of operating rooms

. bysort stcd: egen opra_t_m=mean(opra_t)

. bysort stcd: egen opra_t_sd=sd(opra_t)

. ***mean square feet would indicate average square feet of hospitals in the states and standard deviation inpatient days (within-state standard deviation) would indicate how different each state is in terms of square feet of hospitals

. bysort stcd: egen gfeet_t_m=mean(gfeet_t)

. bysort stcd: egen gfeet_t_sd=sd(gfeet_t)

. **List of Level 1 Aggregate Variables: ipdtot_t_m, ipdtot_t_sd, suroptot_t_m, suroptot_t_sd, opra_t_m, opra_t_sd, gfeet_t_m, gfeet_t_sd

. ***##

. ***M0.1: Fully Unconditional Model for Change in Hospital Beds that are not related to COVID-19 with AHA 2019 and 2020 Data:

```
. mixed noncovbds_change_t || stcd:
Performing EM optimization ...

Performing gradient-based optimization:
Iteration 0:   log likelihood = -10947.471
Iteration 1:   log likelihood =  -10947.47

Computing standard errors ...

Mixed-effects ML regression                     Number of obs     =      2,748
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          5
                                                              avg =       53.9
                                                              max =        301
                                                Wald chi2(0)      =          .
Log likelihood =  -10947.47                     Prob > chi2       =          .

------------------------------------------------------------------------------
noncovbds_change_t | Coefficient  Std. err.      z    P>|z|     [95% conf. interval]
-------------------+----------------------------------------------------------------
             _cons |   786.4425   .3281218  2396.80   0.000     785.7994    787.0856
------------------------------------------------------------------------------
------------------------------------------------------------------------------
  Random-effects parameters  |   Estimate   Std. err.     [95% conf. interval]
```

```
------------------------------+------------------------------------------------
stcd: Identity                |
                  var(_cons) |   1.639623   .7717138      .6517977    4.124536
------------------------------+------------------------------------------------
               var(Residual) |   167.7648   4.547198       159.085    176.9181
------------------------------------------------------------------------------
LR test vs. linear model: chibar2(01) = 13.84         Prob >= chibar2 = 0.0001
. **Insignificant model: (Prob > chi2 = - )
.estat icc
Intraclass correlation


------------------------------------------------------------------------------
                       Level |        ICC   Std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
                        stcd |   .0096788    .004529      .0038562    .0240801
------------------------------------------------------------------------------
. ***M0.2: Fully Unconditional Model for Change in Hospital Beds that are not related to COVID-19 with AHA 2019 and 2020
Data ROBUST
. mixed noncovbds_change_t || stcd:, cov(unstr) robust
. **_cons significant (0.000, 95%[785.793, 787.0921])
. **Insignificant model: (Prob > chi2 = - )
. estat icc
**Names for variables: noncovbds_change_t covsevcases covsevhosp covsevdeaths ipdtot_t suroptot_t opra_t gfeet_t mapp20
. **List of Level 1 Aggregate Variables: ipdtot_t_m, ipdtot_t_sd, suroptot_t_m, suroptot_t_sd, opra_t_m, opra_t_sd,
gfeet_t_m, gfeet_t_sd
```

```
. ***M0.2.1: Model for Change in Hospital Beds that are not related to COVID-19 with AHA 2019 and 2020 Data ROBUST with all level-1 and level-2 predictors to see if robust might still be viable

. mixed noncovbds_change_t covsevcases covsevhosp covsevdeaths ipdtot_t suroptot_t opra_t gfeet_t mapp20|| stcd:, cov(unstr) robust

. mixed noncovbds_change_t covsevcases covsevhosp covsevdeaths ipdtot_t suroptot_t op

> ra_t gfeet_t mapp20|| stcd:, cov(unstr) robust

note: single-variable random-effects specification in stcd equation; covariance
      structure set to identity.


Performing EM optimization ...


Performing gradient-based optimization:

Iteration 0:   log pseudolikelihood = -9526.0012

Iteration 1:   log pseudolikelihood = -9525.9802

Iteration 2:   log pseudolikelihood = -9525.9801


Computing standard errors ...


Mixed-effects regression                        Number of obs     =      2,399
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          4
                                                              avg =       47.0
                                                              max =        291
                                                Wald chi2(8)      =      17.72
```

```
Log pseudolikelihood = -9525.9801               Prob > chi2       =     0.0234

                                        (Std. err. adjusted for 51 clusters in stcd)
------------------------------------------------------------------------------
                    |               Robust
noncovbds_change_t | Coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------------+----------------------------------------------------------------
       covsevcases |    29.9915   17.60588     1.70   0.088     -4.51538    64.49839
        covsevhosp |  -23.33634   201.0984    -0.12   0.908    -417.4821    370.8094
      covsevdeaths |  -1838.288    835.249    -2.20   0.028    -3475.346   -201.2304
         ipdtot_t |   .4818871   .2564204     1.88   0.060    -.0206876    .9844619
        suroptot_t |  -.0188478    .023856    -0.79   0.429    -.0656047    .0279091
           opra_t |   1.100784   .7082156     1.55   0.120    -.2872931    2.488861
          gfeet_t |  -.6049714   .4205556    -1.44   0.150    -1.429245    .2193024
           mapp20 |   .3852508   .5402848     0.71   0.476     -.673688     1.44419
            _cons |   786.7134   5.197186   151.37   0.000     776.5271    796.8997
------------------------------------------------------------------------------

------------------------------------------------------------------------------
                              |               Robust
  Random-effects parameters   |   Estimate   std. err.     [95% conf. interval]
------------------------------+-----------------------------------------------
stcd: Identity                |
                  var(_cons) |   .9785306   .6310808      .2764468    3.463676
------------------------------+-----------------------------------------------
               var(Residual) |    163.835    15.3405      136.3658    196.8375
```

```
------------------------------------------------------------------------------

. **still have high standard errors: 201 (covsevhosp, etc.s

. **Significant model: (Prob > chi2 = 0.0234)

. **Significant variables: covsevdeaths (0.028), _cons (0.000)

. **Insignificant variables: covsevcases (0.088), covsevhosp (0.908), ipdtot_t (0.060), suroptot_t (0.429), opra_t
(0.120), gfeet_t (0.150), mapp20 (0.476)

. estat icc

Residual intraclass correlation

------------------------------------------------------------------------------
                       Level |        ICC   Std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
                        stcd |   .0059372   .0038536      .0016583    .0210244
------------------------------------------------------------------------------

. ***M0.3: Fully Unconditional Model for Change in Hospital Beds that are not related to COVID-19 with AHA 2019 and 2020
Data BOOTSTRAP

(running mixed on estimation sample)

Bootstrap replications (50)

----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5

..................................................    50

Mixed-effects ML regression                     Number of obs     =      2,748

Group variable: stcd                            Number of groups  =         51

                                                Obs per group:

                                                              min =          5

                                                              avg =       53.9

                                                              max =        301
```

```
                                                Wald chi2(0)      =          .
Log likelihood =  -10947.47                     Prob > chi2       =          .
                                          (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
                   |   Observed   Bootstrap                         Normal-based
noncovbds_change_t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------------+----------------------------------------------------------------
             _cons |   786.4425   .2442412  3219.94   0.000     785.9638    786.9212
------------------------------------------------------------------------------

------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Identity               |
                  var(_cons) |   1.639623   1.459955      .2862965    9.390136
-----------------------------+------------------------------------------------
               var(Residual) |   167.7648   15.86249      139.3856     201.922
------------------------------------------------------------------------------
LR test vs. linear model: chibar2(01) = 13.84         Prob >= chibar2 = 0.0001
. **Insignificant model: (Prob > chi2 = - )
. **_cons significant = 0.000
. **Prob >= chibar2 = 0.001
. estat icc
Intraclass correlation
------------------------------------------------------------------------------
```

```
                        Level |        ICC   Std. err.     [95% conf. interval]
------------------------------+------------------------------------------------
                         stcd |   .0096788   .0081436      .0018452    .0491308
------------------------------------------------------------------------------
```

. **Intraclass correlation: .0096799

. ***M0.3.1: Model for Change in Hospital Beds that are not related to COVID-19 with AHA 2019 and 2020 Data BOOSTRAP with all level-1 and level-2 predictors to see if bootstrapping may continue to be viable

. bootstrap, cluster(stcd): mixed noncovbds_change_t covsevcases covsevhosp covsevdeaths ipdtot_t suroptot_t opra_t gfeet_t mapp20|| stcd:

(running mixed on estimation sample)

Bootstrap replications (50)

```
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50
```

```
Mixed-effects ML regression                     Number of obs     =      2,399
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          4
                                                              avg =       47.0
                                                              max =        291
                                                Wald chi2(8)      =      16.18
Log likelihood = -9525.9801                     Prob > chi2       =     0.0399
                                       (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
                   |   Observed   Bootstrap                         Normal-based
noncovbds_change_t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
```

```
-------------------+------------------------------------------------------------------
       covsevcases |    29.9915   16.57605     1.81   0.070    -2.496954    62.47996
        covsevhosp |  -23.33634    214.562    -0.11   0.913    -443.8702    397.1975
      covsevdeaths |  -1838.288   732.4946    -2.51   0.012    -3273.951   -402.6255
         ipdtot_t |   .4818871    .298742     1.61   0.107    -.1036364    1.067411
        suroptot_t |  -.0188478   .0221646    -0.85   0.395    -.0622897    .0245941
            opra_t |   1.100784   .7252807     1.52   0.129    -.3207401    2.522308
           gfeet_t |  -.6049714   .5181473    -1.17   0.243    -1.620521    .4105787
            mapp20 |   .3852508   .5980173     0.64   0.519    -.7868415    1.557343
             _cons |   786.7134    5.86852   134.06   0.000     775.2113    798.2155
------------------------------------------------------------------------------------------

------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Identity               |
                  var(_cons) |   .9785306   5.375612      .0000206     46419.2
-----------------------------+------------------------------------------------
               var(Residual) |    163.835    15.9284      135.4101    198.2268
------------------------------------------------------------------------------

LR test vs. linear model: chibar2(01) = 5.54          Prob >= chibar2 = 0.0093

. **still have high standard errors: ~732 (covsevdeaths), ~214 (covsevhosp)

. **Significant model: (Prob > chi2 = 0.0399)

. **Significant variables: _cons (0.000)
```

```
. **Insignificant variables: covsevcases (0.070), covsevhosp (0.913), covsevdeaths (0.012), ipdtot_t (0.107), suroptot_t
(0.395), gfeet_t (0.243), mapp20 (0.519)

. **LR vs. linear: 5.54

. estat icc

Residual intraclass correlation

------------------------------------------------------------------------------
                       Level |        ICC   Std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
                        stcd |   .0059372   .0323494      1.29e-07    .9963966
------------------------------------------------------------------------------

. ***Since the DV has a Poisson distribution/is leptokurtic rather than normally distributed (Gaussian), the best way to
continue to model it is with bootstrapping

. ***The bootstrapped fully unconditional model is significant (0.0399), but most of the variables are not; only _cons is
significant. This means that the bootstrapped fully unconditional model is significantly different from regular OLS, even
though the DV is very leptokurtic

. ***The other fully unconditional models (regular mixed and robust mixed) are not significant, so they are not
significantly different from regular OLS, therefore their level 2 variance (at the state level) is not significant

. **************************************************************************

. ***M1: Conditional Model with Random Intercept (one way ANCOVA with random intercept)

. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t || stcd:

(running mixed on estimation sample)

Bootstrap replications (50)

----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5

..................................................    50

Mixed-effects ML regression                     Number of obs     =      2,748

Group variable: stcd                            Number of groups  =         51

                                                Obs per group:
```

```
                                                      min =          5
                                                      avg =       53.9
                                                      max =        301
                                            Wald chi2(1)      =       0.22
Log likelihood = -10947.266                 Prob > chi2       =     0.6394
                                       (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
                   |   Observed   Bootstrap                         Normal-based
noncovbds_change_t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------------+----------------------------------------------------------------
          ipdtot_t |   .1153715   .2462382     0.47   0.639    -.3672465    .5979896
             _cons |   785.2914    2.25466   348.30   0.000     780.8723    789.7104
------------------------------------------------------------------------------

------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Identity               |
                  var(_cons) |   1.723715   6.186947      .0015179    1957.451
-----------------------------+------------------------------------------------
               var(Residual) |   167.6922   12.52633      144.8537    194.1316
------------------------------------------------------------------------------
LR test vs. linear model: chibar2(01) = 14.23         Prob >= chibar2 = 0.0001
```

. **Estimating 2 fixed effects: intercept and the effect of total facility inpatient days, so IF THE MODEL WAS SIGNIFICANT, the change in hospital beds not related to COVID-19 for a hospital with inpatient facility days one unit above the mean would be: _cons + ipdtot_t = 785.2914 + .1153715

. **This model is NOT SIGNIFICANT, neither is the total facility inpatient days

. estat icc

Residual intraclass correlation

```
------------------------------------------------------------------------------
                       Level |        ICC   Std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
                        stcd |   .0101745   .0360106      9.30e-06    .9191303
------------------------------------------------------------------------------
```

. **Intraclass correlation: .0101745

. **The increase in intraclass correlation from .0059372 to. 0101745 indicates a increase in the relative share of between-school variance after controlling for total inpatient facility days

. **Proportion of variance explained at each level (comparing the current variance estimates to those in the null model): (M0var(_cons) - M1var(_cons))/M0var(_cons) AND (M0var(Residual) - M1var(Residual))/M0var(Residual):

. **(.9785306 - 1.723715)/.9785306 AND (163.835 - 167.6922)/163.835:

. **-.76153407 AND -.0235431

. ** -76.153% AND -2.35%

. **...so controlling for hospitals' total facility inpatient days explained 76.1% of between-hospital variance, and 2.3% within-hospital variance in the change in beds not related to COVID-19 from 2019 to 2020

. ***M2: Model with random intercept and random slopes (one-way ANCOVA with random intercept and slopes)

. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t || stcd: ipdtot_t, cov(unstr)

(running mixed on estimation sample)

convergence not achieved

Bootstrap replications (50)

----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5

```
.................................................    50
Mixed-effects ML regression                     Number of obs     =      2,748
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          5
                                                              avg =       53.9
                                                              max =        301
                                                Wald chi2(1)      =       0.06
Log likelihood = -10936.542                     Prob > chi2       =     0.8037
                                          (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
                   |   Observed   Bootstrap                         Normal-based
noncovbds_change_t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------------+----------------------------------------------------------------
          ipdtot_t |   .0351652   .1414985     0.25   0.804    -.2421668    .3124973
             _cons |   786.3322   1.396911   562.91   0.000     783.5943    789.0701
------------------------------------------------------------------------------

------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Unstructured           |
               var(ipdtot_t) |   .6525833    .290123       .273031    1.559768
                  var(_cons) |   46.21938   21.55715      18.52746    115.3009
         cov(ipdtot_t,_cons) | -5.491994   2.489878     -10.37206   -.6119229
```

```
------------------------------+------------------------------------------------
               var(Residual) |   165.8185   12.70663       142.694    192.6905
------------------------------------------------------------------------------
LR test vs. linear model: chi2(3) = 35.68                 Prob > chi2 = 0.0000

Note: LR test is conservative and provided only for reference.

Warning: Convergence not achieved.

. **This model is NOT SIGNIFICANT (0.8037) nor are total facility inpatient days (0.398)

. **IF THE MODEL WAS SIGNIFICANT, the change in hospital beds not related to COVID-19 for a hospital with average inpatient
facility days is (786.3322 - 787 (because of constant added))-.6678; each unit increase in inpatient facility days is
associated with .0000118 increase in change in hospital beds not related to COVID-19. More substantively, each additional
month (30 days) increase in inpatient facility days is associated with 20.034 change in hospital beds not related to
COVID-19.

. estat icc

Intraclass correlation


------------------------------------------------------------------------------
                       Level |        ICC   Std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
                        stcd |   .217977    .0735701      .1068437    .3937456
------------------------------------------------------------------------------

. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t || stcd: ipdtot_t, cov(unstr)

. estat recov, corr

Random-effects correlation matrix for level stcd

             |  ipdtot_t      _cons
-------------+----------------------
    ipdtot_t |         1
```

```
       _cons |        -1          1
. **Testing if there is significant variance in inpatient facility day slopes:
. qui bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t || stcd: ipdtot_t, cov(unstr)
convergence not achieved
. estat ic
Akaike's information criterion and Bayesian information criterion
------------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df        AIC        BIC
-------------+----------------------------------------------------------------
           . |      2,748          .  -10936.54       6   21885.08    21920.6
------------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.
. est store ipdtot_t_slope
. qui bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t || stcd:
. estat ic
Akaike's information criterion and Bayesian information criterion
------------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df        AIC        BIC
-------------+----------------------------------------------------------------
           . |      2,748          .  -10947.27       4   21902.53   21926.21
------------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.
. **Difference in BIC: ~6
. **The model with the lower value BIC is mildly preferred (bootstrap model with random intercept and random slopes - M2)
. lrtest . ipdtot_t_slope
```

```
LR test likely invalid with cluster(stcd)
r(498);
. **LR test likely invalid due to clustering, but clustering is necessary because the DV is not normally distributed
. **#####################################
. ***M3: Means-as-outcomes model (Intercepts as outcome)
. bootstrap, cluster(stcd): mixed noncovbds_change_t covsevcases || stcd:
(running mixed on estimation sample)
Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50
Mixed-effects ML regression                     Number of obs     =      2,748
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          5
                                                              avg =       53.9
                                                              max =        301
                                                Wald chi2(1)      =       5.36
Log likelihood = -10946.744                     Prob > chi2       =     0.0206
                                  (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
noncovbds_c~t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
--------------+---------------------------------------------------------------
  covsevcases |   23.29085   10.06369     2.31   0.021     3.566382    43.01531
        _cons |   784.9858   .7608803  1031.68   0.000     783.4945    786.4771
```

```
------------------------------------------------------------------------------

------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Identity               |
                  var(_cons) |   1.517954    5.86115      .0007845    2937.196
-----------------------------+------------------------------------------------
               var(Residual) |    167.746     15.902      139.3028    201.9967
------------------------------------------------------------------------------
LR test vs. linear model: chibar2(01) = 12.71         Prob >= chibar2 = 0.0002

. **This model is significant (p = 0.0206), and the intercept (0.000) and COVID-19 cases per state population (0.021) are
significant

. **SINCE THE MODEL IS SIGNIFICANT, the average change in hospital beds (not related to COVID-19) is 23.29085 units higher
for every one unit increase in the proportion of COVID-19 cases per state population.

. estat icc

Residual intraclass correlation


------------------------------------------------------------------------------
                       Level |        ICC   Std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
                        stcd |   .008968    .0322875      7.32e-06    .9179833
------------------------------------------------------------------------------

. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t covsevcases || stcd: ipdtot_t, cov(unstr)

(running mixed on estimation sample)
```

```
Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50

Mixed-effects ML regression                     Number of obs     =      2,748
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          5
                                                              avg =       53.9
                                                              max =        301
                                                Wald chi2(2)      =       0.74
Log likelihood = -10936.428                     Prob > chi2       =     0.6910
                                  (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
noncovbds_c~t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
     ipdtot_t |   .0465203   .1977795     0.24   0.814    -.3411205     .434161
  covsevcases |   8.783015   10.21543     0.86   0.390    -11.23885    28.80488
        _cons |   785.6643   2.139254   367.26   0.000     781.4714    789.8571
------------------------------------------------------------------------------

------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
```

```
stcd: Unstructured           |
               var(ipdtot_t) |   .6331236   .2774222      .2682309    1.494404
                  var(_cons) |   44.80883   22.68396      16.61317    120.8578
         cov(ipdtot_t,_cons) |  -5.326305   2.503357     -10.23279    -.419816
-----------------------------+------------------------------------------------
               var(Residual) |   165.8394   15.37432      138.2854    198.8837
------------------------------------------------------------------------------
LR test vs. linear model: chi2(3) = 33.33                 Prob > chi2 = 0.0000


Note: LR test is conservative and provided only for reference.
```

. **NOT SIGNIFICANT: 0.6910

. **IF THIS MODEL WAS SIGNIFICANT, the intercept would be the value of hospital beds (not related to COVID-19) in a hospital that has average inpatient days in a state with an average proportion of COVID-19 cases per state = 785.6643 - 787 = -1.3357

. **IF THIS MODEL WAS SIGNIFICANT, the value of hospital beds (not related to COVID-19) in a hospital that has average inpatient days in a state with a one unit increase above the average proportion of COVID-19 cases per state = 8.783015 units higher

. qui bootstrap, cluster(stcd): mixed noncovbds_change ipdtot_t covsevcases || stcd: ipdtot_t, cov(unstr)

convergence not achieved

. estat ic

Akaike's information criterion and Bayesian information criterion

Model	N	ll(null)	ll(model)	df	AIC	BIC
.	2,748	.	-12901.58	7	25817.15	25858.58

```
Note: BIC uses N = number of observations. See [R] BIC note.
. qui bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t covsevcases || stcd:
. estat ic
Akaike's information criterion and Bayesian information criterion
------------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df        AIC        BIC
-------------+----------------------------------------------------------------
           . |      2,748          .  -10946.45       5   21902.89   21932.48
------------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.
. **Difference in BIC: 25858.58 - 21932.48 = 3926.1
. **M4 is strongly preferred to M3 because the difference in BIC is greater than 3900
. **################################################
. **M5: Intercepts and Slopes as Outcomes (Cross-Level Interactions Model)
. bootstrap, cluster(stcd): mixed noncovbds_change_t i.ipdtot_t##i.covsevcases || stcd: ipdtot_t, cov(unstr)
(running mixed on estimation sample)
ipdtot_t:  factor variables may not contain noninteger values
an error occurred when bootstrap executed mixed
r(452);
. **Error - unable to run cross-level interactions with bootstrapping
. **M6.1: Adding level-1 predictor (suroptot) to fixed
. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t suroptot_t covsevcases || stcd: ipdtot_t, cov(unstr)
ipdtot_t:  factor variables may not contain noninteger values
an error occurred when bootstrap executed mixed
r(452);
```

```
. **M6.2: Adding level-1 predictor (suroptot) to fixed and random intercepts

. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t suroptot_t covsevcases || stcd: ipdtot_t suroptot_t,
cov(unstr)

(running mixed on estimation sample)

Bootstrap replications (50)

----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5

..................................................    50


Mixed-effects ML regression                     Number of obs     =      2,748
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          5
                                                              avg =       53.9
                                                              max =        301
                                                Wald chi2(3)      =       0.93
Log likelihood = -10936.414                     Prob > chi2       =     0.8183
                                  (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
noncovbds_c~t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
--------------+---------------------------------------------------------------
     ipdtot_t |   .0779657   .2213034     0.35   0.725    -.3557809    .5117124
   suroptot_t |  -.0013866   .0125078    -0.11   0.912    -.0259015    .0231283
  covsevcases |   8.653584   10.06027     0.86   0.390    -11.06418    28.37134
        _cons |   785.4538   1.824181   430.58   0.000     781.8785    789.0291
```

```
------------------------------------------------------------------------------
------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Unstructured           |
               var(ipdtot_t) |   .6329734   .2455171      .2959527    1.353782
                  var(_cons) |   44.79237   20.22327      18.48825    108.5206
         cov(ipdtot_t,_cons) |  -5.324695   2.224977      -9.68557   -.9638207
-----------------------------+------------------------------------------------
               var(Residual) |   165.8376   16.36269      136.6776    201.2187
------------------------------------------------------------------------------
LR test vs. linear model: chi2(3) = 33.24                 Prob > chi2 = 0.0000

Note: LR test is conservative and provided only for reference.

. **NOT SIGNIFICANT (p = 0.8183), so going back to M4 (bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t
covsevcases || stcd: ipdtot_t, cov(unstr))

. **M7.1: Adding level-1 predictor (opra) to fixed

. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t opra_t covsevcases || stcd: ipdtot_t, cov(unstr)

(running mixed on estimation sample)

Bootstrap replications (50)

----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5

..................................................    50

Mixed-effects ML regression                     Number of obs     =      2,727

Group variable: stcd                            Number of groups  =         51

                                                Obs per group:
```

```
                                                      min =          5
                                                      avg =       53.5
                                                      max =        300
                                            Wald chi2(3)      =       1.13
Log likelihood = -10860.455                 Prob > chi2       =     0.7705
                                  (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
noncovbds_c~t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
     ipdtot_t |  -.0118733   .1907223    -0.06   0.950    -.3856822    .3619356
       opra_t |   .1234078   .4164598     0.30   0.767    -.6928384     .939654
  covsevcases |   9.128272   8.950606     1.02   0.308    -8.414593    26.67114
        _cons |   785.8306    1.78221   440.93   0.000     782.3375    789.3237
------------------------------------------------------------------------------

------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Unstructured           |
               var(ipdtot_t) |   .6269202   .2678521      .2713537    1.448401
                  var(_cons) |   44.26228   20.85029      17.58186    111.4301
         cov(ipdtot_t,_cons) |  -5.267724    2.35359     -9.880676   -.6547717
-----------------------------+------------------------------------------------
               var(Residual) |   166.7731   14.81581      140.1222     198.493
```

```
------------------------------------------------------------------------------
LR test vs. linear model: chi2(3) = 33.00                 Prob > chi2 = 0.0000

Note: LR test is conservative and provided only for reference.

. **NOT SIGNIFICANT (p = 0.7705), so going back to M4 - both its coefficient and corresponding random effects are not
significant

. **M7.2: Adding level-1 predictor (opra) to fixed and random intercepts

. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t opra_t covsevcases || stcd: ipdtot_t opra_t, cov(unstr)

(running mixed on estimation sample)

convergence not achieved

Bootstrap replications (50)

----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5

..................................................    50


Mixed-effects ML regression                     Number of obs     =      2,727
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          5
                                                              avg =       53.5
                                                              max =        300
                                                Wald chi2(3)      =       0.72
Log likelihood = -10857.407                     Prob > chi2       =     0.8688
                                  (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
noncovbds_c~t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
```

```
-------------+----------------------------------------------------------------
     ipdtot_t |   .0650499   .1851457     0.35   0.725    -.2978291    .4279288
       opra_t |   .0484646   .3348817     0.14   0.885    -.6078914    .7048206
  covsevcases |   7.261191   10.27559     0.71   0.480    -12.87859    27.40097
        _cons |   785.4597   1.618514   485.30   0.000     782.2875    788.6319
------------------------------------------------------------------------------

------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Unstructured           |
               var(ipdtot_t) |   .1798129   .1434795       .037637    .8590666
                 var(opra_t) |   .8735224   .5909795      .2319507     3.28967
                  var(_cons) |   33.78632   14.63575      14.45481    78.97131
        cov(ipdtot_t,opra_t) |    .396212   .1919166      .0200623    .7723617
         cov(ipdtot_t,_cons) |  -2.464665    1.35732     -5.124962    .1956328
           cov(opra_t,_cons) |  -5.432123   2.100953     -9.549916    -1.31433
-----------------------------+------------------------------------------------
               var(Residual) |   166.0763   14.93381      139.2408    198.0837
------------------------------------------------------------------------------
LR test vs. linear model: chi2(6) = 39.10                 Prob > chi2 = 0.0000

Note: LR test is conservative and provided only for reference.

Warning: Convergence not achieved.

. **NOT SIGNIFICANT (p = 0.866), so going back to M4 - both its coefficient and corresponding random effects are not
significant
```

```
. **M8.1: Adding level-1 predictor (gfeet_tc) to fixed

. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t suroptot_t gfeet_t covsevcases || stcd: ipdtot_t suroptot_t,
cov(unstr)

(running mixed on estimation sample)

Bootstrap replications (50)

----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5

......x.............x..............................    50

Mixed-effects ML regression                     Number of obs     =      2,420

Group variable: stcd                            Number of groups  =         51

                                                Obs per group:

                                                              min =          4

                                                              avg =       47.5

                                                              max =        292

                                                Wald chi2(4)      =       4.95

Log likelihood = -9579.3652                     Prob > chi2       =     0.2924

                                  (Replications based on 51 clusters in stcd)

------------------------------------------------------------------------------

             |   Observed   Bootstrap                         Normal-based

noncovbds_c~t | coefficient  std. err.      z    P>|z|     [95% conf. interval]

--------------+---------------------------------------------------------------

     ipdtot_t |   .3066729   .3058521     1.00   0.316    -.2927862    .9061319

   suroptot_t |   .0115222   .0148799     0.77   0.439    -.0176418    .0406862

      gfeet_t |  -.6933636    .384697    -1.80   0.071    -1.447356    .0606286

  covsevcases |  -2.477979   9.802743    -0.25   0.800      -21.691    16.73504

        _cons |   791.9844   4.559196   173.71   0.000     783.0485    800.9202
```

```
------------------------------------------------------------------------------
------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Unstructured           |
                var(ipdtot_t) |   .5167837   .3613131      .1312759    2.034382
             var(suroptot_t) |   .0037816   .0009365      .0023274    .0061443
                  var(_cons) |    18.4311    18.8282      2.488916    136.4873
    cov(ipdtot_t,suroptot_t) |  -.0335142   .0145009     -.0619355    -.005093
         cov(ipdtot_t,_cons) |  -2.904374   2.630946     -8.060934    2.252186
       cov(suroptot_t,_cons) |   .1301266   .1087608     -.0830407    .3432939
-----------------------------+------------------------------------------------
               var(Residual) |   156.9698   14.06385      131.6897    187.1028
------------------------------------------------------------------------------
LR test vs. linear model: chi2(6) = 61.16                 Prob > chi2 = 0.0000

Note: LR test is conservative and provided only for reference.

. **MODEL NOT SIGNIFICANT: 0.2924

. **M8.2: Adding level-1 predictor (gfeet_tc) to fixed and random intercepts

. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t suroptot_t gfeet_t covsevcases || stcd: ipdtot_t suroptot_t
gfeet_t, cov(unstr)

(running mixed on estimation sample)

convergence not achieved

Bootstrap replications (50)

----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
```

```
...xxxx..xxx.............x...x.......xx..x.....    50
Mixed-effects ML regression                     Number of obs     =      2,420
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          4
                                                              avg =       47.5
                                                              max =        292
                                                Wald chi2(4)      =       8.42
Log likelihood = -9578.3038                     Prob > chi2       =     0.0774
                                  (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
noncovbds_c~t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
     ipdtot_t |   .3328371   .1989932     1.67   0.094    -.0571824    .7228565
   suroptot_t |   .0118719   .0122273     0.97   0.332    -.0120932    .0358371
      gfeet_t |   -.748002   .3169466    -2.36   0.018    -1.369206    -.126798
  covsevcases |  -2.236663   9.375183    -0.24   0.811    -20.61168    16.13836
        _cons |   792.3925      3.619   218.95   0.000     785.2994    799.4857
------------------------------------------------------------------------------

------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Unstructured           |
```

```
               var(ipdtot_t) |   .6541741    .403133      .1954982    2.188991
             var(suroptot_t) |   .0030515   .0010276      .0015771    .0059043
                var(gfeet_t) |   .4062206   .5453776      .0292394    5.643589
                  var(_cons) |   59.12049   72.88495      5.276663    662.3945
    cov(ipdtot_t,suroptot_t) |  -.0415962   .0171851     -.0752784    -.007914
       cov(ipdtot_t,gfeet_t) |  -.2080546   .2655634     -.7285493      .31244
         cov(ipdtot_t,_cons) |  -1.304261   3.152353     -7.482759    4.874238
     cov(suroptot_t,gfeet_t) |   .0249854   .0163301      -.007021    .0569919
       cov(suroptot_t,_cons) |  -.0686353   .1891521     -.4393665     .302096
          cov(gfeet_t,_cons) |  -3.969212   5.794473     -15.32617    7.387746
-----------------------------+------------------------------------------------
               var(Residual) |   156.6895   14.77215      130.2542      188.49
------------------------------------------------------------------------------
LR test vs. linear model: chi2(10) = 63.28                Prob > chi2 = 0.0000

Note: LR test is conservative and provided only for reference.

Warning: Convergence not achieved.

. ***NOT SIGNIFICANT: 0.0774

. **M9: Adding level-1 predictor (sole community provider status - mapp20) with fixed

. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t suroptot_t mapp20 covsevcases || stcd: ipdtot_t suroptot_t,
cov(unstr)

(running mixed on estimation sample)

. ***NOT SIGNIFICANT: 0.69060

Bootstrap replications (50)

----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5

.................................................x....    50
```

```
Mixed-effects ML regression                     Number of obs     =      2,748
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          5
                                                              avg =       53.9
                                                              max =        301
                                                Wald chi2(4)      =       2.22
Log likelihood = -10928.233                     Prob > chi2       =     0.6960

                                  (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
noncovbds_c~t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
     ipdtot_t |  -.0065098   .2092489    -0.03   0.975      -.41663    .4036104
   suroptot_t |   .0039316   .0085688     0.46   0.646    -.0128629    .0207262
       mapp20 |   .5526334     .68772     0.80   0.422    -.7952731     1.90054
  covsevcases |   8.877475   9.300257     0.95   0.340    -9.350695    27.10564
        _cons |   784.8653   1.901745   412.71   0.000     781.1379    788.5926
------------------------------------------------------------------------------

------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Unstructured           |
```

```
               var(ipdtot_t) |    .399761   .2364932      .1253837    1.274559
             var(suroptot_t) |   .0022785   .0009778      .0009826    .0052835
                  var(_cons) |   17.63828   15.32013       3.21459    96.78025
    cov(ipdtot_t,suroptot_t) |  -.0172868   .0252056     -.0666889    .0321154
         cov(ipdtot_t,_cons) |  -2.478435    1.83211     -6.069305    1.112435
       cov(suroptot_t,_cons) |   .0481912   .2336252     -.4097059    .5060882
-----------------------------+------------------------------------------------
               var(Residual) |   163.5427   14.19449      137.9597    193.8698
------------------------------------------------------------------------------
LR test vs. linear model: chi2(6) = 49.27                 Prob > chi2 = 0.0000

Note: LR test is conservative and provided only for reference.

. **Going back to M4

. **M10: Adding level-2 predictor (covsevhosp_log) with fixed

. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t suroptot_t covsevcases covsevhosp || stcd: ipdtot_t
suroptot_t, cov(unstr)

(running mixed on estimation sample)

Bootstrap replications (50)

----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5

.........x.........................................    50

Mixed-effects ML regression                     Number of obs     =      2,748

Group variable: stcd                            Number of groups  =         51

                                                Obs per group:

                                                              min =          5

                                                              avg =       53.9

                                                              max =        301
```

```
                                                Wald chi2(4)      =       1.02
Log likelihood = -10928.404                     Prob > chi2       =     0.9065
                                  (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
noncovbds_c~t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
     ipdtot_t |   .0073815   .1847511     0.04   0.968     -.354724     .369487
   suroptot_t |   .0038833   .0082469     0.47   0.638    -.0122802    .0200469
  covsevcases |   8.541782   13.34476     0.64   0.522    -17.61346    34.69703
   covsevhosp |   11.30641   174.5138     0.06   0.948    -330.7344    353.3472
        _cons |   785.7864   1.519939   516.99   0.000     782.8074    788.7655
------------------------------------------------------------------------------

------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Unstructured           |
               var(ipdtot_t) |   .4033976   .2345627      .1290586    1.260897
             var(suroptot_t) |   .0022837   .0007696      .0011798    .0044207
                  var(_cons) |   17.91461   14.59719      3.627696     88.4675
    cov(ipdtot_t,suroptot_t) |  -.0172771    .011084     -.0390013    .0044472
         cov(ipdtot_t,_cons) |  -2.507397   1.791486     -6.018646    1.003852
       cov(suroptot_t,_cons) |   .0474219   .0639382     -.0778947    .1727385
-----------------------------+------------------------------------------------
```

```
               var(Residual) |   163.5567   15.24839       136.242    196.3478
------------------------------------------------------------------------------
LR test vs. linear model: chi2(6) = 49.12                 Prob > chi2 = 0.0000

Note: LR test is conservative and provided only for reference.

. ***NOT SIGNIFICANT: 0.9065

. **M11: Adding level-2 predictor (covsevdeaths_sqrt)

. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t suroptot_t covsevcases covsevdeaths || stcd: ipdtot_t
suroptot_t, cov(unstr)

(running mixed on estimation sample)

Bootstrap replications (50)

----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5

..................................................    50

Mixed-effects ML regression                     Number of obs     =      2,748
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          5
                                                              avg =       53.9
                                                              max =        301
                                                Wald chi2(4)      =       2.73
Log likelihood =  -10928.07                     Prob > chi2       =     0.6032
                                  (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
noncovbds_c~t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
```

```
     ipdtot_t |   .0450664   .1776987     0.25   0.800    -.3032167    .3933495
   suroptot_t |   .0032529   .0104165     0.31   0.755    -.0171631    .0236689
  covsevcases |   16.74078   11.65493     1.44   0.151    -6.102474    39.58403
 covsevdeaths |  -767.4797    621.446    -1.23   0.217    -1985.492    450.5321
        _cons |   785.7428   1.571897   499.87   0.000      782.662    788.8237
------------------------------------------------------------------------------

------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Unstructured           |
               var(ipdtot_t) |   .3875387   .2483217      .1103809    1.360618
             var(suroptot_t) |   .0022518   .0008072      .0011153    .0045463
                  var(_cons) |   16.60556   11.84799      4.101339    67.23286
    cov(ipdtot_t,suroptot_t) |   -.017447     .02112     -.0588414    .0239474
         cov(ipdtot_t,_cons) |  -2.351252   1.570916     -5.430191    .7276863
       cov(suroptot_t,_cons) |   .0472747   .1581738     -.2627402    .3572897
-----------------------------+------------------------------------------------
               var(Residual) |    163.614   16.31844      134.5624    198.9377
------------------------------------------------------------------------------
LR test vs. linear model: chi2(6) = 42.30                 Prob > chi2 = 0.0000
Note: LR test is conservative and provided only for reference.
. ***NOT SIGNIFICANT: 0.6032
. **Hessian is not negative semidefinite; an error occurred when bootstrap executed mixed, going back to M4
. **Adding aggregate variables to current best (significant, parsimonious) model (M4)
```

```
. **List of Level 1 Aggregate Variables: ipdtot_t_m, ipdtot_t_sd, suroptot_t_m, suroptot_t_sd, opra_t_m, opra_t_sd, gfeet_t_m, gfeet_t_sd

. *M4.1: Adding aggregates of ipdtot

. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t ipdtot_t_m ipdtot_t_sd covsevcases || stcd: ipdtot_t, cov(unstr)

convergence not achieved

Bootstrap replications (50)

----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5

..................................................    50

Mixed-effects ML regression                     Number of obs     =      2,748

Group variable: stcd                            Number of groups  =         51

                                                Obs per group:

                                                              min =          5

                                                              avg =       53.9

                                                              max =        301

                                                Wald chi2(4)      =       7.34

Log likelihood = -10934.867                     Prob > chi2       =     0.1188

                                  (Replications based on 51 clusters in stcd)

------------------------------------------------------------------------------

             |   Observed   Bootstrap                         Normal-based

noncovbds_c~t | coefficient  std. err.      z    P>|z|     [95% conf. interval]

--------------+---------------------------------------------------------------

     ipdtot_t |   .1379935    .169038     0.82   0.414    -.1933149    .4693019

   ipdtot_t_m |   .0868802   .5282907     0.16   0.869    -.9485506    1.122311

  ipdtot_t_sd |   2.588068   1.219753     2.12   0.034     .1973966    4.978739
```

```
  covsevcases |   3.783271   8.518184     0.44   0.657    -12.91206     20.4786
        _cons |   780.8038   6.510707   119.93   0.000     768.0431    793.5646
------------------------------------------------------------------------------

------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Unstructured           |
               var(ipdtot_t) |   .5781027   .2936338      .2136274    1.564419
                  var(_cons) |   43.65028   23.86634      14.94796    127.4653
         cov(ipdtot_t,_cons) |   -5.02338   2.641993     -10.20159    .1548312
-----------------------------+------------------------------------------------
               var(Residual) |    165.971   17.24581      135.3896    203.4602
------------------------------------------------------------------------------
LR test vs. linear model: chi2(3) = 16.04                 Prob > chi2 = 0.0011

Note: LR test is conservative and provided only for reference.

Warning: Convergence not achieved.

. **NOT SIGNIFICANT: 0.1188

. **M4.2: Adding aggregates of suroptot

. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t suroptot_t_m suroptot_t_sd covsevcases_sqrt_tbc || stcd:
ipdtot_t, cov(unstr)

(running mixed on estimation sample)

Bootstrap replications (50)

----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5

..................................................    50
```

```
Mixed-effects ML regression                     Number of obs     =      2,748
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          5
                                                              avg =       53.9
                                                              max =        301
                                                Wald chi2(4)      =       8.90
Log likelihood = -10934.887                     Prob > chi2       =     0.0635
                                  (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
noncovbds_c~t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
--------------+---------------------------------------------------------------
     ipdtot_t |   .1188121   .1943096     0.61   0.541    -.2620276    .4996519
 suroptot_t_m |  -.0440179   .0173364    -2.54   0.011    -.0779966   -.0100392
suroptot_t_sd |   .0950664   .0445345     2.13   0.033     .0077805    .1823524
covsevcases~c |  -.6177422   4.421934    -0.14   0.889    -9.284573    8.049089
        _cons |   784.7211   2.410379   325.56   0.000     779.9969    789.4454
------------------------------------------------------------------------------

------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Unstructured           |
               var(ipdtot_t) |   .5868487   .3027001      .2135361    1.612802
```

```
                  var(_cons) |   44.27962    24.1398      15.21096    128.8994
         cov(ipdtot_t,_cons) |  -5.097591   2.689243     -10.36841    .1732282
-----------------------------+------------------------------------------------
               var(Residual) |   165.9553   14.90692      139.1656     197.902
------------------------------------------------------------------------------
LR test vs. linear model: chi2(3) = 19.07                 Prob > chi2 = 0.0003
Note: LR test is conservative and provided only for reference.
. **NOT SIGNIFICANT: 0.0635
. **M4.3: Adding aggregates of opra
. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t covsevcases opra_t_m opra_t_sd || stcd: ipdtot_t, cov(unstr)
(running mixed on estimation sample)
Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50
Mixed-effects ML regression                     Number of obs     =      2,748
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          5
                                                              avg =       53.9
                                                              max =        301
                                                Wald chi2(4)      =       8.67
Log likelihood = -10935.235                     Prob > chi2       =     0.0700

                                  (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
```

```
             |   Observed   Bootstrap                         Normal-based
noncovbds_c~t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
--------------+------------------------------------------------------------------
     ipdtot_t |   .0767353   .1845831     0.42   0.678    -.2850408    .4385115
  covsevcases |   1.969793   12.97761     0.15   0.879    -23.46586    27.40545
     opra_t_m |  -.7468519   .6163203    -1.21   0.226    -1.954818    .4611137
    opra_t_sd |   3.119256   2.111317     1.48   0.140     -1.01885    7.257362
        _cons |   785.2236   2.777605   282.70   0.000     779.7796    790.6676
------------------------------------------------------------------------------

------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Unstructured           |
               var(ipdtot_t) |   .6557171   .2391711      .3208064    1.340263
                  var(_cons) |   49.06048   19.87452      22.17726    108.5315
         cov(ipdtot_t,_cons) |  -5.671843   2.172824       -9.9305   -1.413185
-----------------------------+------------------------------------------------
               var(Residual) |   165.8469   13.09226      142.0732    193.5989
------------------------------------------------------------------------------
LR test vs. linear model: chi2(3) = 24.43                 Prob > chi2 = 0.0000
Note: LR test is conservative and provided only for reference.
. **NOT SIGNIFICANT: 0.0700, so trying opra_t_m by itself and opra_t_sd by itself
. **M4.3.1:
. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t covsevcases opra_t_m || stcd: ipdtot_t, cov(unstr)
```

```
(running mixed on estimation sample)

Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50

Mixed-effects ML regression                     Number of obs     =      2,748
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          5
                                                              avg =       53.9
                                                              max =        301
                                                Wald chi2(3)      =       2.31
Log likelihood = -10936.158                     Prob > chi2       =     0.5100
                                  (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
noncovbds_c~t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
--------------+---------------------------------------------------------------
     ipdtot_t |   .0865661   .1547334     0.56   0.576    -.2167059     .389838
  covsevcases |   4.192782   9.488835     0.44   0.659    -14.40499    22.79056
     opra_t_m |  -.7512901   .5578225    -1.35   0.178    -1.844602    .3420219
        _cons |   787.8512   2.219109   355.03   0.000     783.5018    792.2006
------------------------------------------------------------------------------


------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
```

```
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Unstructured           |
               var(ipdtot_t) |   .6058656   .3013354      .2285703    1.605953
                  var(_cons) |   43.01957   22.08994      15.72484    117.6917
         cov(ipdtot_t,_cons) |  -5.105299   2.557645     -10.11819   -.0924059
-----------------------------+------------------------------------------------
               var(Residual) |   165.8713   13.23257      141.8619    193.9442
------------------------------------------------------------------------------
LR test vs. linear model: chi2(3) = 27.84                 Prob > chi2 = 0.0000
Note: LR test is conservative and provided only for reference.
. **NOT SIGNIFICANT: 0.5100
. **M4.3.2:
. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t covsevcases opra_t_sd || stcd: ipdtot_t, cov(unstr)
(running mixed on estimation sample)
Bootstrap replications (50)
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50
Mixed-effects ML regression                     Number of obs     =      2,748
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          5
                                                              avg =       53.9
                                                              max =        301
                                                Wald chi2(3)      =       9.73
```

```
Log likelihood = -10935.517                     Prob > chi2       =     0.0210
                                  (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
noncovbds_c~t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
     ipdtot_t |   .0345751   .1745997     0.20   0.843    -.3076339    .3767842
  covsevcases |   6.542833   9.868397     0.66   0.507    -12.79887    25.88454
    opra_t_sd |   3.133593   2.171723     1.44   0.149    -1.122906    7.390093
        _cons |   783.0589    2.01506   388.60   0.000     779.1094    787.0083
------------------------------------------------------------------------------

------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Unstructured           |
               var(ipdtot_t) |   .6849821   .3394151      .2593587     1.80908
                  var(_cons) |   51.12791   29.21015      16.68606    156.6616
         cov(ipdtot_t,_cons) |  -5.917914   3.151613     -12.09496    .2591335
-----------------------------+------------------------------------------------
               var(Residual) |   165.8221   17.00983       135.621    202.7485
------------------------------------------------------------------------------
LR test vs. linear model: chi2(3) = 28.39                 Prob > chi2 = 0.0000
Note: LR test is conservative and provided only for reference.
. ** SIGNIFICANT (p = 0.0210), so will include opra_t_sd
```

```
. **M4.3.3: Adding aggregates of gfeet

. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t covsevcases gfeet_t_m gfeet_t_sd || stcd: ipdtot_t,
cov(unstr)

(running mixed on estimation sample)

Bootstrap replications (50)

----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5

..................................................    50

Mixed-effects ML regression                     Number of obs     =      2,748
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          5
                                                              avg =       53.9
                                                              max =        301
                                                Wald chi2(4)      =      11.23
Log likelihood = -10934.192                     Prob > chi2       =     0.0241
                                  (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
noncovbds_c~t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
--------------+---------------------------------------------------------------
     ipdtot_t |   .0848159   .1551172     0.55   0.585    -.2192082    .3888399
  covsevcases |  -1.451395   10.22651    -0.14   0.887    -21.49498    18.59219
    gfeet_t_m |  -.2459991   .5569438    -0.44   0.659    -1.337589    .8455906
   gfeet_t_sd |   4.695596   1.753433     2.68   0.007      1.25893    8.132261
        _cons |   783.9127   7.549939   103.83   0.000     769.1151    798.7103
```

```
------------------------------------------------------------------------------
------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Unstructured           |
               var(ipdtot_t) |   .6318935   .2668929      .2761353    1.445992
                  var(_cons) |   49.07886   22.88392      19.67914    122.4004
         cov(ipdtot_t,_cons) |  -5.568897   2.464869     -10.39995   -.7378434
-----------------------------+------------------------------------------------
               var(Residual) |   165.8833   14.47657      139.8037    196.8279
------------------------------------------------------------------------------
LR test vs. linear model: chi2(3) = 17.77                 Prob > chi2 = 0.0005

Note: LR test is conservative and provided only for reference.

. ** SIGNIFICANT (p = 0.0241), so will include gfeet_t_m AND gfeet_t_sd

. **M4.3.3.1: Adding aggregate of opra and gfeet (opra_t_sd, gfeet_t_m, gfeet_t_sd)

. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t covsevcases opra_t_sd gfeet_t_m gfeet_t_sd || stcd:
ipdtot_t, cov(unstr)

(running mixed on estimation sample)


Bootstrap replications (50)

----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5

..................................................    50


Mixed-effects ML regression                     Number of obs     =      2,748
```

```
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          5
                                                              avg =       53.9
                                                              max =        301
                                                Wald chi2(5)      =       9.59
Log likelihood = -10934.151                     Prob > chi2       =     0.0877

                                  (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
noncovbds_c~t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
--------------+---------------------------------------------------------------
     ipdtot_t |   .0832195   .1746177     0.48   0.634     -.259025    .4254639
  covsevcases |  -1.358552   14.29687    -0.10   0.924     -29.3799     26.6628
    opra_t_sd |   .7909029    2.23227     0.35   0.723    -3.584266    5.166072
    gfeet_t_m |  -.2965581   .6276698    -0.47   0.637    -1.526768    .9336521
   gfeet_t_sd |   4.186623   2.132366     1.96   0.050     .0072621    8.365984
        _cons |   784.3989   7.975913    98.35   0.000     768.7664    800.0314
------------------------------------------------------------------------------

------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
```

```
stcd: Unstructured           |
               var(ipdtot_t) |   .6411274   .2728976      .2783737    1.476592
                  var(_cons) |   50.01406   23.21435      20.13731    124.2175
         cov(ipdtot_t,_cons) |   -5.66263   2.500912     -10.56433   -.7609336
-----------------------------+------------------------------------------------
               var(Residual) |   165.8766   17.70072      134.5716    204.4641
------------------------------------------------------------------------------
LR test vs. linear model: chi2(3) = 17.81                 Prob > chi2 = 0.0005

Note: LR test is conservative and provided only for reference.

. **NOT SIGNIFICANT: 0.0877

. **M4.3.3.2: opra_t_m and gfeet_t_sd

. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t covsevcases opra_t_sd gfeet_t_m || stcd: ipdtot_t,
cov(unstr)

(running mixed on estimation sample)

Bootstrap replications (50)

----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5

..................................................    50


Mixed-effects ML regression                     Number of obs     =      2,748
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          5
                                                              avg =       53.9
                                                              max =        301
                                                Wald chi2(4)      =       6.14
```

```
Log likelihood = -10935.135                     Prob > chi2       =     0.1891

                                  (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
noncovbds_c~t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
     ipdtot_t |   .0841341   .1736417     0.48   0.628    -.2561974    .4244657
  covsevcases |   1.726171   14.78014     0.12   0.907    -27.24237    30.69471
    opra_t_sd |   3.167317   2.223218     1.42   0.154     -1.19011    7.524744
    gfeet_t_m |  -.6931063   .4909378    -1.41   0.158    -1.655327    .2691142
        _cons |   791.6502   5.851496   135.29   0.000     780.1815    803.1189
------------------------------------------------------------------------------

------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Unstructured           |
               var(ipdtot_t) |   .6630883   .3960284      .2056802    2.137717
                  var(_cons) |   50.12489   33.38359       13.5877    184.9102
         cov(ipdtot_t,_cons) |  -5.765174   3.629254     -12.87838    1.348033
-----------------------------+------------------------------------------------
               var(Residual) |   165.8567    15.0888      138.7699    198.2308
------------------------------------------------------------------------------
LR test vs. linear model: chi2(3) = 22.91                 Prob > chi2 = 0.0000
Note: LR test is conservative and provided only for reference.
```

```
. **NOT SIGNIFICANT: 0.1891

. **M4.3.3.3:

. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t covsevcases opra_t_sd gfeet_t_sd || stcd: ipdtot_t,
cov(unstr)

(running mixed on estimation sample)


Bootstrap replications (50)

----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5

..................................................    50


Mixed-effects ML regression                     Number of obs     =      2,748
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          5
                                                              avg =       53.9
                                                              max =        301
                                                Wald chi2(4)      =      14.48
Log likelihood = -10934.215                     Prob > chi2       =     0.0059

                                  (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
noncovbds_c~t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
--------------+---------------------------------------------------------------
     ipdtot_t |   .0636842   .1736353     0.37   0.714    -.2766346    .4040031
```

```
  covsevcases |   .1620563    10.1506     0.02   0.987    -19.73275    20.05686
    opra_t_sd |   .5785578   2.165191     0.27   0.789    -3.665138    4.822254
   gfeet_t_sd |   4.547745   1.592104     2.86   0.004     1.427279    7.668211
        _cons |   780.5249   2.274432   343.17   0.000     776.0671    784.9827
------------------------------------------------------------------------------

------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
stcd: Unstructured           |
               var(ipdtot_t) |   .6483414   .3353517      .2352467    1.786833
                  var(_cons) |   50.44378   28.87923      16.42449    154.9257
         cov(ipdtot_t,_cons) |  -5.718811     3.1092     -11.81273    .3751094
-----------------------------+------------------------------------------------
               var(Residual) |   165.8641   13.93891      140.6757    195.5626
------------------------------------------------------------------------------
LR test vs. linear model: chi2(3) = 19.20                 Prob > chi2 = 0.0002
Note: LR test is conservative and provided only for reference.
. **SIGNIFICANT: 0.0059
. qui bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t covsevcases || stcd: ipdtot_t, cov(unstr)
. estat ic
Akaike's information criterion and Bayesian information criterion
------------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df        AIC        BIC
```

```
-------------+------------------------------------------------------------------
           . |      2,748          .  -10936.43       7   21886.86   21928.29
-------------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.

. qui bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t covsevcases opra_t_sd gfeet_t_sd || stcd: ipdtot_t,
cov(unstr)

. estat ic

Akaike's information criterion and Bayesian information criterion


-------------------------------------------------------------------------------
       Model |          N   ll(null)  ll(model)      df        AIC        BIC
-------------+-----------------------------------------------------------------
           . |      2,748          .  -10934.22       9   21886.43    21939.7
-------------------------------------------------------------------------------
Note: BIC uses N = number of observations. See [R] BIC note.

. **Difference in BIC: 21939.7 - 21928.29 = 11.41

. **The model with the lower value BIC is preferred (bootstrap model with inpatient facility days, COVID-19 cases per
state pop., aggregate of operating rooms, aggregate of total gross square feet of physical hospital)

. ***Currently, M4.3.3.3 is preferred, but going to try to add the other two COVID-19 severity measures: covsevhosp and
covsevdeaths

. ***FINAL MODEL - M4.3.3.3: bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t covsevcases opra_t_sd gfeet_t_sd
|| stcd: ipdtot_t, cov(unstr)

. bootstrap, cluster(stcd): mixed noncovbds_change_t ipdtot_t covsevcases opra_t_sd gfeet_t_sd || stcd: ipdtot_t,
cov(unstr)

(running mixed on estimation sample)


Bootstrap replications (50)
```

```
----+--- 1 ---+--- 2 ---+--- 3 ---+--- 4 ---+--- 5
..................................................    50

Mixed-effects ML regression                     Number of obs     =      2,748
Group variable: stcd                            Number of groups  =         51
                                                Obs per group:
                                                              min =          5
                                                              avg =       53.9
                                                              max =        301
                                                Wald chi2(4)      =      15.17
Log likelihood = -10934.215                     Prob > chi2       =     0.0044
                                  (Replications based on 51 clusters in stcd)
------------------------------------------------------------------------------
             |   Observed   Bootstrap                         Normal-based
noncovbds_c~t | coefficient  std. err.      z    P>|z|     [95% conf. interval]
--------------+---------------------------------------------------------------
     ipdtot_t |   .0636842   .1686675     0.38   0.706     -.266898    .3942665
  covsevcases |   .1620563   11.30383     0.01   0.989    -21.99304    22.31716
    opra_t_sd |   .5785578    1.64373     0.35   0.725    -2.643094    3.800209
   gfeet_t_sd |   4.547745   1.395479     3.26   0.001     1.812656    7.282835
        _cons |   780.5249   2.414266   323.30   0.000     775.7931    785.2568
------------------------------------------------------------------------------

------------------------------------------------------------------------------
                             |   Observed   Bootstrap         Normal-based
  Random-effects parameters  |   estimate   std. err.     [95% conf. interval]
```

```
------------------------------+------------------------------------------------
stcd: Unstructured            |
               var(ipdtot_t) |   .6483414    .294779      .2659446     1.58058
                  var(_cons) |   50.44378   24.46981      19.49385    130.5322
         cov(ipdtot_t,_cons) |  -5.718811   2.678514      -10.9686   -.4690194
------------------------------+------------------------------------------------
               var(Residual) |   165.8641   16.61312      136.2998    201.8412
------------------------------------------------------------------------------
LR test vs. linear model: chi2(3) = 19.20                 Prob > chi2 = 0.0002
Note: LR test is conservative and provided only for reference.
. estat icc
Intraclass correlation
------------------------------------------------------------------------------
                       Level |        ICC   Std. err.     [95% conf. interval]
-----------------------------+------------------------------------------------
                       stcd |   .2332036    .0715513     .1219008    .3998556
------------------------------------------------------------------------------
. ***Descriptive Stats: N, Mean, SD, Minimum, Maximum
. codebook noncovbds_change_t
-------------------------------------------------------------------------------
noncovbds_change_t                                                (unlabeled)
-------------------------------------------------------------------------------
                  Type: Numeric (float)
                 Range: [719,837]                     Units: 1
         Unique values: 105                       Missing .: 0/2,748
```

```
                  Mean: 786.502
              Std. dev.:  13.034
            Percentiles:     10%       25%       50%       75%       90%
                             780       787       787       787       792

. codebook ipdtot_t
-------------------------------------------------------------------------------
ipdtot_t                                                        (unlabeled)
-------------------------------------------------------------------------------
                  Type: Numeric (float)
                 Range: [3.9512436,13.48032]          Units: 1.000e-07
          Unique values: 2,690                    Missing .: 0/2,748
                  Mean:  10.007
              Std. dev.: 1.44212
            Percentiles:     10%       25%       50%       75%       90%
                         7.97143   9.01918   10.2267   11.0836    11.707

. codebook suroptot_t
-------------------------------------------------------------------------------
suroptot_t                                                      (unlabeled)
-------------------------------------------------------------------------------
                  Type: Numeric (float)
                 Range: [1,200.10001]                 Units: 1.000e-07
          Unique values: 2,327                    Missing .: 0/2,748
                  Mean: 69.2743
              Std. dev.: 44.2321
            Percentiles:     10%       25%       50%       75%       90%
```

```
                        14.1421   37.6098    64.591   94.9026    130.92
. codebook covsevcases
-------------------------------------------------------------------------------
covsevcases                                                     (unlabeled)
-------------------------------------------------------------------------------
                  Type: Numeric (float)
                 Range: [.01152584,.11872123]         Units: 1.000e-09
         Unique values: 51                         Missing .: 0/2,748
                  Mean: .062185
             Std. dev.: .015199
           Percentiles:     10%       25%       50%       75%       90%
                        .048225   .053369   .060255   .073481   .075712
. codebook covsevhosp
-------------------------------------------------------------------------------
covsevhosp                                                      (unlabeled)
-------------------------------------------------------------------------------
                  Type: Numeric (float)
                 Range: [.00006842,.00680376]         Units: 1.000e-12
         Unique values: 51                         Missing .: 0/2,748
                  Mean: .002016
             Std. dev.: .001737
           Percentiles:     10%       25%       50%       75%       90%
                        .000377   .000429   .001891   .003249   .004312
. codebook covsevdeaths
-------------------------------------------------------------------------------
```

```
covsevdeaths                                                    (unlabeled)
-------------------------------------------------------------------------------
                  Type: Numeric (float)
                 Range: [.0001979,.00204995]          Units: 1.000e-11
         Unique values: 51                         Missing .: 0/2,748
                  Mean: .001033
             Std. dev.: .000369
           Percentiles:     10%       25%       50%       75%       90%
                         .000629   .000821   .000941   .001229   .001608

. codebook opra_t
-------------------------------------------------------------------------------
opra_t                                                          (unlabeled)
-------------------------------------------------------------------------------
                  Type: Numeric (float)
                 Range: [1,6.4424176]                 Units: 1.000e-07
         Unique values: 84                         Missing .: 21/2,748
                  Mean: 3.09211
             Std. dev.: .977726
           Percentiles:     10%       25%       50%       75%       90%
                         2.09861   2.38629   3.07944   3.77259   4.29584

. codebook gfeet_t
-------------------------------------------------------------------------------
gfeet_t                                                         (unlabeled)
-------------------------------------------------------------------------------
                  Type: Numeric (float)
```

```
                Range: [10.19701,16.463739]          Units: 1.000e-07
         Unique values: 2,359                        Missing .: 328/2,748
                  Mean: 12.7443
             Std. dev.: 1.16695

           Percentiles:     10%       25%       50%       75%       90%
                           11.205   11.8678   12.7703   13.5673   14.2391
. codebook mapp20
-------------------------------------------------------------------------------
mapp20                                                Sole Community Provider
-------------------------------------------------------------------------------

                  Type: Numeric (double)
                 Label: mapp20label
                 Range: [1,2]                         Units: 1
         Unique values: 2                            Missing .: 0/2,748
            Tabulation: Freq.   Numeric  Label
                          208         1  Yes
                        2,540         2  No
. sum noncovbds_change_t, detail
                     noncovbds_change_t
-------------------------------------------------------------
      Percentiles      Smallest
 1%          719            719
 5%          769            719
10%          780            719       Obs               2,748
```

```
25%          787             719       Sum of wgt.       2,748
50%          787                       Mean           786.5018
                        Largest       Std. dev.      13.03395
75%          787             837
90%          792             837       Variance       169.8839
95%          802             837       Skewness      -1.129336
99%          837             837       Kurtosis       14.86284
. sum ipdtot_t, detail

                          ipdtot_t
-------------------------------------------------------------

      Percentiles      Smallest
 1%     6.487684       3.951244
 5%     7.432484       4.219508
10%     7.971431       4.564348       Obs               2,748
25%      9.01918       5.123964       Sum of wgt.       2,748
50%     10.22667                      Mean           10.00697
                        Largest       Std. dev.      1.442121
75%     11.08359       13.08599
90%     11.70704       13.22768       Variance       2.079714
95%     12.05441       13.45158       Skewness       -.495789
99%     12.61867       13.48032       Kurtosis       2.812307
. sum suroptot_t, detail

                         suroptot_t
-------------------------------------------------------------

      Percentiles      Smallest
```

```
 1%            1              1
 5%            1              1
10%     14.14214              1       Obs               2,748
25%     37.60983              1       Sum of wgt.       2,748
50%     64.59102                      Mean           69.27432
                      Largest       Std. dev.      44.23207
75%     94.90258          200.1
90%     130.9198          200.1       Variance       1956.476
95%     151.7465          200.1       Skewness        .654197
99%        200.1          200.1       Kurtosis       3.215261
. sum covsevcases, detail

                        covsevcases
-------------------------------------------------------------
      Percentiles      Smallest
 1%      .017764       .0115258
 5%     .0319616       .0115258
10%     .0482254       .0115258       Obs               2,748
25%     .0533688       .0115258       Sum of wgt.       2,748
50%     .0602553                      Mean           .0621851
                       Largest       Std. dev.      .0151988
75%     .0734807       .1187212
90%     .0757121       .1187212       Variance        .000231
95%     .0849104       .1187212       Skewness      -.0359228
99%     .1118391       .1187212       Kurtosis        4.87203
. sum covsevhosp, detail
```

```
                        covsevhosp
-------------------------------------------------------------
      Percentiles      Smallest
 1%     .0001881       .0000684
 5%     .0003366       .0000684
10%     .0003774       .0000684       Obs               2,748
25%     .0004293       .0000684       Sum of wgt.       2,748
50%      .001891                      Mean           .0020162
                        Largest       Std. dev.      .0017369
75%     .0032488       .0068038
90%      .004312       .0068038       Variance       3.02e-06
95%     .0051579       .0068038       Skewness        .646084
99%     .0068038       .0068038       Kurtosis       2.325881
. covsevdeaths, detail
command covsevdeaths is unrecognized
r(199);
. sum covsevdeaths, detail
                        covsevdeaths
-------------------------------------------------------------
      Percentiles      Smallest
 1%     .0002547       .0001979
 5%     .0004439       .0001979
10%     .0006286       .0001979       Obs               2,748
25%     .0008213       .0001979       Sum of wgt.       2,748
```

```
50%     .0009414                    Mean           .0010333
                        Largest     Std. dev.      .0003692
75%     .0012288         .00205
90%     .0016076         .00205     Variance       1.36e-07
95%     .0016625         .00205     Skewness        .397662
99%       .00205         .00205     Kurtosis       3.101712
. sum opra_t, detail

                          opra_t
-------------------------------------------------------------
      Percentiles      Smallest
 1%           1              1
 5%           1              1
10%    2.098612              1     Obs               2,727
25%    2.386294              1     Sum of wgt.       2,727

50%    3.079442                    Mean           3.092112
                        Largest     Std. dev.      .9777255
75%    3.772589       5.828314
90%    4.295837       5.997212     Variance       .9559472
95%    4.688879        6.26269     Skewness      -.1700077
99%    5.204693       6.442418     Kurtosis       2.865853
. sum gfeet_t, detail

                          gfeet_t
-------------------------------------------------------------
```

Percentiles		Smallest		
1%	10.19701	10.19701		
5%	10.86815	10.19701		
10%	11.205	10.19701	Obs	2,420
25%	11.86778	10.19701	Sum of wgt.	2,420
50%	12.77034		Mean	12.74432
		Largest	Std. dev.	1.166951
75%	13.56729	16.32594		
90%	14.23912	16.35483	Variance	1.361775
95%	14.66352	16.35812	Skewness	.0695145
99%	15.36823	16.46374	Kurtosis	2.560949

```
. sum mapp20, detail
```

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Percentiles		Smallest		
1%	1	1		
5%	1	1		
10%	2	1	Obs	2,748
25%	2	1	Sum of wgt.	2,748
50%	2		Mean	1.924309
		Largest	Std. dev.	.2645519
75%	2	2		
90%	2	2	Variance	.0699877
95%	2	2	Skewness	-3.208337

```
99%            2              2       Kurtosis       11.29343

. log close
      name:  donaldan
       log:  L:\Stats Courses\AHA 2019-2020 Data\HLM_2019-2020_data_analysis_final_draft.log
  log type:  text
 closed on:
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```