Statistical Methods in Education Research
Vanderbilt University — September 12, 2023
Prof. Sean P. Corcoran — **68 total points**

Problem Set 2 Solutions

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1. (**6 points**) The following 13 values (x) are the reported number of doctor's visits in the past year for a small subsample of respondents to the National Health Interview Survey in 2020:

$$5, 0, 33, 2, 1, 6, 6, 8, 0, 1, 4, 3, 1$$

   (a) Find the mean, median, and mode for this sample data. Which would you say is "best" for characterizing the central tendency of this distribution, and why?

   (b) Does any observation (or observations) appear to be an outlier? Discuss its impact on how the mean compares to the median.

   (c) What would happen to the mean and median if another observation were added to the sample with $x = 7$?

> See Stata syntax and results below (you can also obtain these easily by hand). The mean is $\bar{x} = \sum x_i/n = 70/13 = 5.4$. The median is 3 (the 7th value when ordered from smallest to largest). The mode is 1, a value that occurs 3 times. 33 is clearly an outlier, and increases the mean relative to the median (the median is 3 while the mean is 5.4). This would suggest the median is preferable to the mean, although it is good practice to report both and note the difference. Adding an observation of $x = 7$ will increase the mean (since it is greater than 5.4) and the median rises to 3.5 (the midpoint of 3 and 4).

```
clear
set obs 13
gen x=5 in 1
replace x=0 in 2
replace x=33 in 3
replace x=2 in 4
replace x=1 in 5
replace x=6 in 6
replace x=6 in 7
replace x=8 in 8
replace x=0 in 9
replace x=1 in 10
replace x=4 in 11
replace x=3 in 12
replace x=1 in 13
summ x, detail
```

```
                              x
-------------------------------------------------------------
      Percentiles      Smallest
 1%            0              0
 5%            0              0
10%            0              1       Obs                  13
25%            1              1       Sum of Wgt.          13

50%            3                      Mean           5.384615
                        Largest       Std. Dev.      8.684646
75%            6              6
90%            8              6       Variance       75.42308
95%           33              8       Skewness       2.708977
99%           33             33       Kurtosis        9.27715

. tabstat x, stat(sum)

    variable |       sum
-------------+----------
           x |        70
------------------------

. egen modex=mode(x)
. table modex

----------------------
    modex |      Freq.
----------+-----------
        1 |         13
----------------------

. set obs 14
number of observations (_N) was 13, now 14

. replace x=7 in 14
(1 real change made)

. summ x, detail
                              x
-------------------------------------------------------------
      Percentiles      Smallest
 1%            0              0
 5%            0              0
10%            0              1       Obs                  14
25%            1              1       Sum of Wgt.          14

50%          3.5                      Mean                5.5
                        Largest       Std. Dev.        8.3551
75%            6              6
90%            8              7       Variance       69.80769
95%           33              8       Skewness       2.757567
99%           33             33       Kurtosis         9.7783
```

2. (**6 points**) Use the definition of the sample mean (and the properties of summation) to show that:

   (a) $\sum(x_i - \bar{x}) = 0$, where $\bar{x}$ is the sample mean.

$$\sum(x_i - \bar{x}) = 0$$
$$\sum x_i - n\bar{x} = 0$$
$$\frac{n\sum x_i}{n} - n\bar{x} = 0$$
$$n\bar{x} - n\bar{x} = 0$$

(b) $\sum(x_i - \bar{x})^2 = \sum x_i^2 - n\bar{x}^2$

$$\begin{aligned}
\sum(x_i - \bar{x})^2 &= \sum x_i^2 - n\bar{x}^2 \\
\sum(x_i^2 - 2x_i\bar{x} + \bar{x}^2) &= \\
\sum x_i^2 - 2\bar{x}\sum x_i + n\bar{x}^2 &= \\
\sum x_i^2 - 2\bar{x}\frac{n\sum x_i}{n} + n\bar{x}^2 &= \\
\sum x_i^2 - 2n\bar{x}^2 + n\bar{x}^2 &= \\
\sum x_i^2 - n\bar{x}^2 &= \sum x_i^2 - n\bar{x}^2
\end{aligned}$$

3. (**56 points - 4 each**) On Github, locate the Stata dataset called *mepssample.dta*. These data are an extract from the Medical Expenditures Panel Survey, a large-scale survey of households about their health and health expenditures. (See `https://www.meps.ahrq.gov/mepsweb/`). Each observation is a person (N=19,386). In some cases there are multiple persons within the same household; you can ignore this aspect of the data.

   Answer the questions below in a .do file that includes a copy of each question followed by Stata output (where applicable) and your response to the question. Graphs can be saved and submitted separately, or combined into a .pdf file with the Stata log.

   See the attached log file

BELOW: NOT REQUIRED

Test your knowledge about variables that have been created using a linear transformation of another variable:

- If each value in a distribution with mean equal to 5 has been tripled, what is the new mean? **15 (the mean also triples)**

- If each value in a distribution with standard deviation equal to 5 has been tripled, what is the new standard deviation? **15 (the standard deviation also triples). In general if one multiplies a variable by *b* the standard deviation of the transformed variable is |b| times the old standard deviation.**
- If each value in a distribution with skewness equal to 1.14 has been tripled, what is the new skewness? **1.14 (the skewness is unchanged unless multiplying by a negative number)**
- If each value in a distribution with mean equal to 5 has the constant 6 added to it, what is the new mean? **11 (the original mean +6)**
- If each value in a distribution with standard deviation equal to 5 has the constant 6 added to it, what is the new standard deviation? **Adding a constant to a variable has no effect on the standard deviation (5).**
- If each value in a distribution with skewness equal to 1.14 has the constant 6 added to it, what is the new skewness? **1.14 (the skewness is unchanged unless multiplying by a negative number)**
- If each value in a distribution with mean equal to 5 has been multiplied by -2, what is the new mean? **-10. In general if one multiplies a variable by *b* the mean of the transformed variable is *b* times the old mean.**
- If each value in a distribution with standard deviation equal to 5 has been multiplied by -2, what is the new standard deviation? **10. In general if one multiplies a variable by *b* the standard deviation of the transformed variable is |b| times the old standard deviation.**
- If each value in a distribution with skewness equal to 1.14 has been multiplied by -2, what is the new skewness? **-1.14. When multiplying a variable by a negative number, the skewness of the transformed variable is -1 times the old skewness.**
- If each value in a distribution with mean equal to 5 has had a constant equal to 6 subtracted from it, what is the new mean? **-1 (the original mean minus 6)**
- If each value in a distribution with standard deviation equal to 5 has had a constant equal to 6 subtracted from it, what is the new standard deviation? **Adding/subtracting a constant to a variable has no effect on the standard deviation (5).**
- If each value in a distribution with skewness equal to 1.14 has had a constant equal to 6 subtracted from it, what is the new skewness? **1.14. The skewness is unaffected unless the original variable has been multiplied by a negative value.**

```
.
. // ********************************************************************
. // LPO.8800 Problem Set 2 - Solution to Question 3
. // Last updated: September 11, 2023
. // ********************************************************************
.
. /* QUESTION #3: For this problem use the file mepssample.dta on Github.
> These data are an extract from the Medical Expenditures Panel Survey, a
> large-scale survey of households about their health and health expenditures.
> (See https://www.meps.ahrq.gov/mepsweb/). Each observation is a person
> (N=19,386); in some cases there are multiple persons within the same household
> .*/
.
.
. use https://github.com/spcorcor18/LPO-8800/raw/main/data/mepssample.dta, ///
>    clear
(Sample of MEPS 2004 data)

.
. // ********
. // Part a
. // ********
. // 4 POINTS
.
. /* Create a tabular relative frequency distribution and (percent) bar graph fo
> r the
> family size variable. What is the most common (modal) family size in this samp
> le,
> and how often was it reported? */
.
.         tabulate famsize

    Size of |
 responding |
 annualized |
     family |      Freq.     Percent        Cum.
------------+-----------------------------------
          1 |      3,471       17.90       17.90
          2 |      5,712       29.46       47.37
          3 |      3,436       17.72       65.09
          4 |      3,389       17.48       82.58
          5 |      1,898        9.79       92.37
          6 |        857        4.42       96.79
          7 |        345        1.78       98.57
          8 |        151        0.78       99.34
          9 |         68        0.35       99.70
         10 |         42        0.22       99.91
         11 |          8        0.04       99.95
         12 |          6        0.03       99.98
         13 |          3        0.02      100.00
------------+-----------------------------------
      Total |     19,386      100.00

.         graph bar, over(famsize) blabel(bar, format(%3.1f)) name(fambar, repla
> ce)

.         graph export fambar.pdf, as(pdf) name(fambar) replace
(file fambar.pdf written in PDF format)
```

```
.
. // ***********************************************************************
. // ***********************************************************************
. // The modal family size is 2, with 29.46% of respondents reporting this
. // value.
. // ***********************************************************************
. // ***********************************************************************
.
.
. // ********
. // Part b
. // ********
. // 4 POINTS
.
. /*  The variables mcs12 and pcs12 are summary scores of well-being. MCS is the
> Mental Component Summary, and PCS is the Physical Component Summary. What are
> the mean and standard deviation of these variables in the data? Provide a
> "five number summary" (min, Q1, median, Q3, max) for these two variables and
> include the IQR.*/
.
.         summm mcs12 pcs12

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
       mcs12 |     19,386    50.22171    10.19464       1.35      75.06
       pcs12 |     19,386    49.01453    11.01185       4.56      72.17

.         tabstat mcs12 pcs12, stat(min p25 p50 p75 max iqr)

   stats |     mcs12     pcs12
---------+--------------------
     min |      1.35      4.56
     p25 |      44.3     43.77
     p50 |     52.65     52.99
     p75 |     57.33     56.71
     max |     75.06     72.17
     iqr |     13.03     12.94
------------------------------

.
.
. // ********
. // Part c
. // ********
. // 4 POINTS
.
. /* Create a new ordinal variable called highested that contains the highest
> education completed by the individual. Use the four variables beginning in
> ed_ to do this. For example, highested=0 if ed_hs=0 (no high school completed)
> highested=1 if ed_hs=1 (high school completed but no more), etc. Repeat part
> (b), but separately by highest level of education completed. How do the MCS
> and PCS distributions compare across levels of educational attainment? For
> example, how do their measures of central tendency compare? Their variation?*/
.
.         gen highested=0 if ed_hs==0
(5,764 missing values generated)

.         replace highested=1 if ed_hs==1
(5,764 real changes made)
```

```
.         replace highested=2 if ed_hsplus==1
(5,017 real changes made)

.         replace highested=3 if ed_col==1
(3,307 real changes made)

.         replace highested=4 if ed_colplus==1
(2,467 real changes made)

.         label define hed 0 "no HS" 1 "HS" 2 "some college" 3 "college" 4 "coll
> ege+",replace

.         label values highested hed

.         fre highested

highested
--------------------------------------------------------------------
                       |      Freq.    Percent      Valid       Cum.
-----------------------+--------------------------------------------
Valid   0 no HS        |       2831      14.60      14.60      14.60
        1 HS           |       5764      29.73      29.73      44.34
        2 some college |       5017      25.88      25.88      70.22
        3 college      |       3307      17.06      17.06      87.27
        4 college+     |       2467      12.73      12.73     100.00
        Total          |      19386     100.00     100.00
--------------------------------------------------------------------

.
. /* when creating variables like highested above it pays to verify how the
> component ed_* variables are coded. As a check to see whether individuals are
> coded a "1" more than once in the ed_* variables, I used the code below.
> There are no such cases--variables seem mutually exclusive).*/
.
.         egen check=rowtotal(ed_*)

.         tabulate check

      check |      Freq.     Percent        Cum.
------------+-----------------------------------
          0 |      2,831       14.60       14.60
          1 |     16,555       85.40      100.00
------------+-----------------------------------
      Total |     19,386      100.00

.         drop check

.
.         tabstat mcs12, by(highested) stat(mean sd min p25 p50 p75 max iqr)

Summary for variables: mcs12
     by categories of: highested

   highested |      mean        sd       min       p25       p50       p75
-------------+------------------------------------------------------------
       no HS |  47.52533  11.34479       1.9     39.96     48.77     56.94
          HS |   49.6437  10.61426      4.73    43.215        52     57.33
some college |  50.57164  10.11016      1.35     45.15     53.35     57.33
     college |    51.403  9.061986     12.45     46.98      54.1     57.16
    college+ |  52.37128  8.492424     11.71     48.84     54.37     57.63
-------------+------------------------------------------------------------
       Total |  50.22171  10.19464      1.35      44.3     52.65     57.33
--------------------------------------------------------------------------
```

```
   highested |       max       iqr
-------------+--------------------
       no HS |     74.15     16.98
          HS |     75.06    14.115
some college |     74.84     12.18
     college |     72.43     10.18
    college+ |     70.48  8.790001
-------------+--------------------
       Total |     75.06     13.03
----------------------------------

.         tabstat pcs12, by(highested) stat(mean sd min p25 p50 p75 max iqr)

Summary for variables: pcs12
     by categories of: highested 

   highested |      mean        sd       min       p25       p50       p75
-------------+------------------------------------------------------------
       no HS |  45.16709  12.34802      6.08     36.68     48.75     55.09
          HS |  47.97236  11.20774      7.57     41.98     51.93     56.15
some college |  49.26236  10.84113      4.56     44.27     53.18     56.71
     college |  51.44491  9.687731      7.33     48.18      54.8     57.57
    college+ |   52.1027  9.092791     11.29     49.46     55.13     57.76
-------------+------------------------------------------------------------
       Total |  49.01453  11.01185      4.56     43.77     52.99     56.71
--------------------------------------------------------------------------

   highested |       max       iqr
-------------+--------------------
       no HS |     65.73     18.41
          HS |     72.17     14.17
some college |     70.87     12.44
     college |      71.7  9.389999
    college+ |     69.86  8.299999
-------------+--------------------
       Total |     72.17     12.94
----------------------------------

. 
. // ***********************************************************************
. // ***********************************************************************
. // Mental Component Survey (MCS) and Physical Component Survey (PCS): the 
. // central tendency of these measures (both mean and median) rise as
. // educational attainment increases. Variability in these measures (both
. // the sd and the IQR) fall as educational attainment increases.
. // ***********************************************************************
. // ***********************************************************************
. 
. 
. // ********
. // Part d
. // ********
. // 4 POINTS
. 
. /* Create a boxplot that shows the distribution of number of doctor's office
> visits (use_off). What do the whiskers (tails) represent in this graph? Are
> there any outlier values of doctor's office visits?*/
. 
.         graph box use_off , title("Number of office-based provided visits") //
> /
>                 name(boxoffice, replace)
```

```
.         graph export boxoffice.pdf, name(boxoffice) as(pdf) replace
(file boxoffice.pdf written in PDF format)

.
. // ********************************************************************
. // ********************************************************************
. // The lower whisker extends to the minimum value in this case (0). Because
. // there are outlier values at the top of the distribution, the upper whisker
. // extends to the upper adjacent value--the last value observed in the data
. // before the the threshold used to determine outliers (1.5 IQR above the
. // 75th percentile).
. // ********************************************************************
. // ********************************************************************
.
. // note, to see without outliers:
.         graph box use_off, nooutsides

.
.
. // ********
. // Part e
. // ********
. // 4 POINTS
.
. /* Now create a boxplot that shows the distribution of PCS separately by
> highest level of education completed. How do these distributions compare? */
.
.         graph box pcs12, over(highested) name(boxpcs, replace)

.         graph export boxpcs.pdf, name(boxpcs) as(pdf) replace
(file boxpcs.pdf written in PDF format)

.
. // ********************************************************************
. // ********************************************************************
. // The figures show visually what was found in part (c)--the distribution
. // of PCS increases with educational attainment and becomes less variable.
. // ********************************************************************
. // ********************************************************************
.
.
. // ********
. // Part f
. // ********
. // 4 POINTS
.
. /* Based on a visual inspection of the graphs above, how would you describe
> the skewness of the variables you have examined thus far (MCS, PCS, and
> doctor's office visits)?  */
.
. // ********************************************************************
. // ********************************************************************
. // The doctor's office visit distribution was clearly very positively
. // skewed. Most respondents had zero or very few visits, while a small
. // share of respondents had comparably very large numbers of office visits.
. // The PCS and MCS distributions appear negatively skewed. There is a long
. // tail (and some outlying values) toward the bottom of the distribution.
. // ********************************************************************
. // ********************************************************************
.
```

```
.
. // ********
. // Part g
. // ********
. // 4 POINTS
.
. /* Use the skewness statistic to assess the skewness of these variables (MCS,
> PCS, and doctor's office visits). In your do file, calculate the standard
> error of the skewness (see the lecture notes for the formula) and determine
> whether these distributions are significantly skewed or not.  */
.
.         summ mcs12, detail

               Mental health component of SF12
-------------------------------------------------------------
      Percentiles      Smallest
 1%        19.57           1.35
 5%        30.31            1.9
10%        35.69           4.73       Obs              19,386
25%         44.3            6.4       Sum of Wgt.      19,386

50%        52.65                      Mean           50.22171
                        Largest       Std. Dev.      10.19464
75%        57.33          74.15
90%        61.12          74.81       Variance       103.9306
95%        62.49          74.84       Skewness      -.9985878
99%        65.56          75.06       Kurtosis       3.792512

.         scalar a=r(skewness)

.         scalar b=sqrt((6*r(N)*(r(N)-1))/((r(N)-2)*(r(N)+1)*(r(N)+3)))

.         display a
-.99858779

.         display b
.0175913

.         display a/b
-56.766005

.
.         summ pcs12, detail

              Physical health component of SF12
-------------------------------------------------------------
      Percentiles      Smallest
 1%           17           4.56
 5%        24.69           6.08
10%         31.5           6.08       Obs              19,386
25%        43.77           6.26       Sum of Wgt.      19,386

50%        52.99                      Mean           49.01453
                        Largest       Std. Dev.      11.01185
75%        56.71          70.87
90%        58.96          70.89       Variance       121.2607
95%        60.45           71.7       Skewness      -1.237738
99%        63.43          72.17       Kurtosis       3.862569

.         scalar a=r(skewness)
```

```
.         scalar b=sqrt((6*r(N)*(r(N)-1))/((r(N)-2)*(r(N)+1)*(r(N)+3)))

.         display a
-1.2377382

.         display b
.0175913

.         display a/b
-70.360816

. 
.         summm use_off, detail

               # office-based provider visits
-------------------------------------------------------------
      Percentiles      Smallest
 1%            0              0
 5%            0              0
10%            0              0       Obs              19,386
25%            0              0       Sum of Wgt.      19,386

50%            2                      Mean           5.802383
                        Largest       Std. Dev.      10.86976
75%            7            164
90%           15            166       Variance       118.1518
95%           23            167       Skewness       5.549091
99%           51            187       Kurtosis       54.47084

.         scalar a=r(skewness)

.         scalar b=sqrt((6*r(N)*(r(N)-1))/((r(N)-2)*(r(N)+1)*(r(N)+3)))

.         display a
5.5490914

.         display b
.0175913

.         display a/b
315.44522

. 
. // ***********************************************************************
. // ***********************************************************************
. // In all three cases above, I divided the skewness statistic (saved as "a")
. // by the standard error of the skewness (calculated as "b"). r(N) is the
. // count of observations used in the previous command. The rule of thumb
. // is that if this absolute value of the ratio is >2, the distribution is
. // significantly skewed. All three ratios exceed 2.
. // ***********************************************************************
. // ***********************************************************************
. 
.         // Note: if you have summskew installed you can use the following
.         summskew mcs12
skewness =  -0.999; seskew =   0.018 ; skewness ratio = -56.766

.         summskew pcs12
skewness =  -1.238; seskew =   0.018 ; skewness ratio = -70.361
```

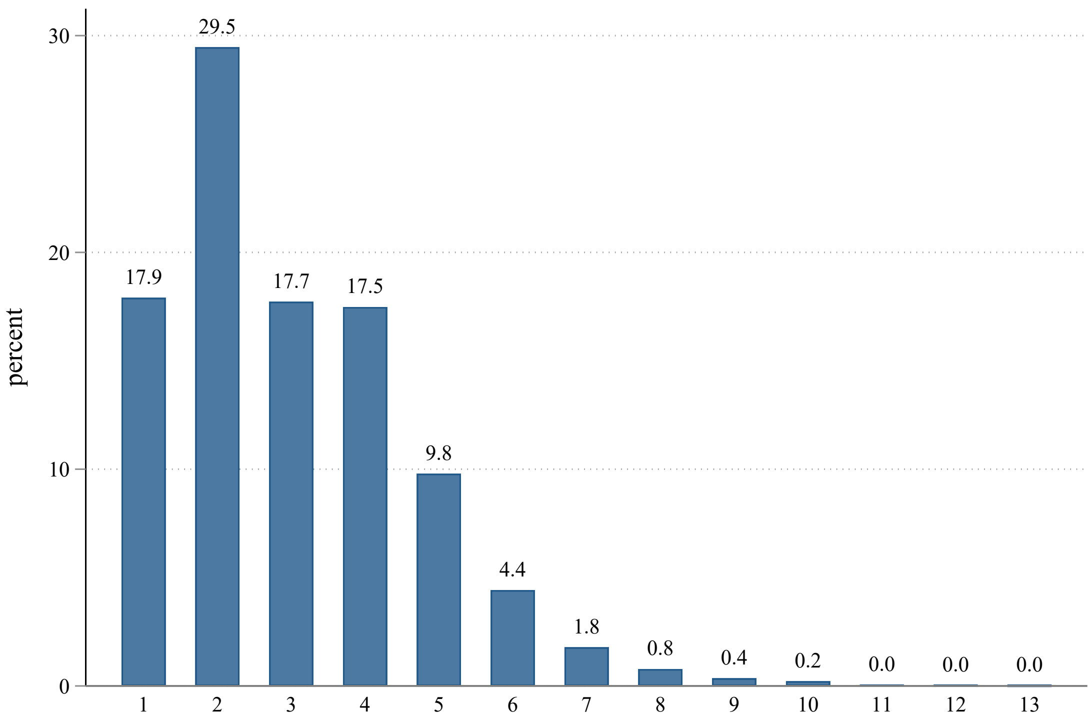
```
.         summskew use_off
skewness =   5.549; seskew =   0.018 ; skewness ratio = 315.445

.
.
. // ********
. // Part h
. // ********
. // 4 POINTS
.
. /* You are considering doing a log transformation of the doctor's office
> visits variable to reduce the skewness. Would this help? Why or why not?
> (Try it and see what happens). */
.
.         gen lnoff=ln(use_off)
(5,673 missing values generated)

.         histogram lnoff
(bin=41, start=0, width=.12758802)

.         summ lnoff

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
       lnoff |     13,713    1.490513    1.078619          0   5.231109

.         count if use_off==0
  5,673

.
.         summ lnoff, detail

                            lnoff
-------------------------------------------------------------
      Percentiles      Smallest
 1%            0              0
 5%            0              0
10%            0              0       Obs              13,713
25%     .6931472              0       Sum of Wgt.      13,713

50%     1.386294                      Mean           1.490513
                        Largest       Std. Dev.      1.078619
75%     2.302585       5.099866
90%     2.944439       5.111988       Variance       1.163419
95%     3.332205       5.117994       Skewness       .3161302
99%     4.060443       5.231109       Kurtosis        2.42947

.         scalar a=r(skewness)

.         scalar b=sqrt((6*r(N)*(r(N)-1))/((r(N)-2)*(r(N)+1)*(r(N)+3)))

.         display a
.31613018

.         display b
.02091519

.         display a/b
15.114858
```

```
.
. // ***********************************************************************
. // ***********************************************************************
. // The distribution of the logged doctor's visits appears less skewed,
. // however, there are lots of zero values in the orginal variable and the
. // log transformation is not defined at zero.
. // ***********************************************************************
. // ***********************************************************************
.
.
. // ********
. // Part i
. // ********
. // 4 POINTS
.
. /* You are considering doing a log transformation of the PCS variable to
> reduce the skewness. Would this help? Why or why not? (Try it and see what
> happens). */
.
.         gen lnpcs=ln(pcs12)

.         histogram pcs12, nodraw name(orig, replace)
(bin=42, start=4.5599999, width=1.6097619)

.         histogram lnpcs, nodraw name(logged, replace)
(bin=42, start=1.5173227, width=.06575481)

.         graph combine orig logged, row(1) ysize(4) xsize(6)

.         graph export lnpcs.pdf, as(pdf) replace
(file lnpcs.pdf written in PDF format)

.
.         summ lnpcs, detail

                            lnpcs
-------------------------------------------------------------
      Percentiles      Smallest
 1%     2.833213       1.517323
 5%     3.206398       1.805005
10%     3.449988       1.805005       Obs              19,386
25%     3.778949        1.83418       Sum of Wgt.      19,386

50%     3.970103                      Mean           3.857338
                        Largest       Std. Dev.      .2890377
75%     4.037951       4.260847
90%     4.076859       4.261129       Variance       .0835428
95%     4.101817       4.272491       Skewness      -2.048169
99%     4.149937       4.279025       Kurtosis       7.933831

.         scalar a=r(skewness)

.         scalar b=sqrt((6*r(N)*(r(N)-1))/((r(N)-2)*(r(N)+1)*(r(N)+3)))

.         display a
-2.0481687

.         display b
.0175913
```

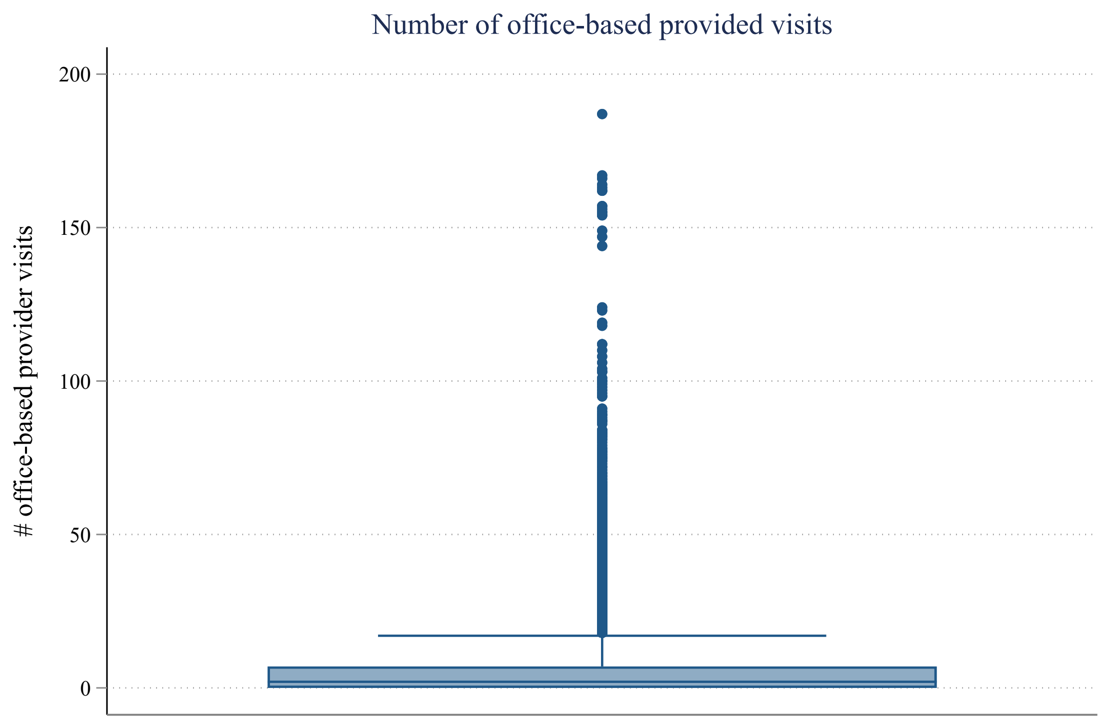
```
.         display a/b
-116.43078

.
. // *********************************************************************
. // *********************************************************************
. // The distribution of the logged PCS is more skewed than before!
. // We typically do log transformations to make a distributions less right-
. // skewed. This distribution was left skewed. Translating the original
. // variable (*-1) and adding a constant to get all values above 1 helps
. // (see below).
. // *********************************************************************
. // *********************************************************************
.
.         qui summ pcs12

.         gen lnpcs2=ln((-1*pcs12)+r(max)+1)

.         histogram lnpcs2, nodraw name(logged2, replace)
(bin=42, start=0, width=.1006771)

.         graph combine orig logged2, row(1) ysize(4) xsize(6)

.         graph export lnpcs2.pdf, as(pdf) replace
(file lnpcs2.pdf written in PDF format)

.
.
. // ********
. // Part j
. // ********
. // 4 POINTS
.
. /* The variable exp_tot reports the total amount of medical expenses incurred
> during the year. Use this variable to create a z-score for exp_tot as shown in
> class. Run a full set of descriptive statistics to demonstrate this new
> variable has a mean of 0 and standard deviation of 1.*/
.
.         egen zexp_tot=std(exp_tot)

.         summ zexp_tot

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
    zexp_tot |     19,386   -1.55e-09           1  -.3772595   44.71924

.
. // *********************************************************************
. // *********************************************************************
. // The mean of the z-score is indeed zero (or very close to it--there is a
. // small rounding difference) and the sd is 1.
. // *********************************************************************
. // *********************************************************************
.
.
. // ********
. // Part k
. // ********
. // 4 POINTS
.
```

```
. /* What level of medical expenditure corresponds to a z-score of 0.2 in this
> data? Of -0.2? Interpret these values in words.*/
.
.         summ exp_tot

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
     exp_tot |     19,386     3685.25    9768.475          0     440524

.         display r(mean) + 0.2*r(sd)
5638.9447

.         display r(mean) - 0.2*r(sd)
1731.5548

.
. // **********************************************************************
. // **********************************************************************
. // Results are above. $5,638 is 0.2 standard deviations above the mean.
. // $1,732 is 0.2 standard deviations below the mean.
. // **********************************************************************
. // **********************************************************************
.
.
. // ********
. // Part l
. // ********
. // 4 POINTS
.
. /* What proportion of individuals have a z-score of medical expenditures
> between -1 and +1? Why isn't this value 68% (or at least closer to it), as
> the Empirical Rule would suggest?*/
.
.         count if zexp_tot>=-1 & zexp_tot<=1
  18,237

.         scalar a = r(N)

.         count if zexp_tot~=.
  19,386

.         scalar b = r(N)

.         display a/b
.94073042

.
. // **********************************************************************
. // **********************************************************************
. // Results are above. First I count the observations with a z-score
. // between -1 and 1 and store it as "a". Then I count the number of non-
. // missing z-scores and store this as "b". The proportion is a/b, or 94.7%.
. // The Empirical Rule applies to **normal** distributions, which this is not.
. // (This distribution is in fact very skewed).
. // **********************************************************************
. // **********************************************************************
.
.
. // ********
. // Part m
```

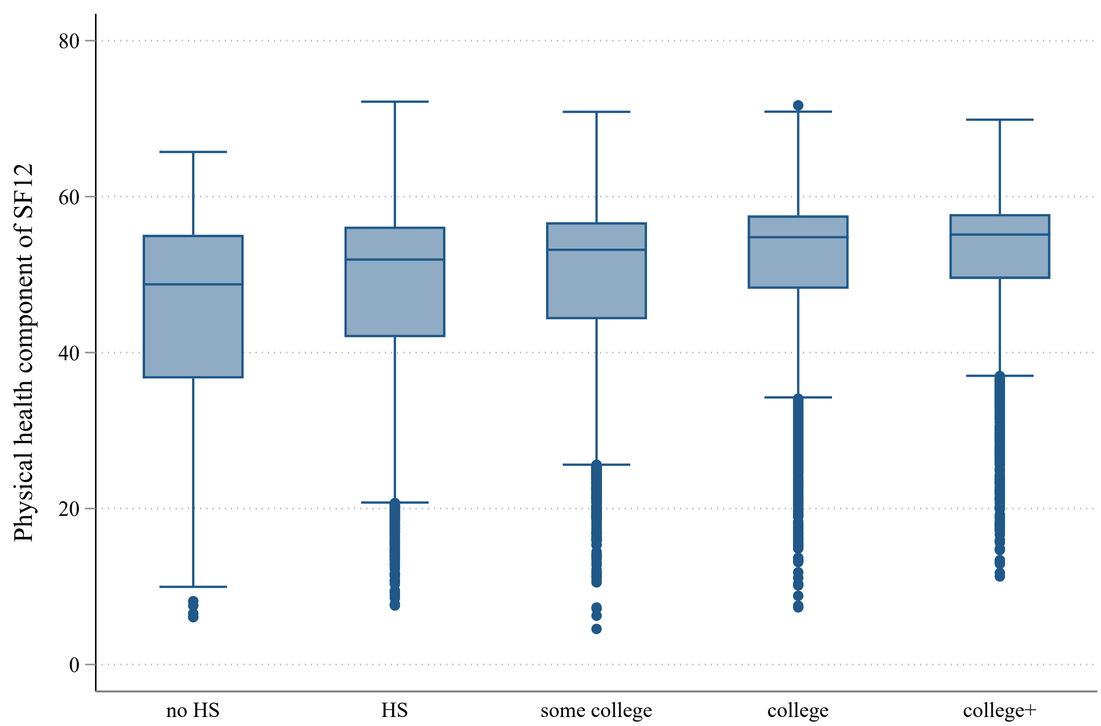
```
. // ********
. // 4 POINTS
. 
. /* What is the 43rd percentile for total medical expenses (exp_tot)? Explain/
> show how you got your answer.*/
. 
.         centile exp_tot, centile(43)

                                                       -- Binom. Interp. --
    Variable |       Obs  Percentile    Centile        [95% Conf. Interval]
-------------+-------------------------------------------------------------
     exp_tot |    19,386         43      622.41             597         651

. 
. // *****************************************************************
. // *****************************************************************
. // Results are above using the centile command. As an alternative, we can
. // use the index values of the observations as shown below.
. // *****************************************************************
. // *****************************************************************
. 
. // we want the observation indexed as follows. It's a fractional value so we
. // take the next highest observation.
.         display (43*r(N))/100
8335.98

. 
.         sort exp_tot

.         list exp_tot if _n==8336

       +---------+
       | exp_tot |
       |---------|
 8336. |     622 |
       +---------+

. 
. 
. // ********
. // Part n
. // ********
. // 4 POINTS
. 
. /* The variable ins_unins is a dichotomous variable that equals 1 if the indiv
> idual
> lacks health insurance (and 0 otherwise). What is the mean of this variable an
> d
> how should it be interpreted? */
. 
.         summ ins_unins

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
   ins_unins |     19,386    .1776024    .3821875          0          1

. 
. // *****************************************************************
. // *****************************************************************
. // The mean of a dichotomous (dummy) variable is the proportion of obs
. // equal to one. In this case th mean is 0.178, so 17.8% of respondents
. // are uninsured.
. // *****************************************************************
. // *****************************************************************
> 
. 
. // Close log and convert to PDF
.         log close
```



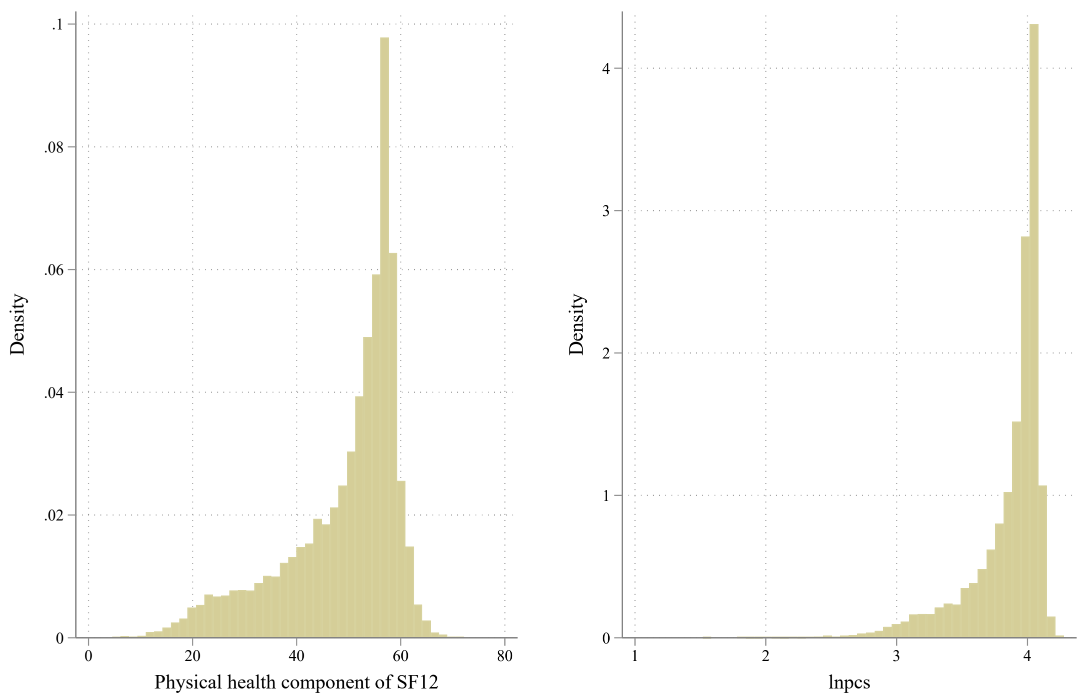
percent
0
10
20
30
17.9
29.5
17.7
17.5
9.8
4.4
1.8
0.8
0.4
0.2
0.0
0.0
0.0
1
2
3
4
5
6
7
8
9
10
11
12
13

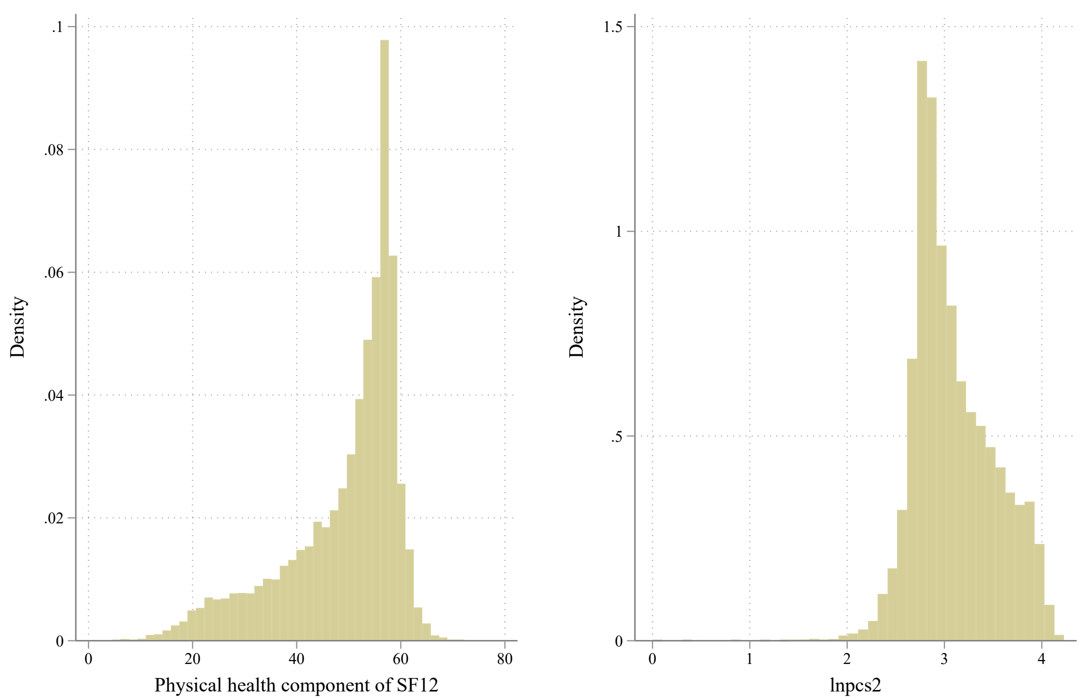


Number of office-based provided visits
office-based provider visits
200
150
100
50
0



Physical health component of SF12
80
60
40
20
0
no HS
HS
some college
college
college+


Density
.1
.08
.06
.04
.02
0
0
20
40
60
80
Physical health component of SF12
Density
4
3
2
1
0
1
2
3
4
lnpcs



Density
.1
.08
.06
.04
.02
0
0
20
40
60
80
Physical health component of SF12
Density
1.5
1
.5
0
0
1
2
3
4
lnpcs2