

Consider a population of size *N* = 6:

 2 6 8 10 10 12

Since we know the *entire* population, we can find the values of the parameters, which are 

Let us first consider simple random samples (SRS) of size *n* = 2. We list them below, along with their means (), the *estimates* of:

 Sample 

 2, 6 4

 2, 8 5

 2, 10 6

 2, 10 6

 2, 12 7

 6, 8 7

 6, 10 8

 6, 10 8

 6, 12 9

 8, 10 9

 8, 10 9

 8, 12 10

 10, 10 10

 10, 12 11

 10, 12 11

 Thus, we have the following *sampling distribution*: 

  

1. 1 [1/15]
2. 1 [1/15]
3. 2 [2/15]
4. 2 [2/15]
5. 2 [2/15]
6. 3 [3/15]

10 2 [2/15]

 11 2 [2/15]

 (Continued)

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The mean of this sampling distribution, , is

 

illustrating that the mean value [or expected value, E()] of the sampling distribution is the population mean, that is,

 

The variance of the distribution, , called the *sampling variance*, is

 Var () = 

and so , called the *standard error* of the mean, is

 

 Let us now use this sampling distribution to confirm that

 

by substituting in the values. We have

 

 

 

which verifies the result.

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 Since *N* = 6 for our population, there are six possible sampling distributions: for *n* = 1 (which is just the population distribution), for *n* = 2 (which we have discussed), and for *n* = 3, 4, 5, and 6. All six are given below.

 

For *n* = 1:  frq For *n* = 2:  frq For *n* = 3:  frq

 2 1 4 1 5.3 1

 6 1 5 1 6 2

 8 1 6 2 6.6 3

 10 2 7 2 7.3 2

 12 1 8 2 8 4

 9 3 8.6 2

 10 2 9.3 3

 11 2 10 2

 10.6 1

For *n* = 4:  frq For *n* = 5­:  frq For *n* = 6:  frq

 6.5 2 7.2 1 8 1

 7 2 7.6 2

 7.5 3 8.0 1

 8 2 8.4 1

 8.5 2 9.2 1

 9 2

 9.5 1

 10 1

Notice the increasing precision as *n* increases. For example, as we go from the sampling distribution for *n* = 2 to *n* = 3, the range of possible values for the statistic decreases from 11 – 4 = 7 to 10.6 – 5.3 = 5.3.

Another way of saying this is that the sampling variance drops from 64/15 to 64/30, or the standard error of the mean drops from their square roots, from about 2.07 to 1.46. A complete summary is given below.

 *n* 1 2 3 4 5 6

  8 8 8 8 8 8

  3.27 2.07 1.46 1.03 0.65 0

 range 10 7 5.3 3.5 2 0