

## 12.3: Standard Error of the Mean

Later in the course it will become essential to be able to characterize how variable our samples are, in order to make inferences about the sample statistics. For the mean, we do this using a quantity called the *standard error* of the mean (SEM), which one can think of as the standard deviation of the sampling distribution. To compute the standard error of the mean for our sample, we divide the estimated standard deviation by the square root of the sample size:

$$SEM = \frac{\hat{\sigma}}{\sqrt{n}}$$

Note that we have to be careful about computing SEM using the estimated standard deviation if our sample is small (less than about 30).

Because we have many samples from the NHANES population and we actually know the population SEM (which we compute by dividing the population standard deviation by the size of the population), we can confirm that the SEM computed using the population parameter (1.44) is very close to the observed standard deviation of the means for the samples that we took from the NHANES dataset (1.44).

The formula for the standard error of the mean says that the quality of our measurement involves two quantities: the population variability, and the size of our sample. Because the sample size is the denominator in the formula for SEM, a larger sample size will yield a smaller SEM when holding the population variability constant. We have no control over the population variability, but we *do* have control over the sample size. Thus, if we wish to improve our sample statistics (by reducing their sampling variability) then we should use larger samples. However, the formula also tells us something very fundamental about statistical sampling – namely, that the utility of larger samples diminishes with the square root of the sample size. This means that doubling the sample size will *not* double the quality of the statistics; rather, it will improve it by a factor of

Unexpected text node: '18.3 we will discuss statistical power, which is intimately tied to this idea.'

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