Retail Food Risk Factor Study Guide to Sample Size

Understanding Sample Size, Confidence Level, and Margin of Error

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Understanding Sample Size

First let's talk about why we sample. Sampling, if done correctly, allows us to estimate with a known level of confidence and error, the occurrence of risk factors without having to collect data in every establishment. This allows us to conserve resources while getting results that we can— confidently—use to make data driven decisions and track trends. If you are doing a data collection, you will need a representative sample that is large enough to support meaningful statistical analysis. The sample size depends on three inputs: the number of establishments, the confidence level desired, and the margin of error you deem acceptable. With a higher confidence level and a lower the margin of error, the more certain you can be that the estimates reflect the occurrence of risk factors in your establishments; however, this means a larger sample size and more resources.

The FDA uses a 95% confidence level and a 5% margin of error for each category in our national studies. You are welcome to use different benchmarks; however, the lower the confidence level and the wider the margin of error, the less representative your sample might be and the more likely you are to miss trends over time.

Confidence Level

You may hear people say, "I'm 95% confident that I'm right." Well, in statistics, there's a specific meaning behind that statement. Your confidence level expresses how sure you are that your sample captured the actual occurrence of risk factors in your community. Remember, samples *estimate* what's going on so that you don't have to collect data in every establishment, but you want to know what that estimate captures. Additionally, you want to be confident that if someone else repeated your study, they'd get close to the same result. So, nutshell– we want to be confident that our sample is representative, it catches what we need it to, and that our results are repeatable.

 If you're a visual person, you can see how this works on the graph below. The graph shows the range of values for 100 repeated samples with a 95% confidence level. The blue bars capture the actual, or population value, shown by the dotted line, while the red ones don't include it. If you look closely, you can see that there are 95 blue bars that contain the actual value and five red that don't, which we would expect with a 95% confidence level. If the confidence level was 90%, we would expect 90 samples to contain the actual value, giving us 90 blue lines and 10 red.

Margin of Error

Now let's talk margin of error, which you might hear as "plus or minus x%." Your margin of error is how close you want your estimated value to be from the real value. The closer you want it to be, the smaller the margin of error. On this chart, the black dots are the sample means for our 100 samples from above. Again, the dotted line is the population mean. The margin of error is shown by the solid lines, acting as the minimum and maximum boundaries between which all sample means should fall. The closer you want your estimated mean to be to the actual value, the smaller the margin of error, and the closer the solid lines—and the black dots— would get to the dotted line.
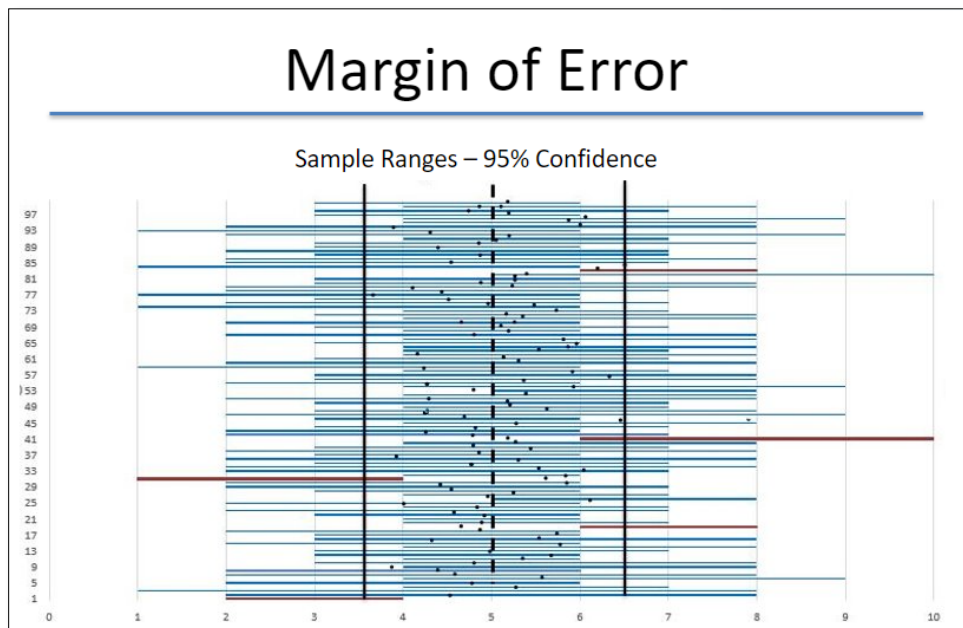
Interpreting Confidence Level and Margin of Error

So, let's put this together. If you used a 95% confidence level with a 5% margin of error and found that improper holding was out in 45% of the places where you could observe holding temperatures, that means you can be 95% sure that the actual occurrence is within 5% of the sample findings. Your sample size to get that estimate is dependent on the number of establishments in your inventory, and your chosen confidence level and margin of error.

Sampling vs. Using Entire Inventory

First, if you have less than 30 in any facility category, it makes sense to do all establishments in that group. You likely won't gain much, if anything, by sampling, and you want to ensure you have enough facilities to draw conclusions. Second, if you are using existing inspection data, you likely do not have to pull samples. Remember that sampling is done to approximate what is going on when you cannot collect data in each facility. If you have routine inspection data for all your eligible establishments, you have a population metric, no estimate needed. That said, if you decide to do a hybrid approach and combine the data collection with routine inspections, you will need pull a random sample to determine which establishments participate in the hybrid visit unless you do your entire inventory.

Sample Size Calculators and Resources

The good news is that you do not have to understand all the math that goes into figuring out the sample size for your chosen confidence level and margin of error. There are resources available on the internet.

1. https://www.calculator.net/sample-size-calculator.html
2. https://www.surveymonkey.com/mp/sample-size-calculator/
3. http://www.raosoft.com/samplesize.html
4. https://www.checkmarket.com/sample-size-calculator/

Bottomline

There are three things that affect your sample size: the number of facilities in your inventory, and the confidence level and margin of error you choose. The higher the confidence level and the lower the margin of error, the larger your sample will need to be, and up to a certain point, the larger your inventory, the larger your sample size will need to be. Remember that there is a trade-off between a smaller sample size and the accuracy and precision of your findings.