

# Determining sample size

How to ensure you get  
the correct sample size

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# Introduction

How many responses do you really need? This simple question is a never-ending quandary for researchers. A larger sample can yield more accurate results — but excessive responses can be pricey.

Consequential research requires an understanding of the statistics that drive sample size decisions. A simple equation will help you put the migraine pills away and sample confidently.

Before you can calculate a sample size, you need to determine a few things about the target population and the sample you need:

**1. Population Size** How many total people fit your demographic? For instance, if you want to know about mothers living in the US, your population size would be the total number of mothers living in the US. Don't worry if you are unsure about this number. It is common for the population to be unknown or approximated.

**2. Margin of Error (Confidence Interval)** No sample will be perfect, so you need to decide how much error to allow. The confidence interval determines how much higher or lower than the population mean you are willing to let your sample mean fall. If you've ever seen a political poll on the news, you've seen a confidence interval. It will look something like this: "68% of voters said yes to Proposition Z, with a margin of error of +/- 5%."

**3. Confidence Level** How confident do you want to be that the actual mean falls within your confidence interval? The most common confidence intervals are 90% confident, 95% confident, and 99% confident.

**4. Standard of Deviation** How much variance do you expect in your responses? Since we haven't actually administered our survey yet, the safe decision is to use .5 – this is the most forgiving number and ensures that your sample will be large enough.

Okay, now that we have these values defined, we can calculate our needed sample size.



Your confidence level corresponds to a Z-score. This is a constant value needed for this equation. Here are the z-scores for the most common confidence levels:

- + 90% – Z Score = 1.645
- + 95% – Z Score = 1.96
- + 99% – Z Score = 2.326

If you choose a different confidence level, use the Z-score table below to find your score.

Next, plug in your Z-score, Standard of Deviation, and confidence interval into this equation:\*

$$\text{Necessary Sample Size} = (Z\text{-score})^2 - \text{StdDev}^2(1-\text{StdDev}) / (\text{margin of error})^2$$

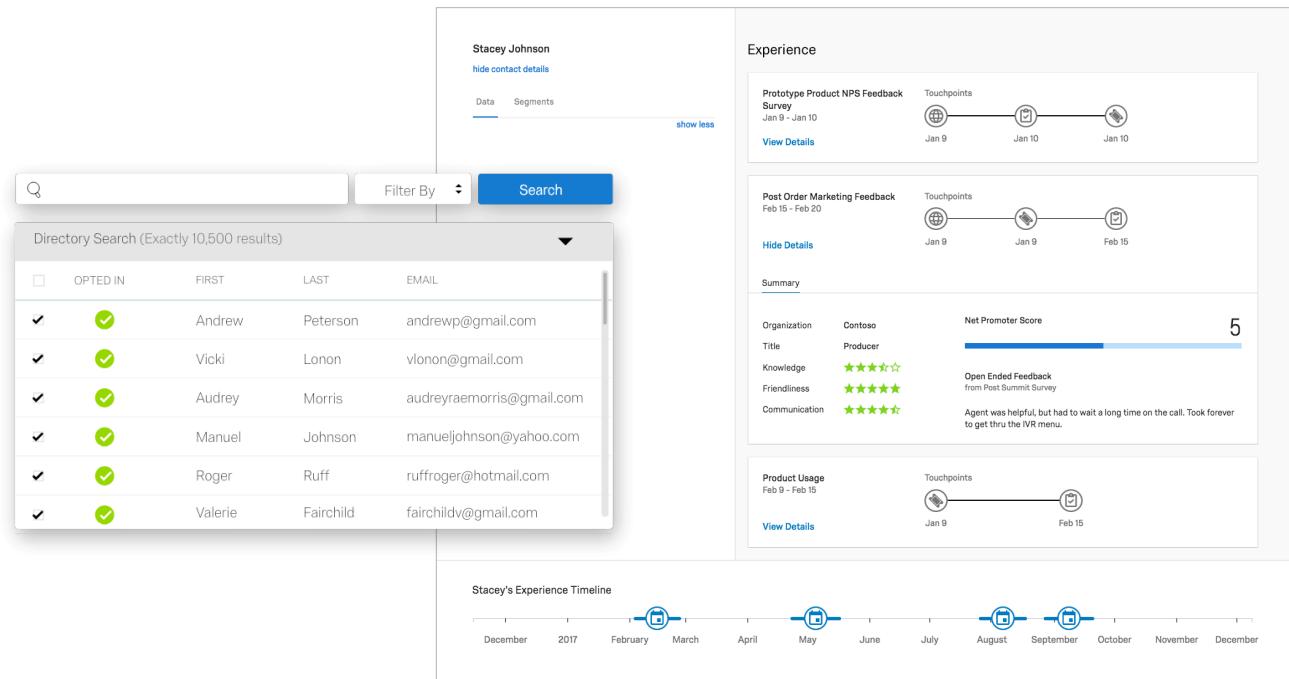
Here is how the math works assuming you chose a 95% confidence level, .5 standard deviation, and a margin of error (confidence interval) of +/- 5%.

$$\begin{aligned} & ((1.96)^2 \times .5(.5)) / (.05)^2 \\ & (3.8416 \times .25) / .0025 \\ & .9604 / .0025 \\ & 384.16 \\ & 385 \text{ respondents are needed} \end{aligned}$$

**Voila!** You've just determined your sample size.

If you find your sample size is too large to handle, try slightly decreasing your confidence level or increasing your margin of error – this will increase the chance for error in your sampling, but it can greatly decrease the number of responses you need.

Need help finding a qualified panel for your survey? With [Qualtrics Panels](#), we'll find your target respondents for the best price, and manage it from start to finish.



The screenshot displays the Qualtrics CoreXM platform interface. On the left, there's a search bar with a dropdown menu showing 'Directory Search (Exactly 10,500 results)'. Below the search bar is a table listing contacts with columns for OPTED IN, FIRST, LAST, and EMAIL. The contacts listed are Andrew Peterson, Vicki Lonon, Audrey Morris, Manuel Johnson, Roger Ruff, and Valerie Fairchild. To the right of the search area, there's a detailed view for 'Stacey Johnson' showing segments, touchpoints for a 'Prototype Product NPS Feedback Survey' (Jan 9 - Jan 10), and a summary section with a Net Promoter Score of 5. The summary also includes a 'Product Usage' section for 'Feb 9 - Feb 15' with a touchpoint on Jan 9 and Feb 15. At the bottom, there's a timeline titled 'Stacey's Experience Timeline' showing touchpoints across various months from December 2017 to December.

\*This equation is for an unknown population size or a very large population size. If your population is smaller and known, just use the calculator above or read page 7 of this document.

## APPENDIX1

# Z score table

# Z score table

**Z SCORE TABLE — CHART VALUE CORRESPONDS TO AREA BELOW Z SCORE**

<b>z</b>	<b>0.09</b>	<b>0.08</b>	<b>0.07</b>	<b>0.06</b>	<b>0.05</b>	<b>0.04</b>	<b>0.03</b>	<b>0.02</b>	<b>0.01</b>	<b>0.00</b>
<b>-3.4</b>	0.0002	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
<b>-3.3</b>	0.0003	0.0004	0.0004	0.0004	0.0004	0.0004	0.0004	0.0005	0.0005	0.0005
<b>-3.2</b>	0.0005	0.0005	0.0005	0.0006	0.0006	0.0006	0.0006	0.0006	0.0007	0.0007
<b>-3.1</b>	0.0007	0.0007	0.0008	0.0008	0.0008	0.0008	0.0009	0.0009	0.0009	0.0010
<b>-3.0</b>	0.0010	0.0010	0.0011	0.0011	0.0011	0.0012	0.0012	0.0013	0.0013	0.0013
<b>-2.9</b>	0.0014	0.0014	0.0015	0.0015	0.0016	0.0016	0.0017	0.0018	0.0018	0.0019
<b>-2.8</b>	0.0019	0.0020	0.0021	0.0021	0.0022	0.0023	0.0023	0.0024	0.0025	0.0026
<b>-2.7</b>	0.0026	0.0027	0.0028	0.0029	0.0030	0.0031	0.0032	0.0033	0.0034	0.0035
<b>-2.6</b>	0.0036	0.0037	0.0038	0.0039	0.0040	0.0041	0.0043	0.0044	0.0045	0.0047
<b>-2.5</b>	0.0048	0.0049	0.0051	0.0052	0.0054	0.0055	0.0057	0.0059	0.0060	0.0062
<b>-2.4</b>	0.0064	0.0066	0.0068	0.0069	0.0071	0.0073	0.0075	0.0078	0.0080	0.0082
<b>-2.3</b>	0.0084	0.0087	0.0089	0.0091	0.0094	0.0096	0.0099	0.0102	0.0104	0.0107
<b>-2.2</b>	0.0110	0.0113	0.0116	0.0119	0.0122	0.0125	0.0129	0.0132	0.0136	0.0139
<b>-2.1</b>	0.0143	0.0146	0.0150	0.0154	0.0158	0.0162	0.0166	0.0170	0.0174	0.0179
<b>-2.0</b>	0.0183	0.0188	0.0192	0.0197	0.0202	0.0207	0.0212	0.0217	0.0222	0.0228
<b>-1.9</b>	0.0233	0.0239	0.0244	0.0250	0.0256	0.0262	0.0268	0.0274	0.0281	0.0287
<b>-1.8</b>	0.0294	0.0301	0.0307	0.0314	0.0322	0.0329	0.0336	0.0344	0.0351	0.0359
<b>-1.7</b>	0.0367	0.0375	0.0384	0.0392	0.0401	0.0409	0.0418	0.0427	0.0436	0.0446
<b>-1.6</b>	0.0455	0.0465	0.0475	0.0485	0.0495	0.0505	0.0516	0.0526	0.0537	0.0548
<b>-1.5</b>	0.0559	0.0571	0.0582	0.0594	0.0606	0.0618	0.0630	0.0643	0.0655	0.0668
<b>-1.4</b>	0.0681	0.0694	0.0708	0.0721	0.0735	0.0749	0.0764	0.0778	0.0793	0.0808
<b>-1.3</b>	0.0823	0.0838	0.0853	0.0869	0.0885	0.0901	0.0918	0.0934	0.0951	0.0968

<b>-1.2</b>	0.0985	0.1003	0.1020	0.1038	0.1056	0.1075	0.1093	0.1112	0.1131	0.1151
<b>-1.1</b>	0.1170	0.1190	0.1210	0.1230	0.1251	0.1271	0.1292	0.1314	0.1335	0.1357
<b>-1.0</b>	0.1379	0.1401	0.1423	0.1446	0.1469	0.1492	0.1515	0.1539	0.1562	0.1587
<b>-0.9</b>	0.1611	0.1635	0.1660	0.1685	0.1711	0.1736	0.1762	0.1788	0.1814	0.1841
<b>-0.8</b>	0.1867	0.1894	0.1922	0.1949	0.1977	0.2005	0.2033	0.2061	0.2090	0.2119
<b>-0.7</b>	0.2148	0.2177	0.2206	0.2236	0.2266	0.2296	0.2327	0.2358	0.2389	0.2420
<b>-0.6</b>	0.2451	0.2483	0.2514	0.2546	0.2578	0.2611	0.2643	0.2676	0.2789	0.2743
<b>-0.5</b>	0.2776	0.2810	0.2843	0.2877	0.2912	0.2946	0.2982	0.3015	0.3050	0.3085
<b>-0.4</b>	0.3121	0.3156	0.3192	0.3228	0.3264	0.3300	0.3336	0.3372	0.3409	0.3446
<b>-0.3</b>	0.3483	0.3520	0.3557	0.3594	0.3632	0.3669	0.3707	0.3745	0.3783	0.3821
<b>-0.2</b>	0.3859	0.3897	0.3936	0.3974	0.4013	0.4052	0.4090	0.4129	0.4168	0.4207
<b>-0.1</b>	0.4247	0.4286	0.4325	0.4364	0.4404	0.4443	0.4483	0.4522	0.4562	0.4602
<b>-0.0</b>	0.4641	0.4681	0.4721	0.4761	0.4801	0.4840	0.4800	0.4920	0.4960	0.5000

<b>z</b>	<b>0.00</b>	<b>0.01</b>	<b>0.02</b>	<b>0.03</b>	<b>0.04</b>	<b>0.05</b>	<b>0.06</b>	<b>0.07</b>	<b>0.08</b>	<b>0.90</b>
<b>0.0</b>	0.5000	0.5040	0.5080	0.5120	0.5160	0.5199	0.5239	0.5279	0.5319	0.5359
<b>0.1</b>	0.5398	0.5438	0.5478	0.5517	0.5557	0.5596	0.5636	0.5675	0.5714	0.5753
<b>0.2</b>	0.5793	0.5832	0.5871	0.5910	0.5948	0.5987	0.6026	0.6064	0.6103	0.6141
<b>0.3</b>	0.6179	0.6217	0.6255	0.6293	0.6331	0.6368	0.6406	0.6443	0.6480	0.6517
<b>0.4</b>	0.6554	0.6591	0.6628	0.6664	0.6700	0.6736	0.6772	0.6808	0.6844	0.6879
<b>0.5</b>	0.6915	0.6950	0.6985	0.7019	0.7054	0.7088	0.7123	0.7157	0.7190	0.7224
<b>0.6</b>	0.7257	0.7291	0.7324	0.7357	0.7389	0.7422	0.7454	0.7486	0.7517	0.7549
<b>0.7</b>	0.7580	0.7611	0.7642	0.7673	0.7704	0.7734	0.7764	0.7794	0.7823	0.7852
<b>0.8</b>	0.7881	0.7910	0.7939	0.7967	0.7995	0.8023	0.8051	0.8078	0.8106	0.8133
<b>0.9</b>	0.8159	0.8186	0.8212	0.8238	0.8264	0.8289	0.8315	0.8340	0.8365	0.8389
<b>1.0</b>	0.8413	0.8438	0.8461	0.8485	0.8505	0.8531	0.8554	0.8577	0.8599	0.8621
<b>1.1</b>	0.8643	0.8665	0.8686	0.8708	0.8729	0.8749	0.8770	0.8790	0.8810	0.8830
<b>1.2</b>	0.8849	0.8869	0.8888	0.8907	0.8925	0.8944	0.8962	0.8980	0.8997	0.9015
<b>1.3</b>	0.9032	0.9049	0.9066	0.9082	0.9099	0.9115	0.9121	0.9147	0.9162	0.9177
<b>1.4</b>	0.9192	0.9207	0.9222	0.9236	0.9251	0.9265	0.9279	0.9292	0.9306	0.9319
<b>1.5</b>	0.9332	0.9345	0.9357	0.9370	0.9382	0.9394	0.9406	0.9418	0.9429	0.9441
<b>1.6</b>	0.9452	0.9463	0.9474	0.9484	0.9495	0.9505	0.9515	0.9525	0.9535	0.9545
<b>1.7</b>	0.9554	0.9564	0.9573	0.9582	0.9591	0.9599	0.9608	0.9616	0.9625	0.9633
<b>1.8</b>	0.9642	0.9649	0.9656	0.9664	0.9671	0.9678	0.9686	0.9693	0.9699	0.9706
<b>1.9</b>	0.9713	0.9719	0.9726	0.9732	0.9738	0.9744	0.9759	0.9756	0.9761	0.9767
<b>2.0</b>	0.9772	0.9778	0.9783	0.9788	0.9793	0.9798	0.9803	0.9808	0.9812	0.9817
<b>2.1</b>	0.9821	0.9826	0.9830	0.9834	0.9838	0.9842	0.9846	0.9850	0.9854	0.9857
<b>2.2</b>	0.9861	0.9864	0.9868	0.9871	0.9875	0.9878	0.9881	0.9884	0.9887	0.9890
<b>2.3</b>	0.9893	0.9896	0.9898	0.9901	0.9904	0.9906	0.9909	0.9911	0.9913	0.9916

<b>2.4</b>	0.9918	0.9920	0.9922	0.9925	0.9927	0.9929	0.9931	0.9932	0.9934	0.9936
<b>2.5</b>	0.9938	0.9940	0.9941	0.9943	0.9945	0.9946	0.9948	0.9949	0.9951	0.9952
<b>2.6</b>	0.9953	0.9955	0.9956	0.9957	0.9959	0.9960	0.9961	0.9962	0.9963	0.9964
<b>2.7</b>	0.9965	0.9966	0.9967	0.9968	0.9969	0.9970	0.9971	0.9972	0.9973	0.9974
<b>2.8</b>	0.9974	0.9975	0.9976	0.9977	0.9977	0.9978	0.9979	0.9979	0.9980	0.9981
<b>2.9</b>	0.9981	0.9982	0.9982	0.9983	0.9984	0.9984	0.9985	0.9985	0.9986	0.9986
<b>3.0</b>	0.9987	0.9987	0.9987	0.9988	0.9988	0.9989	0.9989	0.9989	0.9990	0.9990
<b>3.1</b>	0.9990	0.9991	0.9991	0.9991	0.9992	0.9992	0.9992	0.9992	0.9993	0.9993
<b>3.2</b>	0.9993	0.9993	0.9994	0.9994	0.9994	0.9994	0.9994	0.9995	0.9995	0.9995
<b>3.3</b>	0.9995	0.9995	0.9995	0.9996	0.9996	0.9996	0.9996	0.9996	0.9996	0.9997
<b>3.4</b>	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9997	0.9998

## APPENDIX 2

# Determining the sample size

## Determining the sample size

Just as the fpc factor is used to develop confidence interval estimates, it also is used to determine sample size when sampling without replacement. For example, in estimating the mean, the sampling error is

$$e = Z \frac{\sigma}{\sqrt{n}} \sqrt{\frac{N-n}{N-1}}$$

and in estimating the proportion, the sampling error is

$$e = Z \sqrt{\frac{p(1-p)}{n}} \sqrt{\frac{N-n}{N-1}}$$

To determine the sample size in estimating the mean or the proportion

$$n_0 = \frac{Z^2 \sigma^2}{e^2} \quad \text{and} \quad n_0 = \frac{Z^2 p(1-p)}{e^2}$$

where  $n_0$  is the sample size without considering the finite population correction factor. Applying the fpc factor results in the actual sample size  $n$

Sample size determination using the finite population correction factor

$$n = \frac{n_0 N}{n_0 + (N - 1)}$$

In determining the sample size for Saxon Home Improvement Company, a sample size of 97 was needed (rounded up from 96.04) for the mean and a sample of 100 (rounded up from 99.96) was needed for the proportion. Using the fpc factor for the mean, with N = 5,000, e = \$5, S = \$25, and Z = 1.96 (for 95% confidence), leads to

$$n = \frac{(96.04)(5,000)}{96.04 + (5,000 - 1)} = 94.24$$

Thus, n = 95. Using the fpc factor for the proportion, with N = 5,000, e = 0.07, p = 0.15, and Z = 1.96 (for 95% confidence),

$$n = \frac{(99.96)(5,000)}{99.96 + (5,000 - 1)} = 98.02$$

Thus, n = 99. To satisfy both requirements simultaneously with one sample, the larger sample size of 99 is needed. PHStat output is displayed in *Figure 8.30*.

	A	B
1	<b>Sample Size for Estimating the Mean</b>	
2		
3	<b>Population Standard Deviation</b>	<b>25</b>
4	<b>Sampling Error</b>	<b>5</b>
5	<b>Confidence Level</b>	<b>95%</b>
6	<b>Z Value</b>	-1.95996108
7	<b>Calculated Sample Size</b>	96.03618611
8	<b>Sample Size Needed</b>	<b>97</b>
9		
10		
11	<b>Finite Populations</b>	
12	<b>Population Size</b>	<b>5000</b>
13	<b>Sample Size with FPC</b>	94.24485185
14	<b>Sample Size Needed</b>	<b>95</b>

**Figure 8.30**

Sample size for estimating the mean sales invoice amount with the finite population correction for the Saxon Home Improvement Company.



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