

A Researcher Wishes To Estimate The Percentage Of Adults Who Support Abolishing The Penny. What Size

A Researcher Wishes To Estimate The Percentage Of Adults Who Support Abolishing The Penny. What Size

Understanding public opinion on various policy issues is essential for policymakers, economists, and social scientists. When it comes to the debate over whether to abolish the penny, a small but significant denomination of currency, researchers often face the challenge of determining the appropriate sample size needed to generate reliable and valid estimates. Estimating the percentage of adults who support abolishing the penny involves careful planning, especially concerning the size of the sample, the margin of error, and the confidence level. In this article, we will explore the key considerations and statistical methods needed to determine the right sample size for such a survey.

Understanding the Importance of Sample Size in Survey Research

Sample size plays a critical role in survey research because it directly impacts the accuracy and reliability of the results.

Why Is Sample Size Important?

- Accuracy of Estimations: Larger samples tend to produce estimates closer to the true population parameter.
- Confidence in Results: An adequately sized sample allows researchers to confidently state that their results reflect the population.
- Resource Efficiency: While larger samples improve accuracy, they also require more resources. Finding the optimal balance is essential.

Consequences of an Inadequate Sample Size

- Underpowered Studies: Small samples may not detect actual support for abolishing the penny, leading to Type II errors.
- Overly Large Samples: Excessively large samples may waste resources without significantly improving accuracy.
- Biased Results: Non-representative samples can skew the findings, regardless of size.

Determining the Appropriate Sample Size: Key Factors

Calculating the correct sample size involves considering several factors:

1. Estimated Population Proportion (p)

- The proportion of adults expected to support abolishing the penny.
- If no prior data exists, a conservative estimate of 50% ($p=0.5$) is often used because it maximizes the required sample size.

2. Margin of Error (E)

- The maximum acceptable difference between the sample estimate and the true population proportion.
- Commonly set at 3%, 5%, or 2%, depending on the desired precision.

3. Confidence Level (Z)

- Reflects the degree of certainty that the true population parameter falls within the margin of error.
- Typical confidence levels are 90%, 95%, or 99%.
- Corresponding Z-scores: 1.645 (90%), 1.96 (95%), 2.576 (99%).

4. Population Size (N)

- The total number of adults in the population.
- For large populations, the finite population correction factor becomes negligible.

Calculating Sample Size: The Statistical Formula

The most common formula for estimating sample size for proportions is:

$$n_0 = (Z^2 p (1 - p)) / E^2$$

Where:

- n_0 = initial sample size estimate for large populations
- Z = Z-score corresponding to desired confidence level
- p = estimated proportion of support
- E = desired margin of error

Adjusting for Finite Population (if N is small):

$$n = (N n_0) / (n_0 + N - 1)$$

Where:

- n = adjusted sample size considering the population size
- N = total population size

Practical Example: Estimating Support for Abolishing the Penny

Suppose a researcher wants to estimate the percentage of U.S. adults supporting the abolition of the penny with a 95% confidence level and a margin of error of 3%.

Step 1: Define parameters

- Estimated proportion, $p = 0.5$ (assuming maximum variability)
- Confidence level = 95% $\rightarrow Z = 1.96$
- Margin of error, $E = 0.03$

Step 2: Calculate initial sample size

$$\begin{aligned} n_0 &= (1.96^2 \cdot 0.5 \cdot 0.5) / 0.03^2 \\ n_0 &= (3.8416 \cdot 0.25) / 0.0009 \\ n_0 &= 0.9604 / 0.0009 \\ n_0 &\approx 1067.11 \end{aligned}$$

Step 3: Adjust for finite population

Assuming the adult population $N \approx 250$ million, the correction factor is negligible, so:

$$n \approx n_0 \approx 1067$$

Result:

A sample size of approximately 1,067 adults would be sufficient to estimate the support for abolishing the penny within a 3% margin of error at 95% confidence.

Additional Considerations in Sample Size Determination

While the above provides a statistical basis for sample size, other factors may influence the final decision:

1. Population Diversity

- If support varies significantly across different demographics (age, income, region), stratified sampling may require larger overall samples to ensure representation.

2. Response Rate

- Anticipate the proportion of individuals who will respond; oversampling may be necessary if response rates are low.

3. Budget and Resources

- Larger samples increase costs; balancing statistical needs with available resources is essential.

4. Use of Pilot Studies

- Conducting a small pilot can provide better estimates of p , leading to more accurate sample size calculations.

Choosing the Right Sampling Method

The method of sampling influences both the required sample size and the reliability of results.

Common Sampling Techniques:

- Simple Random Sampling: Equal chance for all individuals; ideal but sometimes impractical.
- Stratified Sampling: Dividing the population into subgroups; ensures representation.
- Cluster Sampling: Sampling groups or clusters, often used for large geographic areas.
- Systematic Sampling: Selecting every k th individual from a list.

The choice depends on research logistics and desired accuracy.

Conclusion: Ensuring Reliable Estimates on Public Support

Estimating the percentage of adults who support abolishing the penny requires careful

consideration of statistical principles and practical constraints. By understanding the key factors—such as the expected support level, confidence level, margin of error, and population size—researchers can determine an appropriate sample size that balances accuracy with resource efficiency. Proper planning ensures that survey results are representative, reliable, and valuable for informing policy discussions. As the debate continues, accurately gauging public opinion through well-designed surveys remains a cornerstone of effective policymaking and democratic participation.

References and Further Reading

- Cochran, W. G. (1977). Sampling Techniques. John Wiley & Sons.
- Israel, G. D. (1992). Sampling the Evidence of Extension Education. Program Evaluation and Organizational Development.
- Lohr, S. L. (2019). Sampling: Design and Analysis. Chapman & Hall/CRC.
- SurveyMonkey Blog. (2020). How to Calculate Sample Size for Your Survey. Retrieved from <https://www.surveymonkey.com/curiosity/sample-size-calculator/>

Keywords: sample size, survey research, public opinion, support for abolishing the penny, statistical calculation, confidence level, margin of error, population proportion, research methodology

Frequently Asked Questions

What is the appropriate sample size for estimating the percentage of adults supporting abolishing the penny with a 95% confidence level and a 5% margin of error?

The sample size can be calculated using the formula: $n = (Z^2 p (1-p)) / E^2$. Assuming no prior estimate for p (using $p=0.5$ for maximum variability), $Z=1.96$ for 95% confidence, and $E=0.05$, the required sample size is approximately 385 respondents.

How does the expected support percentage influence the sample size needed for the survey?

If the expected support percentage (p) is closer to 50%, a larger sample size is needed for the same confidence and margin of error. If support is very high or very low (near 0% or 100%), the required sample size decreases.

What factors should be considered when determining

the sample size for this survey?

Factors include the desired confidence level, margin of error, estimated support percentage, population size (if finite), and the survey's design (e.g., simple random sampling vs. stratified sampling).

Can a smaller sample size be used if the researcher has limited resources?

Yes, but it will increase the margin of error and reduce the precision of the estimate. Researchers can balance resources and precision by adjusting the confidence level or acceptable margin of error.

What role does the population size play in determining the sample size for this survey?

If the adult population is large (over 10,000), the sample size calculation remains similar. For smaller populations, a finite population correction factor can be applied to reduce the required sample size.

How can pilot studies help in estimating the support percentage for more accurate sample size calculation?

Pilot studies provide preliminary data on support levels, allowing researchers to estimate p more accurately, which helps in calculating an optimal sample size tailored to the expected support percentage.

What statistical tools or software can assist in calculating the required sample size for this survey?

Tools like GPower, SurveyMonkey's sample size calculator, SAS, SPSS SamplePower, or online calculators can assist in accurately determining the needed sample size based on specified parameters.

Additional Resources

Sample Size Determination for Estimating Support for Abolishing the Penny

Introduction

When conducting survey-based research, especially in the context of gauging public opinion on policy issues like abolishing the penny, determining the appropriate sample size

is a fundamental step. An accurate estimate hinges on selecting a sample that is large enough to produce reliable, valid results but not so large that it wastes resources. This guide explores the key considerations and calculations involved in determining the optimal sample size for estimating the percentage of adults who support abolishing the penny.

Understanding the Research Context

Before diving into the math, it's crucial to understand the context and objectives of the survey:

- Objective: To estimate the proportion (percentage) of adults in a population who support eliminating the penny.
- Target Population: All adults within a specified geographic area (e.g., national, state, or local).
- Outcome Measure: A proportion (percentage) that reflects support or opposition.
- Desired Precision: How close the estimate should be to the true population proportion.
- Confidence Level: The degree of certainty that the true population proportion falls within the margin of error.

Key Statistical Concepts

To determine the sample size, one must understand several statistical principles:

Margin of Error (E)

- The range within which the true proportion is expected to lie, with a certain confidence.
- For example, a margin of error of $\pm 3\%$ indicates the estimate is expected to be within 3 percentage points of the true value.

Confidence Level

- The probability that the interval estimated (estimate $\pm$ margin of error) contains the true proportion.
- Common confidence levels include 90%, 95%, and 99%. The most typical choice is 95%.

Population Proportion (p)

- The expected proportion of adults supporting abolishing the penny.
- If unknown, the most conservative estimate is $p=0.5$, which maximizes the required sample size.

Variance of the Proportion

- Given by $p(1 - p)$. The maximum variance occurs at $p=0.5$.

Sample Size Calculation Formula

The standard formula for calculating the required sample size when estimating a proportion is:

$$n = \frac{Z^2 \times p \times (1 - p)}{E^2}$$

Where:

- n: Required sample size
- Z: Z-score corresponding to the desired confidence level (e.g., 1.96 for 95%)
- p: Estimated proportion supporting abolishing the penny
- E: Desired margin of error (expressed as a decimal)

Step-by-Step Calculation Process

Step 1: Define the Parameters

- Confidence Level: 95% ($Z=1.96$)
- Estimated Support (p): Since no prior data exists, assume 50% support ($p=0.5$) for maximum sample size.
- Margin of Error (E): For example, $\pm 3\%$ ($E=0.03$)

Step 2: Plug Values into the Formula

$$n = \frac{(1.96)^2 \times 0.5 \times 0.5}{(0.03)^2}$$

$$n = \frac{3.8416 \times 0.25}{0.0009}$$

$$n = \frac{0.9604}{0.0009} \approx 1067.11$$

Step 3: Round Up

Since sample size must be a whole number, round up:

$$\begin{aligned} & \backslash \\ n &= 1068 \\ & \backslash \end{aligned}$$

Meaning, approximately 1,068 respondents are needed to estimate support within $\pm 3\%$ at 95% confidence, assuming a 50% support estimate.

Adjustments and Considerations

While the above calculation provides a baseline, several factors may influence the actual sample size needed.

1. Prior Knowledge of Support Levels

If preliminary data suggest the support level is, say, 60%, the sample size can be slightly reduced because the variance $p(1-p)$ is lower at $p=0.6$:

$$\begin{aligned} & \backslash \\ p &= 0.6 \rightarrow p(1-p) = 0.6 \times 0.4 = 0.24 \\ & \backslash \end{aligned}$$

Recalculating:

$$\begin{aligned} & \backslash \\ n &= \frac{1.96^2 \times 0.6 \times 0.4}{0.03^2} = \frac{3.8416 \times 0.24}{0.0009} \\ & \approx 1024 \\ & \backslash \end{aligned}$$

Less than 1,068, indicating that prior estimates can refine the sample size.

2. Desired Precision

- More precise estimates (e.g., $\pm 2\%$) require larger samples.
- Less precise estimates (e.g., $\pm 5\%$) require smaller samples.

For example, for a $\pm 2\%$ margin:

$$\begin{aligned} & \backslash \\ E &= 0.02 \\ & \backslash \end{aligned}$$

$$\begin{aligned} & \backslash \\ n &= \frac{1.96^2 \times 0.5 \times 0.5}{0.02^2} = \frac{3.8416 \times 0.25}{0.0004} = \\ & \frac{0.9604}{0.0004} = 2401 \\ & \backslash \end{aligned}$$

Thus, 2,401 respondents are needed for a $\pm 2\%$ margin at 95% confidence.

3. Finite Population Correction (FPC)

If the population size (N) is small, the sample size can be adjusted:

$$n_{\text{adj}} = \frac{n}{1 + \frac{n-1}{N}}$$

For large populations (e.g., over 100,000), the correction is negligible.

4. Non-Response Rate

In real-world surveys, not everyone responds. To account for this:

$$n_{\text{final}} = \frac{n}{(1 - r)}$$

Where r is the anticipated non-response rate (e.g., 20%). For 20% non-response:

$$n_{\text{final}} = \frac{1068}{0.8} = 1335$$

Practical Considerations in Sample Size Determination

Beyond the statistical calculations, researchers should consider practical factors:

- Budget Constraints: Larger samples increase costs.
- Time Constraints: Larger samples take longer to collect.
- Sampling Method: Random sampling ensures representativeness; some methods may require larger samples.
- Population Diversity: Highly heterogeneous populations might require stratified sampling and larger samples per subgroup.

Choosing the Optimal Sample Size

Given the calculations and considerations, the researcher should:

- Decide on acceptable margin of error (e.g., $\pm 3\%$).
- Choose a confidence level (usually 95%).
- Use prior data if available; otherwise, default to $p=0.5$.
- Adjust for expected non-response.
- Balance statistical needs with resource limitations.

For example, if the goal is to estimate support within $\pm 3\%$ at 95% confidence, and an expected support level of 50%, a sample size of approximately 1,068 respondents (adjusted for non-response) would be appropriate.

Conclusion

Determining the right sample size is a critical step in survey research, especially when estimating proportions such as support for policy changes like abolishing the penny. The key lies in balancing statistical precision with practical constraints. The core formula provides a robust starting point, but real-world factors such as prior knowledge, resource limits, and population characteristics must be incorporated into final decisions.

By carefully planning and calculating the necessary sample size, researchers can ensure their findings are both accurate and representative, ultimately leading to more informed policy discussions and decisions. Whether aiming for a broad national survey or a focused regional study, understanding and applying these principles will enhance the quality and credibility of the research outcomes.

[A Researcher Wishes To Estimate The Percentage Of Adults Who Support Abolishing The Penny What Size](#)

A Researcher Wishes To Estimate The Percentage Of Adults Who Support Abolishing The Penny What Size

Related Articles

- [A Bank's Roe Account For Its Financial Leverage. A Bank's Roa Account For Its Financial Leverage. A.](#)
- [1.11\) Describe How To Format A Works-cited List Using MLA Style.A Publication YearBfirst Wordcity Of](#)
- [A Radio Station Had 120 Tickets To A Concert. They Gave Away 2 Times As Many Tickets To Listeners As](#)

[Back to Home](#)