Indonesian Journal of

Teaching in Science

IJOTIS

JURNAL UPI

Choosing Sampling Techniques and Calculating Sample Size

Om Prakash Giri

School of Engineering, Pokhara University, Nepal
Correspondence: E-mail: omgpkr5@gmail.com

A B S T R A C T

Researchers often face data collection challenges due to sampling technique limitations, which can hinder the study's ability to address its research questions comprehensively. To overcome these challenges, selecting appropriate sampling methods and ensuring a sufficiently large sample size are crucial. Effective sample selection and size are essential for meeting the study's primary objectives and safeguarding time, money, and resources. Understanding and applying correct sampling techniques enhance the research's reliability, validity, and generalizability, leading to more informed decisions. Proper sample size calculations and techniques support reliable and credible research results, uphold ethical standards, and improve the overall quality of studies. By employing these practices, researchers can produce meaningful findings that advance knowledge and have practical implications across various fields. Ensuring a truly representative sample is vital for making valid inferences about the population, as bias in sampling can lead to unreliable results. Proper sampling techniques help eliminate bias, ensuring that findings accurately apply to the entire population.

A R T I C L E   I N F O

1. INTRODUCTION

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Sed dapibus et in survey research, selecting the right sampling method and size is essential for accurate results (Rahman, 2023). Sampling involves selecting participants from a larger population based on criteria specific to the research study to ensure relevant and representative data collection. Understanding sampling techniques is essential for conducting quality research and obtaining accurate, representative results (Gill, 2020). Field observations, interviews, and casual chats are qualitative data sources, while survey questions and interview topics provide quantitative data. Each type supports different aspects of research analysis. The sampling method should be rigorous to minimize error and bias while maximizing representativeness for accurate and reliable results (Tyrer & Heyman, 2016). To make valid inferences, proper sample selection is crucial. Incorrect sampling can lead to errors and misleading conclusions. This study introduces basic sampling concepts and various selection methods.

2. METHODS

The method was done by taking data from a literature survey. Data was obtained from internet sources, specifically articles published in international journals.

3. RESULTS AND DISCUSSION
3.1. Results
3.1.1. Basic Concepts in Sampling Methodology

In research, the sample should ideally represent the target population with minimal error, avoiding substitution or incompleteness. The process of selecting this sample is known as the sampling method (Elfil & Negida, 2019).

3.1.1.1. Population

A population is a group of individuals, objects, items, or entities sharing common characteristics or attributes (Etikan & Babatope, 2019). The target population refers to the specific group of individuals a researcher intends to study, defined by carefully considered boundaries. It should be broad enough to gather sufficient data but also specific enough to avoid including irrelevant individuals. This process requires repeated review to ensure the population accurately represents the study's focus. Mathematically, a population is represented as "N".

3.1.1.2. Finite Population

A finite population is one where subjects or items are countable and exhaustible, such as the total number of engineers in a municipality, as they can all be accurately counted.

3.1.1.3. Infinite Population

An infinite population consists of items or subjects that cannot be exhaustively counted, such as the number of labor forces in the construction industry, where the exact number is uncountable and constantly changing.

3.1.1.4. Sample

A sample, denoted as "n," is a subset of a population representing the whole. It enables researchers to generalize findings to the larger population. The process of selecting a sample

is called sampling, and its accuracy is influenced by various factors. These factors include the research approach, analytical method, model complexity, time, resources, sample size from similar studies, completion rate, and data analysis software used.

3.1.1.5. Sampling

Sampling involves selecting a subset of a population to represent the whole in survey research. It clarifies data by using a smaller, representative group to manage costs and timelines effectively. Researchers must choose participants who reflect the entire population accurately. Sampling methodology is a statistical approach for gathering and analyzing data, helping to determine how to approach research and obtain meaningful insights from a larger population (Afifah *et al*., 2022).

3.1.1.6. Why Sampling?

Selecting samples from a population is often necessary for several reasons:
(i)   Time: Research may be time-bound, making it impractical to gather information from the entire population within the allocated timeframe.
(ii) Finance: Sampling is cost-effective compared to studying the entire population, as it requires fewer financial resources.
(iii) Human Resources: Limited personnel with the necessary expertise may restrict the ability to study all subjects in research.
(iv) Location: Geographical constraints can limit access to the entire population, making sampling essential.

3.1.1.7. Sample Size

The sample size must be estimated when proposing a study. Large samples are unnecessary and unethical, while small samples are unscientific (Naing *et al*., 2006). A sample that's too small may fail to detect important effects or provide accurate estimates, while a sample that's too large can increase costs and complexity (Etikan & Babatope, 2019). Therefore, determining the optimum sample size through careful analysis during the planning phase is essential for accurate and cost-effective research. Various methods exist for calculating sample size based on study objectives and design.

3.1.1.8. Calculation of Sample Size

Several approaches exist for determining sample size, including using a census for small populations, imitating sample sizes from similar studies, using published tables, and applying formulas. Tables offer a useful guide for sample size determination, but calculations might be needed for varying levels of precision, confidence, and variability. Alternatively, sample size can be determined using specific formulas tailored to the study's requirements (Oakland, 1953).

3.1.2. Sample Size Calculation for Infinite/Large Population

An infinite population has an uncountable number of items or subjects. Equation 1 to determine representative sample sizes for large populations. Where, n = sample size, Z = Z statistic for a level of confidence, for the level of confidence of 95%, which is conventional, the Z value is 1.96, P = Assume there is a large population but that we do not know the variability in the proportion that will adopt the practice; therefore, assume p=0.5 (maximum variability) and e = precision (in the proportion of one; if 5%, e= 0.05).

$$n = \frac{Z^2 P(1-)}{e^2} = \frac{1.96^2 \times 0.5(1-0.5)}{0.05^2} = 385 \qquad (1)$$

3.1.3. Sample Size Calculation for Finite/ Small Population

A finite population consists of subjects or items that are exhaustible and countable. Formula shown in Equation 2, to calculate sample sizes at a 95% confidence level with ±5% precision. Here, n is the sample size, N is the population size, and e is precision.

$$n = \frac{N}{1 + Ne^2} \qquad (2)$$

Sample size depends on the population size and the precision required for results. It varies from single cases to thousands, guided by research questions.

3.1.4. Sample Size Calculation for Qualitative Research

For a relatively homogeneous population, it is recommended to conduct up to 12 focus groups or 30 in-depth interviews to ensure sufficient data (Boddy, 2015). In grounded theory studies, it is suggested to conduct at least five one-hour interviews to achieve theoretical saturation and ensure comprehensive data coverage (Corbin & Strauss, 2010). An upper limit of 50 interviews is recommended, as larger studies may compromise the quality of data collection and analysis in interview-based research. For grounded theory, 20 to 30 informants are recommended, 4 to 5 cases for case study research, and 2 to 3 cases for narrative research to ensure sufficient depth and rigor. In a well-defined cultural domain or study of lived experience, 10–20 knowledgeable individuals are usually sufficient to uncover and understand the core categories of the research. It is recommended to have 5 to 8 participants in a homogeneous sample or subgroup. If seeking disconfirming evidence or using maximum variation sampling, 12 to 20 participants may be necessary to capture diverse perspectives (Sim *et al.*, 2018).

3.1.5. Sampling Technique

The primary aim of sampling is to obtain a representative sample from a larger population, allowing researchers to study a smaller group and make valid generalizations (Rahman, 2023). Sampling is the process of selecting a subset from a population and is a research study (Suresh *et al.*, 2011). Sampling techniques are divided into two main categories: probability sampling, where each member has a known chance of being selected, and non-probability sampling, where selection is based on non-random criteria. The choice of technique impacts the study's validity and generalizability. The suitability of a sample probability or nonprobability depends on how well it meets its intended goals. Sampling methods are classified in **Figure 1**.
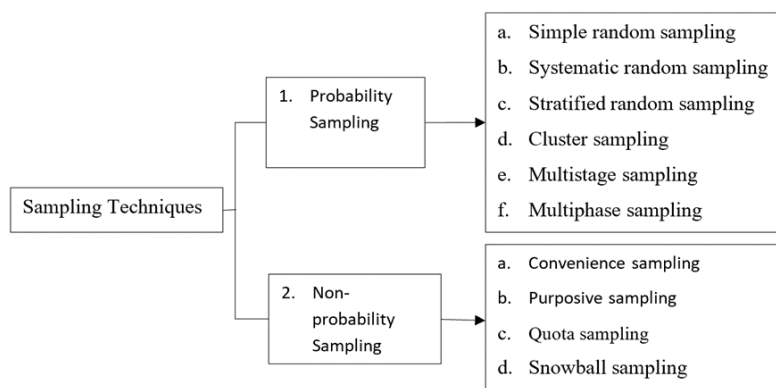

Figure 1. Sampling Techniques.

3.1.6. Probability Sampling

This method of sampling is used when the entire population is accessible, and the investigators have a complete list of all subjects in the target population for selection (Rahman *et al.*, 2022). Here, each individual in the population has an equal chance of being selected for the study. In probability sampling, each segment of the population has a non-zero chance of being selected, ensuring that the sample is likely representative of the entire population. This method enhances the likelihood of obtaining a representative sample (Iliyasu & Etikan, 2021). It is preferred for its equal representativeness, as each member of the population has an equal chance of being selected, ensuring unbiased results (Curtin *et al.*, 2005). However, they can be more costly and require a complete list of all units of analysis, making them impractical in some situations (Legan & Vandeven, 2003). Probability sampling is further classified as:

(i) Simple Random Sampling (**Figure 2**). In simple random sampling, every population member has an equal chance of selection, allowing for a quantitative description of the relationship between the sample and the population. This method provides confidence intervals, indicating where the true population parameter likely lies. The initial step in obtaining a random sample involves defining the target population, referred to as the sampling frame. This frame is essentially a comprehensive list of all individuals or entities relevant to the study, from which the sample will be drawn. In this type of sampling, each population element has an equal chance of selection. The population must have a finite number of distinguishable, non-overlapping elements that can be listed or mapped. In simple random sampling, population units are numbered from 1 to N. Random numbers between 1 and N are then generated using a random number table or computer program. Each number has an equal chance of selection. Simple random sampling offers the benefits of simplicity and impartiality. Despite its straightforward execution and elimination of bias, it is rarely used because subgroups are drawn randomly from the larger population, which may not always address specific research needs effectively (Adeoye, 2024).

> **Pros:** *The process is straightforward and considered fair, as it ensures every individual has an equal chance of being selected.*
>
> **Cons:** *A complete and current list of all individuals in the population is required for accurate sampling, but such information is often not readily available, complicating the process.*

Figure 2. Pros and Cons of Simple Random Sampling

(ii) Systematic Sampling (**Figure 3**). Systematic sampling offers an improvement over simple random sampling by providing a more structured approach. However, it requires detailed information about the entire population. This type of sampling is used for homogeneous populations and differs from simple random sampling, as not every element has an equal probability of inclusion. Elements are selected at regular intervals based on time, space, or order (e.g., every 30 minutes, two meters apart, or every 5th element). This systematic approach ensures regularity and uniformity.

> **Pros:** *This method is easier to implement than simple random sampling and usually achieves more even representation across the population.*
>
> **Cons:** *The systematic selection process can overlook important population characteristics due to its reliance on a fixed algorithm, potentially missing key traits that are crucial for accurate representation.*

Figure 3. Pros and Cons of Systematic Sampling.

(iii) Stratified Sampling (**Figure 4**). A population of N units is divided into non-overlapping subpopulations (N1, N2, ..., NL). These subpopulations collectively comprise the entire population. These subpopulations are called strata. Once the strata are determined, independent samples are drawn from each, with sample sizes within the strata denoted as n1, n2, ... nL, respectively. Stratified random sampling reduces human bias and provides a highly representative sample of the population. Using probabilistic methods allows for generalizations and statistical inferences, enhancing external validity by ensuring the sample accurately reflects the population. Stratified sampling is not effective if the population cannot be divided into distinct, non-overlapping subgroups. If sample sizes are based on data availability rather than subgroup sizes or variances, especially with significant variance differences, it can result in inaccurate findings.

> **Pros:** *A stratified sample is more representative of the population as it accounts for shared and unique characteristics during selection. This approach enhances external validity and generalizability, making the study's findings more applicable to the broader population.*
>
> **Cons:** *Stratified sampling is ineffective if the population cannot be fully divided into distinct characteristics or if the strata cannot be proportionally sized, limiting the accuracy and representativeness of the sample.*

Figure 4. Pros and Cons of Stratified Random Sampling.

(iv) Cluster Sampling (**Figure 5**). When a research area is too large, dividing it into smaller, equal parts and then randomly selecting from these smaller units is an effective strategy. This method involves sampling from clusters of smaller units, making it more economical by focusing on selected clusters. However, cluster sampling generally offers less precision compared to simple random sampling due to the reduced detail and variability within the clusters (Etikan, 2017). There are several types of cluster sampling, including (i) Single-stage Cluster Sampling (each unit within selected clusters is chosen as a sample. Researchers divide the population into clusters and then randomly select clusters, collecting data from every unit within the chosen clusters) and Double-stage Cluster Sampling (it involves collecting data from a random subsample of individual units within selected clusters. It is used when testing the entire cluster is too costly or difficult. However, this method is less accurate than single-stage sampling due to its reduced representation of the population.

> **Pros:** *Cluster sampling is cost-effective and practical for large populations, often reducing variation by grouping individuals into clusters rather than sampling individuals separately, making it efficient for extensive studies.*
> **Cons:** *If a biased cluster is chosen, it may lead to the assumption that the entire population has that bias. Relying on selection rather than random probabilities can increase the potential for error.*

Figure 5. Pros and Cons of Cluster Sampling.

(v)   Multi-stage Sampling. Multi-stage sampling adds more steps compared to double-stage sampling, but both are similar in approach. Researchers continue randomly sampling from clusters at multiple levels until they gather a sufficient number of samples for the study. Multistage sampling, often used in large-scale geographical studies, combines various probability sampling methods for effectiveness and efficiency. It is particularly applicable for extensive inquiries, such as nationwide surveys, to manage complex and diverse populations. For example, Stage 1: Random Selection: 5 clusters from each sector with a stratum of low-, middle-, and high-end-income families. Stage 2: – sub-dividing each class according to the income through a random cluster choice. Stage 3: sub-dividing each class into the relative literacy levels.

3.1.7. Non-probability Sampling Technique

Non-probability sampling uses non-random methods, often relying on judgment and convenience rather than randomization. Participants are selected based on ease of access, such as friends or coursemates. This sampling technique does not give every object or subject an equal chance of being selected (Etikan, 2016). While it simplifies sampling and is sometimes the only option, it often lacks generalizability, making findings applicable only to the specific sample rather than the broader population (Etikan, 2017). When equal chance selection isn't possible, non-probability sampling is recommended. It's faster and less costly than probability sampling but susceptible to selection bias. Non-probability methods cannot reliably estimate population sizes or make broad generalizations, as they rely on researcher discretion or random events. This sampling technique is further categorized as follows:

(i)   Convenience Sampling (**Figure 6**). A convenience sample includes individuals most accessible to the researcher, providing required information easily and inexpensively. However, it may not be representative of the population, limiting generalizability. For example, surveying fellow students after classes provides convenient data but doesn't represent the entire university student body. Convenience sampling is ideal for young researchers who have limited mobility. It's effective for studying diverse populations, saving both time and money. Favored in early survey research phases, it provides quick and straightforward data collection. Despite resistance from statisticians, it is essential to obtain insights rapidly and with minimal financial commitment, making it valuable for preliminary studies (Alvi, 2016; Taherdoost, 2016). This method is most effective when the population is diverse and widely dispersed (Mohsin, 2021). Convenience sampling is often used in early survey research for quick, easy data collection.

Pros: This sampling technique leverages the investigator's expertise effectively and is also cost-efficient, making it a practical choice for gathering data while maximizing resource use.

Cons: This technique is objective but prone to errors and uncontrolled variation. Inferential statistics cannot be applied, limiting its ability to generalize findings effectively.

Figure 6. Pros and Cons of Convenience Sampling.

(ii) Purposive/Judgemental Sampling Technique (**Figure 7**). Purposive sampling provides several advantages, such as the ability to justify generalizing findings from a targeted sample and conducting in-depth analyses. It is flexible, saves time and money, and helps identify extreme perspectives within populations, leading to lower margins of error by collecting data directly from sources. However, it also has drawbacks. Generalizing results to a larger population can be complex, making it difficult to validate accuracy and representativeness. The approach may struggle with large populations and can be challenging to defend. Additionally, detecting sampling errors can be problematic (Shaturaev, 2022). It uses the researcher's expertise to select participants based on identified variables and practical knowledge. This systematic approach enhances sample credibility by including individuals with in-depth experience or special knowledge relevant to the research topic (Shorten & Moorley, 2014). It is used to find participants with specific traits crucial to the study. Though this sample may not represent the entire population, participants can provide valuable insights into the research question. Purposive sampling is most effective when research targets a limited number of individuals in a population who possess specific characteristics that the researcher seeks from the target group.

Pros: Purposive sampling allows researchers to justify participant selection based on analytical, logical, or theoretical reasons. It's particularly useful in qualitative research with multiple phases or objectives, enabling a focused approach to study specific aspects of a population.

Cons: Purposive sampling can be prone to researcher bias, especially if judgment criteria are poorly documented or explained. This method also makes it difficult to justify the sample's representativeness of the overall population.

Figure 7. Pros and Cons of Purposive Sampling.

(iii) Quota Sampling (**Figure 8**). Quota sampling is a non-random technique where participants are selected based on predetermined characteristics, ensuring the sample's distribution matches that of the wider population. It is a nonprobability technique where researchers select samples based on fixed quotas. After stratifying the population into groups by pre-specified characteristics, subsets are chosen using convenience or judgment sampling. It is useful when time, budget, or detailed accuracy is limited, ensuring quotas from each subgroup without randomization within the subgroups (Moser, 1952). Researchers use proportionate stratified sampling to select a sample size from each population subgroup based on their proportion. Quota sampling is suitable when precision is less critical and the researcher has a clear research purpose and thorough knowledge of the population. It works well for comparing subgroups by

identifying distinct characteristics and interrelated traits among them. This method ensures that each subgroup is represented according to predefined quotas, allowing for effective comparative analysis (Iliyasu & Etikan, 2021).

> ***Pros:*** *Quota sampling is faster and simpler than stratified sampling since it doesn't involve random sampling. It also facilitates the exploration of distinctions within subgroups, making it an efficient method for specific analyses.*
>
> ***Cons:*** *Without random sampling, calculating sampling error is impossible, and sampling bias becomes a concern. Consequently, drawing accurate conclusions about the entire population can be challenging.*

Figure 8. Pros and Cons of Quota Sampling.

(iv) Snowball Sampling (**Figure 9**). This sampling process involves using networks to select a study sample, particularly useful when the researcher has limited knowledge of the group. Initial contacts lead to additional participants, aiding communication and decision-making. However, it can introduce bias and becomes challenging as the sample size grows. Its effectiveness relies heavily on the researcher's personal or professional contacts. Success in this method depends on these connections, making it ideal for reaching hard-to-find individuals but contingent on the researcher's network (Waters, 2015). Despite its limitations, snowball sampling remains valuable for studies where direct access to participants is challenging (Waters, 2015).

> ***Pros:*** *This strategy is highly effective for identifying and recruiting individuals in populations that are hard to reach or difficult to identify, making it valuable for challenging research contexts.*
>
> ***Cons:*** *Without random selection, sampling error cannot be calculated, making it impossible to determine the degree of confidence in the results. This limits the reliability and validity of the study's interpretations.*

Figure 9. Pros and Cons of Snow Ball Sampling.

3.2. Discussion

Research involves solving issues, gaining knowledge, or finding better solutions. It must be organized and systematic to be effective. Determining the optimal sample size is crucial for research success. A sample too small may lead to imprecise or undetectable results, while an extensive sample can increase cost and complexity. Choosing an appropriate sample size requires considering factors like budget, time, variables, and the complexity of the research model to ensure valid and reliable results (Rahman, 2023). Careful consideration of sample size and power analysis is essential during research planning and design stages (Suresh *et al.,* 2011). To determine the correct sample size, account for the study's purpose, population size, required precision, confidence level or risk, and variability in the attributes measured. These criteria are key for accurate sampling. For heterogeneous populations, multi-stage sampling or weighted groupings are needed to accurately reflect different segments, layers, or clusters within the population (Mweshi & Sakyi, 2020).

Probability sampling ensures representative samples through methods like random and stratified sampling. Non-probability sampling relies on judgment and does not guarantee full representation. However, non-probability sampling is less reliable for accurate population

representation compared to probability sampling methods (Adeoye, 2024). Both convenience and purposive sampling have limitations, including non-random selection and researcher bias, which affect the ability to generalize findings. Non-probability sampling selects participants based on individual judgment and is valued for ensuring the representation of the entire population. Examples include convenience, sequential, quota, judgmental, and snowball sampling. The key difference between non-probability and probability sampling lies in the lack of random selection, leading to potential bias in non-probability techniques (Adeoye, 2024).

Both convenience and purposive sampling involve nonrandom participant selection, introducing researcher bias and limiting population inferences. Convenience sampling is commonly used in quantitative research, while purposive sampling is typical in qualitative studies. Purposive sampling is not suitable for quantitative variables, and convenience sampling aligns more with quantitative research. The technique choice depends on the study's type and nature (Etikan, 2016). Quota and stratified sampling both divide the target population into groups to obtain a representative sample. However, stratified sampling uses random sampling and requires a sampling frame, allowing for error calculation. Quota sampling, commonly used by market analysts, is cost-effective and convenient but prone to bias, as it relies on availability sampling without a sampling frame (Iliyasu & Etikan, 2021).

While conducting a qualitative study authors must demonstrate that the sample is appropriate and sufficient to support the findings. They should report how the sample was selected, the number of participants or observations with a rationale, and participant characteristics. If data saturation is claimed, evidence of how it was determined must be provided (Gill, 2020). In quantitative research, sampling is crucial for obtaining a representative sample from a larger population, ensuring accurate and reliable results (Rahman *et al.*, 2022).

4. CONCLUSION

Sampling is a critical statistical technique used to select a subset from a larger population, enabling researchers to conduct studies when analyzing the entire population is impractical. By choosing a representative sample, researchers can gather reliable and high-quality data while managing resources efficiently. Proper sampling is essential for achieving accurate, generalizable results and ensuring that research findings are valid and meaningful. The choice between probability and non-probability sampling methods impacts the representativeness of the sample. Probability sampling methods, such as simple random sampling, stratified sampling, and cluster sampling, offer more reliable results as they provide every member of the population with a known chance of selection. This reduces bias and enhances the accuracy of inferences drawn from the sample. In contrast, non-probability sampling methods, including convenience, purposive, quota, and snowball sampling, are more prone to bias and are less representative of the entire population. These methods may be useful for specific contexts but typically do not support broad generalizations. Determining the appropriate sample size is equally crucial. A sample that is too small may not capture the diversity of the population, leading to unreliable results, while a sample that is too large can increase costs and complexity. Effective sample size calculations, guided by research objectives and design, are essential for balancing precision and resource use. Adhering to these principles helps in selecting appropriate sampling methods and ensuring a sample size that provides reliable results. Researchers must comprehend various sampling strategies and follow established guidelines for sample size to achieve accurate and meaningful results. This study supports

researchers in choosing the right sampling method and sample size, enhancing the overall quality and applicability of their research.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

6. REFERENCES

Adeoye, M. A. (2024). Review of Sampling Techniques for Education Moses. *ASEAN Journal for Science Education*, *2*(2), 87–94.

Afifah, S., Mudzakir, A., and Nandiyanto, A. B. D. (2022). How to calculate paired sample t-test using spss software: from step-by-step processing for users to the practical examples in the analysis of the effect of application anti-fire bamboo teaching materials on student learning outcomes. *Indonesian Journal of Teaching in Science*, *2*(1), 81–92.

Boddy, C. R. (2015). The sample size for qualitative interviews. *Qualitative Market Research: An International Journal*, *19*(2003), 426–432.

Corbin, J. and Strauss, A. (2010). Basics of qualitative research: Techniques and procedures for developing grounded theory. *Canadian Journal of University Continuing Education*, *36*(2), 358.

Curtin, R., Presser, S., and Singer, E. (2005). Changes in telephone survey nonresponse over the past quarter century. *Public Opinion Quarterly*, *69*(1), 87–98.

Elfil, M., and Negida, A. (2019). Sampling methods in clinical research; an educational review. *Archives of Academic Emergency Medicine*, *7*(1), 3–5.

Etikan, I. (2016). Comparison of convenience sampling and purposive sampling. *American Journal of Theoretical and Applied Statistics*, *5*(1), 1.

Etikan, I. (2017). Sampling and sampling methods. *Biometrics and Biostatistics International Journal*, *5*(6), 215–217.

Etikan, I., and Babatope, O. (2019). A basic approach in sampling methodology and sample size calculation. *MedLife Clinics*, *1*, 1006.

Gill, S. L. (2020). Qualitative Sampling Methods. *Journal of Human Lactation*, *36*(4), 579–581.

Iliyasu, R., and Etikan, I. (2021). Comparison of quota sampling and stratified random sampling. *Biometrics and Biostatistics International Journal*, *10*(1), 24–27.

Legan, D., and Vandeven, M. H. (2003). Sampling techniques. *Detecting Pathogens in Food*, *November 2017*, 20–51.

Mohsin, A. (2021). A manual for selecting sampling techniques in research. university of Karachi, Iqra. University. *Munich Personal RePEC Archive*, *2016*, 1–56.

Moser, C. A. (1952). Quota sampling. *Journal of the Royal Statistical Society. Series A (General)*, *115*(3), 411.

Mweshi, G. K., and Sakyi, K. (2020). Application of sampling methods for the research design. *Archives of Business Research*, *8*(11), 180–193.

Naing, L., Winn, T., and Rusli, B. N. (2006). Practical issues in calculating the sample size for prevalence studies. *Archives of Orofacial Sciences*, *1*(Ci), 9–14.

Oakland, G. B. (1953). Determining sample size. *The Canadian Entomologist*, *85*(3), 108–113.

Rahman, M. (2023). Sample size determination for survey research and non-probability sampling techniques: A review and set of recommendations introduction. *In survey research, choosing the suitable sampling method and sample size are crucial steps (Rahman et al ., 2022), 11*(1), 42–62.

Rahman, M. M., Tabash, I., M., Salamzadeh, A., Abduli, Selajdin, and Rahaman, M. S. (2022). Sampling techniques (probability) for quantitative social science researchers: a conceptual guideline with examples. *SEEU Review*, *17*(1), 42–51.

Shaturaev, J. (2022). Assessment methodology role of family entrepreneurship in the sphere of services. *ASEAN Journal of Economic and Economic Education*, *1*(2), 67–78.

Shorten, A., and Moorley, C. (2014). Selecting the sample. *Evidence-Based Nursing*, *17*(2), 32–33.

Sim, J., Saunders, B., Waterfield, J., and Kingstone, T. (2018). Can sample size in qualitative research be determined a priori? *International Journal of Social Research Methodology*, *21*(5), 619–634.

Suresh, K., Thomas, S. V., and Suresh, G. (2011). Design, data analysis, and sampling techniques for clinical research. *Annals of Indian Academy of Neurology*, *14*(4), 287–290.

Tyrer, S., and Heyman, B. (2016). Sampling in epidemiological research: issues, hazards, and pitfalls. *BJPsych Bulletin*, *40*(2), 57–60.

Waters, J. (2015). Snowball sampling: a cautionary tale involving a study of older drug users. *International Journal of Social Research Methodology*, *18*(4), 367–380.