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Review

Methods in health research: Probability and non-probability sampling

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ABSTRACT

Background: Sampling is a crucial step in health research that directly affects internal and external validity. Selecting the appropriate sampling technique minimizes bias and enhances population representativeness.
Objective: To review the concepts, types, strengths, limitations, and applications of probability and non-probability sampling techniques in health research.
Discussion: Probability sampling, such as simple random, systematic, stratified, cluster, and multistage, provides equal selection chances for all population members, enabling precise parameter estimation and robust inferential statistical analysis. It is ideal for national disease prevalence surveys, population-based program evaluations, or large-scale clinical trials. Non-probability sampling, including convenience, purposive, quota, and snowball, is faster, cost-effective, and useful for accessing hidden populations, such as marginalized groups or individuals with sensitive health conditions, although it limits result generalizability. Method selection should consider research objectives, population characteristics, available resources, ethics, and the type of data required. In certain contexts, combining both approaches can leverage quantitative rigor with qualitative depth.
Conclusion: No single sampling technique is universally superior. Probability sampling is best suited for large-scale quantitative studies or when precise population estimates are required. Non-probability sampling is appropriate for exploratory studies, hard-to-reach populations, or when resources are limited. Combining both approaches can yield qualitatively rich yet quantitatively valid data, strengthening the evidence base for decision-making in health research.

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1. Introduction

Sampling is a critical stage in research methodology, including in the field of health sciences, as the quality of the sample directly influences the internal and external validity of research findings. In both epidemiological and clinical studies, obtaining a sample that is representative of the target population is a prerequisite for producing findings that can be generalized and utilized as a basis for decision-making in public health. The appropriate selection of sampling techniques plays a vital role in minimizing sampling bias and enhancing data collection efficiency through ensuring adequate population representativeness.

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The selection of sampling methods in health research is determined not only by statistical considerations but also by ethical factors, population characteristics, and the overall objectives of the study. For instance, infectious disease surveillance studies often employ cluster sampling to achieve cost efficiency, whereas exploratory studies on health behaviors within marginalized groups may rely on snowball sampling to reach hard-to-access populations (Magnani et al., 2005; Vincent & Thompson, 2022). A comprehensive understanding of the principles, strengths, limitations, and applications of each technique is essential for researchers to determine the most appropriate sampling strategy in relation to the specific research context. This article aims to examine the fundamental concepts, types, and practical applications of probability and non-probability sampling techniques in health research. It is expected that this discussion will serve as a reference for health researchers in designing studies with both strong methodological rigor and high practical relevance.

2. Theoretical Framework

A population refers to all individuals or items that share specific characteristics within a defined location and time frame. For instance, in a study on sexually transmitted diseases (STDs), the population may comprise all individuals with STDs in the study area during a specified period. Populations are often delineated by geographical boundaries or specific contexts, such as a city, country, or community, which help define the scope of the research. A sample is a smaller subset drawn from the larger population, used to make observations and draw conclusions about the population as a whole. The process of sampling involves selecting a subset that is considered to represent the characteristics of the overall population, with the aim of conducting measurements or observations without examining the entire population. Sampling is essential in health research because studying the entire population is often impractical due to constraints such as cost, time, and accessibility. The sample must be representative to ensure that findings can be generalized to the broader population, thereby avoiding biases that could distort results. This is particularly important in health research, as population characteristics (such as age, sex, and health status) can significantly influence outcomes (Beck, 2024; Christman, 2009; Das et al., 2023; Narayan et al., 2023; Rudolph et al., 2023).

Sampling techniques are generally categorized into two main approaches: probability sampling and non-probability sampling. Probability sampling is based on the principle that

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each element of the population has an equal and measurable chance of being selected, thereby producing data that are more accurate and generalizable. Common types include simple random sampling, systematic sampling, stratified sampling, cluster sampling, and multistage sampling. In contrast, non-probability sampling selects samples without giving each population member an equal chance of selection, making it more prone to bias. However, it is often used when there are limitations related to time, cost, or accessibility. Methods in this category include convenience sampling, purposive sampling, quota sampling, and snowball sampling (Ajithakumari G, 2024; Bhardwaj, 2019; Setia, 2016).

3. Probability Sampling

Probability sampling is a method of sample selection in which every member of the population has an equal and measurable chance of being chosen. This approach generally requires a complete sampling frame, thereby minimizing selection bias and enabling the statistical generalization of research findings. A sampling frame is a list or database that includes all elements of the target population and serves as the basis for drawing a probability sample, ensuring that each unit has a known probability of selection (Martínez-Mesa et al., 2016). For example, in research on child nutrition in a specific region, the sampling frame could be derived from healthcare center records. This means that while the actual number of children in the population may be much larger, the selected sample would be drawn from the healthcare center database.

1) Simple random sampling

   Simple random sampling (SRS) is a technique in which n units are selected from a population of N units, where each unit has an equal probability of being chosen. SRS is particularly useful in studies where the population is relatively homogeneous, as it facilitates straightforward statistical analysis and allows findings to be generalized to a broader population, ultimately contributing to effective health interventions and policymaking (Keith et al., 2023; Latpate et al., 2021; Wahab, 2021). An example is a study on the prevalence of COVID-19, where cases may occur in any location and among any individual. Using a sampling frame such as a population registry or a list of healthcare facility visitors, the sample can then be selected randomly through methods such as random number generators, random number tables, lotteries, and similar techniques.

2) Systematic sampling

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Systematic sampling is a technique in which elements are selected at predetermined intervals (the sampling interval) after a random starting point has been chosen. Each selected member in this approach is referred to as the K^{th} element (Bhardwaj, 2019; Hankin et al., 2019b). For example, if the goal is to select ten patients from a group of fifty individuals, the K^{th} element is determined by dividing 50 by 10, resulting in a sampling interval of five. Consequently, every fifth patient would be included in the sample, meaning that patients numbered 5, 10, 15, 20, 25, 30, 35, 40, 45, and 50 would be selected for the study.

3) Stratified sampling

Stratified random sampling involves dividing the population into distinct strata based on specific characteristics that are relevant to the survey, such as age, gender, or socioeconomic status. Independent samples are then drawn from each stratum. Selection within each stratum can be conducted using unbiased methods, and if simple SRS is applied within strata, it is referred to as stratified random sampling (Hankin et al., 2019a; Parsons, 2005). Contoh pada penelitian kejadian hipertensi pada 1200 pasien rumah sakit. For instance, in a hospital-based study of 1,200 patients to assess hypertension prevalence, stratification variables could include age groups (<40 years, 40–59 years, and >59 years) and gender (male and female). This would produce the following strata and population sizes:

- S1: Male <40 years – 200 individuals
- S2: Male 40–59 years – 150 individuals
- S3: Male >59 years – 100 individuals
- S4: Female <40 years – 300 individuals
- S5: Female 40–59 years – 250 individuals
- S6: Female >59 years – 200 individuals

If the total sample size is set at 300 patients, proportional allocation per stratum is calculated as:

$$\frac{Polulation\ in\ stratum}{Total\ population}\ x\ Sample\ size$$

Thus, for S1 calcutaled 200 X 300 : 1200 = 50 individuals. This calculation is repeated for each stratum, after which the specific samples are selected using SRS within each stratum.

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4) Cluster sampling

Cluster sampling is a technique in which the population is divided into groups, or clusters, typically based on geographical boundaries or organizational structures, and then entire clusters are randomly selected for study. This method is commonly used when the population is widely dispersed and difficult to access on an individual basis. Although similar in appearance, cluster sampling and stratified sampling differ significantly. In cluster sampling, the researcher randomly selects from naturally existing groups, such as districts within a regency or families within a community structure (Bhardwaj, 2019; Kim, 2025). For example, in a study on anemia among adolescents in a particular city, schools could be used as clusters. The number of clusters to be studied would be determined and then selected using simple random sampling (SRS) or systematic sampling. Samples are subsequently drawn from each of the selected clusters.

5) Multistage sampling

Multistage sampling is a complex form of cluster sampling that involves selecting samples in several stages, often combining different sampling methods at each stage. This approach is particularly useful for large and heterogeneous populations, enabling researchers to manage logistical constraints while maintaining a representative sample (Bhardwaj, 2019; Christman, 2014). For example, in a study on type 2 diabetes among adults in Province A, the sampling process could be conducted in several stages: (1) Cluster sampling at the district level, randomly selecting five districts; (2) Cluster sampling at the subdistrict level, randomly selecting three subdistricts within each chosen district; (3) Within each selected subdistrict, compiling a list of households and selecting households using systematic sampling with a fixed interval of five; and (4) From each selected household, randomly choosing one respondent aged over 30 years to undergo diabetes screening.

4. Non-Probability Sampling

Non-probability sampling is a method of sample selection in which the likelihood of each member of the population being chosen is not equal. The selection of samples is based on the researcher’s subjective judgment, ease of access, or specific desired characteristics. This technique is frequently employed in exploratory research, qualitative studies, or when targeting hard-to-reach populations, although it has inherent limitations in the generalizability

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of results. Common types of non-probability sampling include convenience sampling, purposive sampling, quota sampling, and snowball sampling (Das et al., 2023; MULİSA, 2022).

1) Convenience sampling

Convenience sampling is a sample selection technique based on the ease of access or availability of respondents at the time of the study. It is a widely used non-probability sampling method across various fields of research due to its practicality and cost-effectiveness. However, it is often criticized for its potential to introduce bias and limit the generalizability of findings. This method involves selecting participants based on their accessibility and proximity to the researcher, which may lead to the overrepresentation of certain demographic groups and the underrepresentation of others. Despite these limitations, convenience sampling remains prevalent, particularly in studies where time and resources are constrained (Doebel & Frank, 2024; Lines et al., 2022; Slep et al., 2006). A study aims to assess patient satisfaction with services at a community health center.

The researcher selects respondents from patients waiting in the waiting area on the day of data collection. All patients present and willing to be interviewed at that time are included in the sample, without considering the entire patient list or prior visit schedules.

2) Purposive sampling

Purposive sampling, also known as judgmental sampling, is a non-probability sampling technique in which participants are selected based on specific criteria relevant to the research objectives, as determined by the researcher. It is widely used in qualitative research to identify participants or cases that are most informative for addressing the research questions. This method is particularly effective when the researcher needs to focus on specific characteristics of the target population, thereby enabling a deeper understanding of the phenomenon under investigation (Nyimbili & Nyimbili, 2024). A researcher aims to explore the experiences of pregnant women with gestational hypertension in accessing antenatal care services. Using purposive sampling, the researcher selects participants who meet the following inclusion criteria: (1) diagnosed with gestational hypertension during their current pregnancy, (2) in their third trimester, and (3) attending antenatal care at least twice in the last month. These criteria ensure that the selected participants have direct, relevant experiences that can provide rich, detailed insights into the research topic.

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3) Quota sampling

Quota sampling is a non-probability sampling method in which samples are selected to reflect the characteristics of a specific population (based on predefined criteria) according to predetermined quotas, often derived from census data, while using convenience sampling to recruit participants. This approach is particularly useful when time and resources are limited, as it enables researchers to collect data quickly from a large pool of volunteers (Hossan et al., 2023; Li et al., 2023). A researcher is studying dietary habits among adolescents in an urban area. Based on recent census data, the adolescent population consists of 60% females and 40% males. The researcher sets a quota to interview 300 participants, with 180 females and 120 males. Within each gender category, participants are recruited using convenience sampling at local schools, youth centers, and public parks until the quota for each group is reached.

4) Snowball sampling

Snowball sampling is a sampling technique in which initial respondents recommend or recruit other individuals from the same population to participate in the study. This method is particularly useful for obtaining samples from rare or hidden populations that are difficult or resource-intensive to access using other sampling methods. However, it has certain limitations, such as the inability to determine the sample size at the outset of the research. Data collection is typically concluded at the researcher's discretion when no new or relevant information emerges from additional participants—a point referred as data saturation (Sebele-Mpofu, 2021). A researcher aims to explore traditional postpartum care practices among women in an indigenous community. Due to the cultural sensitivity of the topic and the closed nature of the community, initial participants are identified through a local midwife who has long served the area. After participating in in-depth interviews, these women are asked to recommend other mothers who have experienced traditional postpartum care and are willing to share their experiences. Recruitment continues through these referrals, expanding gradually into the community, until the researcher observes that no new cultural practices or perspectives are emerging, indicating that data saturation has been reached.

5. Comparison of Probability and Non-Probability Sampling

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The selection of sampling techniques in health research should take into account the study objectives, population characteristics, available resources, and the expected level of precision. Probability sampling allows for accurate estimation of population parameters and is essential for studies aimed at generalizing findings to a broader population. This method supports statistical calculations of potential error and confidence intervals, thereby enhancing the external validity of the research. It is regarded as the gold standard in scientific studies due to its objectivity and accuracy (Lynn, 2016; Nj & Um, 2020).

Non-probability sampling methods, such as convenience and purposive sampling, are often more flexible and less costly than probability sampling. They enable researchers to collect data quickly without the need for a complete sampling frame, which is particularly useful in exploratory studies or when resources are limited. Although these techniques are more prone to selection bias and have limitations in generalizing results, they are often a realistic choice for exploratory research, qualitative studies, or when the population is difficult to fully identify (Boyd et al., 2023; Ibrahim & Marcaccio, 2023; Turban et al., 2023).

Probability methods in health research are more appropriate for large-scale quantitative studies, such as national disease prevalence surveys or evaluations of population-based health programs. Conversely, non-probability methods are more suitable for studies that emphasize an in-depth understanding of phenomena, such as research on health behaviors in marginalized communities or high-risk groups. Beyond methodological considerations, ethical factors also influence the choice of sampling techniques. For example, snowball sampling in research on culturally influenced health behaviors allows researchers to protect respondent confidentiality while reaching populations that are difficult to access through probability methods. Therefore, the choice of sampling technique is not merely a technical decision but also a research strategy that must be adapted to the study's context, objectives, and constraints (Marks & Rhodes, 2019; Stratton, 2023). Table 1 presents a comparison of these two approaches.

Table 1. Comparisons of probabilitas and non-probabilitas sampling

Aspect	Probability Sampling	Non-Probabilitas Sampling
Basic principle	Every member of the population has an equal and measurable chance of being selected	The likelihood of selection is unequal among population members and cannot be calculated with certainty

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Sampling frame	Requires a clear and complete sampling frame	Does not require a complete sampling frame
Potential bias	Relatively low if procedures are properly implemented	High, as sample selection is subjective or based on ease of access
Estimation precision	High; allows calculation of population parameters and confidence intervals	Low; difficult to accurately estimate population parameters
Generalizability	High (strong external validity)	Low; findings are difficult to generalize to the entire population
Resource requirements	Generally requires more time, cost, and manpower	More efficient in terms of time, cost, and manpower
Complexity	More complex, requiring systematic design and procedures	Simpler and more flexible
Suitability	National disease prevalence surveys, population-based health program evaluations, clinical trials	Exploratory studies of health behavior, qualitative research on hard-to-reach groups, preliminary studies
Example	Simple random sampling, systematic sampling, stratified sampling, cluster sampling, multi-stage sampling	Convenience sampling, purposive sampling, quota sampling, snowball sampling

6. Implications of Sampling Technique Selection in Health Research

The selection of sampling techniques in health research is not merely a technical decision; it also carries direct implications for the validity, reliability, and practical utility of the study's findings. This decision influences the interpretation of results, the confidence of readers in the findings, and the potential application of the research outcomes in public health policy and practice.

1) Implications for internal and external validity

   Probability sampling techniques, by virtue of providing equal selection opportunities to all members of the population, tend to produce higher external validity. This allows research findings to be generalized more accurately to the target population. Conversely, non-probability sampling techniques risk reducing external validity due to selection bias, although internal validity can still be maintained if the research design and variable control are rigorously implemented (Hsia, 2005; Langer, 2018; Tin & Bui, 2024).

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2) Efficiency and resource availability

   In large-scale health research, such as national disease prevalence surveys or evaluations of public health interventions, probability sampling is often the preferred choice despite its higher time and cost demands. However, in situations with limited resources or difficult access, non-probability sampling may be a more practical alternative. Such efficiency is particularly important in health emergencies, such as outbreak investigations, where rapid data collection is a priority (Langer, 2018; Sakshaug et al., 2021).

3) Suitability for research objectives and types

   Probability methods are better suited for confirmatory quantitative research aimed at measuring prevalence, causal relationships, or health trends. In contrast, non-probability methods are more appropriate for exploratory or qualitative studies, where the focus is on gaining an in-depth understanding of a phenomenon rather than estimating population parameters (Marks & Rhodes, 2019; Setia, 2016).

4) Ethical considerations and accessibility

   In health research involving sensitive or hard-to-reach populations—such as individuals living with HIV/AIDS, people who inject drugs, or sex workers—techniques like snowball sampling can facilitate participant recruitment while protecting privacy and safety. Nevertheless, researchers must acknowledge the limitations in generalizability and report them transparently in publications (MacKellar et al., 1996; Moxon & Waters, 2023).

5) Impact on data analysis

   Probability sampling enables the use of inferential statistical methods with a clearly defined confidence level. In contrast, non-probability sampling generally restricts researchers to descriptive or exploratory analyses, with results being more appropriate for generating initial hypotheses rather than formally testing them (Langer, 2018; Stratton, 2023; Tin & Bui, 2024).

Probability sampling remains the preferred method for confirmatory quantitative research due to its ability to produce generalizable results, whereas non-probability sampling offers valuable insights in exploratory and qualitative research contexts. Several studies recommend combining probability and non-probability samples to leverage the strengths of both approaches. This strategy can be particularly effective in studies with low-prevalence

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outcomes, where non-probability samples may complement probability samples to increase sample size and representativeness (Wiśniowski et al., 2020; Xi et al., 2024).

7. Rekomendation

Based on this review, the following recommendations are proposed for sampling in health research:

1) Use probability sampling when the research objective is to obtain accurate and generalizable population estimates.
2) Use non-probability sampling when the study is exploratory in nature, the population is hard to access, or there are constraints in time and resources.
3) Combine both methods (mixed-method sampling) where feasible to obtain data that are both qualitatively rich and quantitatively valid.
4) Transparently report the rationale for method selection, implementation procedures, and limitations in scientific publications.

8. Conclusion

The choice of sampling technique in health research is a critical factor that determines the quality, validity, and relevance of research findings. Probability sampling offers equal and measurable chances of selection for every population member, thereby producing precise and generalizable estimates. Conversely, non-probability sampling provides flexibility and efficiency but is limited in external validity due to potential selection bias. In practice, no single sampling method is universally "best." The decision should be guided by the research objectives, type of data required, resource availability, population characteristics, and ethical considerations.

9. Conflict of interest

All authors declare no conflict of interest.

10. References

Ajithakumari G. (2024). Sample size determination and sampling technique. *International Journal of Science and Research (IJSR)*, *13*(9), 1432–1440. https://doi.org/10.21275/ES24924103353

Beck, K. (2024). Study population. In *Translational orthopedics* (pp. 97–100). Elsevier. https://doi.org/10.1016/B978-0-323-85663-8.00066-0

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Vol. 3, No. 2, August 2025, pp. 220 – 234
ISSN: 3026-5037 DOI: https://doi.org/10.71357/hsij.v3i2.64

Bhardwaj, P. (2019). Types of sampling in research. *Journal of the Practice of Cardiovascular Sciences*, *5*(3), 157. https://doi.org/10.4103/jpcs.jpcs_62_19

Boyd, R. J., Powney, G. D., & Pescott, O. L. (2023). We need to talk about nonprobability samples. *Trends in Ecology & Evolution*, *38*(6), 521–531. https://doi.org/10.1016/j.tree.2023.01.001

Christman, M. C. (2009). *Sampling of rare populations* (pp. 109–124). https://doi.org/10.1016/S0169-7161(08)00006-0

Christman, M. C. (2014). Multistage design. In *Wiley StatsRef: Statistics Reference Online*. Wiley. https://doi.org/10.1002/9781118445112.stat07579

Das, B. K., Jha, D. N., Sahu, S. K., Yadav, A. K., Raman, R. K., & Kartikeyan, M. (2023). Concept of sampling methodologies and their applications. In *Concept Building in Fisheries Data Analysis* (pp. 17–40). Springer Nature Singapore. https://doi.org/10.1007/978-981-19-4411-6_2

Doebel, S., & Frank, M. C. (2024). Broadening convenience samples to advance theoretical progress and avoid bias in developmental science. *Journal of Cognition and Development*, *25*(2), 261–272. https://doi.org/10.1080/15248372.2023.2270055

Hankin, D. G., Mohr, M. S., & Newman, K. B. (2019a). Stratified sampling. In *Sampling Theory* (pp. 68–91). Oxford University PressOxford. https://doi.org/10.1093/oso/9780198815792.003.0005

Hankin, D. G., Mohr, M. S., & Newman, K. B. (2019b). Systematic sampling. In *Sampling Theory* (pp. 48–67). Oxford University PressOxford. https://doi.org/10.1093/oso/9780198815792.003.0004

Hossan, D., Dato' Mansor, Z., & Jaharuddin, N. S. (2023). Research population and sampling in quantitative study. *International Journal of Business and Technopreneurship (IJBT)*, *13*(3), 209–222. https://doi.org/10.58915/ijbt.v13i3.263

Hsia, J. (2005). Probability sampling. In *Encyclopedia of biostatistics*. Wiley. https://doi.org/10.1002/0470011815.b2a16051

Ibrahim, Z., & Marcaccio, S. E. (2023). Study population. In *Translational sports medicine* (pp. 103–105). Elsevier. https://doi.org/10.1016/B978-0-323-91259-4.00105-3

Keith, R. J., Holm, R. H., Amraotkar, A. R., Bezold, M. M., Brick, J. M., Bushau-Sprinkle, A. M., Hamorsky, K. T., Kitterman, K. T., Palmer, K. E., Smith, T., Yeager, R., & Bhatnagar, A.

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Vol. 3, No. 2, August 2025, pp. 220 – 234
ISSN: 3026-5037 DOI: https://doi.org/10.71357/hsij.v3i2.64

(2023). Stratified simple random sampling versus volunteer community-wide sampling for estimates of COVID-19 prevalence. *American Journal of Public Health*, *113*(7), 768–777. https://doi.org/10.2105/AJPH.2023.307303

Kim, J. K. (2025). *Statistics in survey sampling* (1st ed.). Chapman and Hall/CRC.

Langer, G. (2018). The importance of probability-based sampling methods for drawing valid inferences. In *The Palgrave Handbook of Survey Research* (pp. 7–12). Springer International Publishing. https://doi.org/10.1007/978-3-319-54395-6_2

Latpate, R., Kshirsagar, J., Kumar Gupta, V., & Chandra, G. (2021). Simple random sampling. In *Advanced sampling methods* (pp. 11–35). Springer Singapore. https://doi.org/10.1007/978-981-16-0622-9_2

Li, Y., Fay, M., Hunsberger, S., & Graubard, B. I. (2023). Variable inclusion strategies for effective quota sampling and propensity modeling: An application to SARS-CoV-2 infection prevalence estimation. *Journal of Survey Statistics and Methodology*, *11*(5), 1204–1228. https://doi.org/10.1093/jssam/smad026

Lines, T., Burdick, C., Dewez, X., Aldridge, E., Neal-Williams, T., Walker, K., Akhlaghi, H., Paul, B., & Taylor, D. M. (2022). Nature and extent of selection bias resulting from convenience sampling in the emergency department. *Emergency Medicine Journal*, *39*(4), 325–330. https://doi.org/10.1136/emermed-2021-211390

Lynn, P. (2016). Principles of sampling. In *Research methods for postgraduates: Third edition* (pp. 244–254). John Wiley & Sons, Ltd. https://doi.org/10.1002/9781118763025.ch24

MacKellar, D., Valleroy, L., Karon, J., Lemp, G., & Janssen, R. (1996). The young men's survey: methods for estimating HIV seroprevalence and risk factors among young men who have sex with men. *Public Health Reports (Washington, D.C. : 1974)*, *111 Suppl 1*(Suppl 1), 138–144.

Magnani, R., Sabin, K., Saidel, T., & Heckathorn, D. (2005). Review of sampling hard-to-reach and hidden populations for HIV surveillance. *AIDS*, *19*(Supplement 2), S67–S72. https://doi.org/10.1097/01.aids.0000172879.20628.e1

Marks, E. L., & Rhodes, B. B. (2019). Needles in Haystacks and diamonds in the rough: Using probability and nonprobability methods to survey low-incidence populations. *Survey Methods: Insights from the Field*, 11959.

Health Sciences International Journal (HSIJ)
Vol. 3, No. 2, August 2025, pp. 220 – 234
ISSN: 3026-5037 DOI: https://doi.org/10.71357/hsij.v3i2.64

Martínez-Mesa, J., González-Chica, D. A., Duquia, R. P., Bonamigo, R. R., & Bastos, J. L. (2016). Sampling: How to select participants in my research study? *Anais Brasileiros de Dermatologia*, *91*(3), 326–330. https://doi.org/10.1590/abd1806-4841.20165254

Moxon, D., & Waters, J. (2023). The ethics of researching “hard to reach” populations. In *Ethical dilemmas in international criminological research* (pp. 99–112). Routledge. https://doi.org/10.4324/9781003241515-8

MULİSA, F. (2022). Sampling techniques involving human subjects: Applications, pitfalls, and suggestions for further studies. *International Journal of Academic Research in Education*, *8*(1), 74–83. https://doi.org/10.17985/ijare.1225214

Narayan, K. G., Sinha, D. K., & Singh, D. K. (2023). Sampling techniques. In *Veterinary public health & epidemiology* (pp. 111–123). Springer Nature Singapore. https://doi.org/10.1007/978-981-19-7800-5_12

Nj, G., & Um, T. (2020). Sampling and sample size in clinical research - A scientific and ethical imperative. *The Journal of the Association of Physicians of India*, *68*(3), 11–12.

Nyimbili, F., & Nyimbili, L. (2024). Types of purposive sampling techniques with their examples and application in qualitative research studies. *British Journal of Multidisciplinary and Advanced Studies*, *5*(1), 90–99. https://doi.org/10.37745/bjmas.2022.0419

Parsons, V. (2005). Stratified Sampling. In *Encyclopedia of biostatistics*. Wiley. https://doi.org/10.1002/0470011815.b2a16074

Rudolph, J. E., Zhong, Y., Duggal, P., Mehta, S. H., & Lau, B. (2023). Defining representativeness of study samples in medical and population health research. *BMJ Medicine*, *2*(1), e000399. https://doi.org/10.1136/bmjmed-2022-000399

Sakshaug, J. W., Wiśniowski, A., Perez Ruiz, D. A., & Blom, A. G. (2021). *Combining scientific and non-scientific surveys to improve estimation and reduce costs* (pp. 71–93). https://doi.org/10.1007/978-3-030-54936-7_4

Sebele-Mpofu, F. Y. (2021). The Sampling conundrum in qualitative research: Can saturation help alleviate the controversy and alleged subjectivity in sampling? *International Journal of Social Science Studies*, *9*(5), 11. https://doi.org/10.11114/ijsss.v9i5.5294

Setia, M. (2016). Methodology series module 5: Sampling strategies. *Indian Journal of Dermatology*, *61*(5), 505. https://doi.org/10.4103/0019-5154.190118

Health Sciences International Journal (HSIJ)
Vol. 3, No. 2, August 2025, pp. 220 – 234
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Slep, A. M. S., Heyman, R. E., Williams, M. C., Van Dyke, C. E., & O'Leary, S. G. (2006). Using random telephone sampling to recruit generalizable samples for family violence studies. *Journal of Family Psychology*, *20*(4), 680–689. https://doi.org/10.1037/0893-3200.20.4.680

Stratton, S. J. (2023). Population sampling: Probability and non-probability techniques. *Prehospital and Disaster Medicine*, *38*(2), 147–148. https://doi.org/10.1017/S1049023X23000304

Tin, N. T., & Bui, H. P. (2024). *Sampling, generalizability, and reliability* (pp. 103–121). https://doi.org/10.4018/979-8-3693-2603-9.ch008

Turban, J. L., Almazan, A. N., Reisner, S. L., & Keuroghlian, A. S. (2023). The importance of non-probability samples in minority health research: Lessons learned from studies of transgender and gender diverse mental health. *Transgender Health*, *8*(4), 302–306. https://doi.org/10.1089/trgh.2021.0132

Vincent, K., & Thompson, S. (2022). Estimating the size and distribution of networked populations with snowball sampling. *Journal of Survey Statistics and Methodology*, *10*(2), 397–418. https://doi.org/10.1093/jssam/smaa042

Wahab, A. (2021). Sampling in Health Research [*in Indonesia*]. *Jurnal Pendidikan Dan Teknologi Kesehatan*, *4*(1), 38–45. https://doi.org/10.56467/jptk.v4i1.23

Wiśniowski, A., Sakshaug, J. W., Perez Ruiz, D. A., & Blom, A. G. (2020). Integrating probability and nonprobability samples for survey inference. *Journal of Survey Statistics and Methodology*, *8*(1), 120–147. https://doi.org/10.1093/jssam/smz051

Xi, W., Hinton, A., Lu, B., Krotki, K., Keller-Hamilton, B., Ferketich, A., & Sukasih, A. (2024). Analysis of combined probability and nonprobability samples: A simulation evaluation and application to a teen smoking behavior survey. *Communications in Statistics - Simulation and Computation*, *53*(7), 3285–3301. https://doi.org/10.1080/03610918.2022.2102181