RESEARCH COLUMN

Sampling Methods in Cardiovascular Nursing Research: An Overview

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Abstract

Cardiovascular nursing research covers a wide array of topics from health services to psychosocial patient experiences. The selection of specific participant samples is an important part of the research design and process. The sampling strategy employed is of utmost importance to ensure that a representative sample of participants is chosen. There are two main categories of sampling methods: probability and non-probability. Probability sampling is the random selection of elements from the population, where each element of the population has an equal and independent chance of being included in the sample. There are five main types of probability sampling including simple random sampling, systematic sampling, stratified sampling, cluster sampling, and multi-stage sampling. Non-probability sampling methods are those in which elements are chosen through non-random methods for inclusion into the research study and include convenience sampling, purposive sampling, and snowball sampling. Each approach offers distinct advantages and disadvantages and must be considered critically. In this research column, we provide an introduction to these key sampling techniques and draw on examples from the cardiovascular research. Understanding the differences in sampling techniques may aid nurses in effective appraisal of research literature and provide a reference point for nurses who engage in cardiovascular research.

Keywords: sampling, probability sampling, non-probability sampling, cardiovascular nursing research

Kandola, D., Banner, D., O'Keefe-McCarthy, S., & Jassal, D., Sampling Methods in Cardiovascular Nursing Research: An Overview. *Canadian Journal of Cardiovascular Nursing*, *24*(3), 15–18.

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Researchers are frequently charged with the task of undertaking research that is both credible and has wider reaching applicability to the larger population. This is particularly important in the area of cardiovascular health, where the growing levels of cardiovascular disease continue to put a strain on global health care systems and create significant burden for sufferers and their loved ones (Berra, Fletcher, Hayman, & Miller, 2011; Deaton et al., 2011; World Health Organization, 2007; Yusuf & McKee, 2014). Continued research is needed to drive improvements in the clinical management of cardiovascular disease and the development of effective and responsive health care systems.

The time and expense involved in research can make it challenging for researchers to study entire populations and, as a result, sampling techniques are used to assist in the selection of a representative sample (Sandelowski, 2000). The process of selecting a sample can be complex and the researcher must have sound knowledge of the population characteristics and sampling methods in order to ensure that a valid and robust sample is selected. If the researcher fails to achieve this, the research may not capture an appropriate target population and, as a result, may have limited applicability and usefulness at the practice level. In this research column, we will provide an introduction to the importance of sampling, followed by an overview of the key sampling techniques. We will draw on examples from cardiovascular research to highlight these. Understanding the different sampling techniques can assist cardiovascular nurses as they appraise research literature for application to practice, and it can provide a foundation for novice researchers as they begin their research journey.

Sampling: A Critical Part of the Research Process

Decisions around sampling are critical to the overall research process and there are several points that a researcher must consider when choosing a sampling method for research. These include the research problem, the researcher's personal experiences, and the intended audience (Creswell, 2013). As a starting point, the researcher must have a strong grasp of the population under study and may require access to detailed information about the overall population. This may include a consideration of factors such as gender, clinical status, geographical location, or institutional affiliation (Creswell, 2013). Once the target population is identified, the researcher must then consider the sampling techniques to be used.

Sampling Techniques

There are two main sampling approaches: probability and non-probability sampling (Bowling, 2009). These approaches will now be defined along with an overview of the key sampling techniques.

Probability sampling. Probability sampling can be defined as the random selection of elements from the population, where each element of the population has an equal and independent chance of being included in the sample (LoBiondo-Wood & Haber, 2013). Probability samples are most commonly associated with quantitative research studies, where a high level of control and manipulation may be required. The use of probability sampling techniques decreases the likelihood of selection bias and minimizes the potential for skewed results. There are five main types of probability sampling including simple random sampling, systematic sampling, stratified sampling, cluster sampling, and multi-stage sampling. These will now be presented.

Simple random sampling. Simple random sampling is the most straightforward form of random probability sampling. It is a sampling strategy that requires the researcher to define the overall population of interest and develop a sampling frame (LoBiondo-Wood & Haber, 2013). In the sampling frame, a list of the units of a given population is generated. The researcher then uses this to select participants using a "lottery method" or a table of random numbers based on a predefined sample size. For example, a study conducted by Benson et al. (2005) examined whether there was any difference between three methods of sheath removal following a percutaneous coronary intervention procedure: manual compression, mechanical compression with the Compressar, and mechanical compression with the Femostop device. The researchers randomly assigned 90 patients using a random-numbers table to undergo one of three methods of sheath removal. By using a simple randomized sampling technique, the researchers were able to avoid any selection bias.

Systematic random sampling. Systematic sampling is a less time-consuming form of simple random sampling. It uses a list of the population from which individuals or units of individuals are chosen at regular and predetermined intervals, for example, every ninth or "*k*th" person is selected from a list (LoBiondo-Wood & Haber, 2013). Wolf, Miller, and Devine (2003) investigated the relationship between nurse caring and patient satisfaction in patients undergoing invasive cardiac procedures. A systematic random sample of males and females hospitalized for interventional cardiac procedures was selected from a list of all patients as participants in the study. By using this approach, researchers are able to undertake a relatively simple sampling process while avoiding any selection bias. However, the risk of bias is higher when compared to simple random sampling, as the sampling interval can coincide with systematic variations in the sampling frame (LoBiondo-Wood & Haber, 2013).

Stratified random sampling. A stratified random sampling technique involves the researcher splitting the population into subgroups or strata (LoBiondo-Wood & Haber, 2013). It is best used when a sample with specific characteristics such as specific age ranges or area of residence is required. The sampling frame is divided into groups or strata according to these characteristics. Following this, systematic samples of pre-determined size are obtained at random from these strata in order to ensure equal distribution or representation of groups in the sample as compared to the larger population (Warner, 2008). In an earlier cross-sectional study, Dwyer, Williams & Mummery (2007) explored the attitudes of rural nurses towards defibrillation to assist in the development of nurse-initiated defibrillation programs. Rural registered nurses were divided into three distinct strata and a stratified sample of 30% of the full-time registered nurses (n = 436) was drawn from a list of nurses in 51 rural acute care hospitals throughout Australia. By doing this, the researchers were able to sample widely from the overall population of nurses, while maintaining an appropriate sample size.

Cluster sampling. Cluster sampling is most useful when a complete sampling frame is non-existent or when there are logistical issues such as a large geographic area or time constraints (LoBiondo-Wood & Haber, 2013). In health research, the cluster technique involves the selection of a random sample of geographical or organizational units (e.g., hospitals), within which a predetermined number of participants are sampled. Koelewijn-van Loon et al. (2009) employed this method of sampling and examined the effect of involving patients in nurse-led cardiovascular risk management on lifestyle adherence and cardiovascular risk. Stratification divided the Netherland region into four distinct geographic areas from which a total of 615 participants were selected through cluster sampling from 25 practices (13 in the experimental group and 12 in the control group). This method can be useful where there is a large or diverse target population or where resources such as financial support or time may be limited.

Multi-stage sampling. Multi-stage sampling is usually a combination of two or more of the aforementioned sampling strategies. This type of sampling involves the researcher developing sampling units or clusters. These clusters start large and become increasingly smaller. These clusters may be selected using simple of stratified random sampling techniques (LoBiondo-Wood & Haber, 2013). Multi-stage and cluster sampling may be problematic as there is greater risk of a non-representative sample because participants are chosen in strata. This aside, the advantage of using these techniques in combination is that a sampling frame of individual units is not required as clusters are used. From clusters, individual units can then be selected. Furthermore, the sample is easier to select as individual units are together in clusters instead of being scattered throughout the population.

Non-probability sampling. Non-probability sampling methods are those in which elements are chosen through non-random methods for inclusion into a research study. They include convenience sampling, purposive sampling, and snowball sampling. A drawback that exists for these types of sampling methods is that every element is not guaranteed to have a chance for inclusion into the study (LoBiondo-Wood

& Haber, 2013). Further, the research results cannot be generalized to entire populations and, therefore, are often used for pilot studies, as a basis to inform future research. While these methods are most common in qualitative research, they may also be used in quantitative research if the researcher is unable to access the data required to use random sampling techniques (Moule & Goodman, 2013).

Convenience sampling. Convenience sampling involves the selection of participants from a population in a non-random manner, selecting members simply because they are available and accessible (LoBiondo-Wood & Haber, 2013). Although convenient, this method of sampling introduces systematic difference, that is, sampling bias. The differences in sample compared to the actual population characteristics may lead to an under-representation in the sample. However, advantages include the ability to sample from an accessible population and not having to require a complete list of the population elements (Acharya, Prakash, Saxena, & Nigam, 2013). In a study by Zambroski, Moser, Bhat, & Ziegler (2005), a convenience sample of 53 patients with heart failure was recruited to determine (a) symptom prevalence, severity, distress and symptom burden in patients with heart failure; (b) impact of age and gender on symptom prevalence, severity, distress and symptom burden; and (c) impact of symptom prevalence and symptom burden on health-related quality of life (HRQOL). While this approach enabled researchers to capture the experiences of heart failure in a range of patients, there remains the potential for sampling bias if only the most motivated participants took part in the study.

Purposive sampling. Purposive sampling involves the investigation of participants based on the judgment of the researcher. Through this process, a researcher will hand-pick cases based on his/her knowledge and experience in the area (LoBiondo-Wood & Haber, 2013). A related type of sampling is known as theoretical sampling; this is typically associated with grounded theory studies (Charmaz, 2006). This sampling technique may be used to examine specific characteristics of a population (purposive sampling) or to examine areas of interest emerging from the analysis (theoretical sampling) (Coyne, 1997). In a recent grounded theory study conducted by Banner, Miers, Clarke and Albarran (2012), a sample of 30 women was recruited to explore the experience of undergoing coronary artery bypass graft surgery. An initial convenience sample was selected to garner general insights, with theoretical sampling being used to hone in on interesting leads resulting from the analysis and emerging theory. In this study, women's experiences of coronary artery bypass graft surgery were shown to be affected by levels of spousal support, as well as the relative urgency of the cardiac-related procedure. As a result, theoretical sampling was used to further compare and delineate the experiences of those with or without spousal and family support, as well as those receiving urgent and non-urgent surgery.

Snowball sampling. Snowball sampling uses initial identified participants to provide names of other potential participants. The approach is frequently used if the sample is hard to find or access (LoBiondo-Wood & Haber, 2013) and that meet the study participant inclusion criteria. It is a commonly used technique for participant recruitment involving particularly sensitive issues, such as HIV/AIDS (Muhib et al., 2001). Dykes, Rothschild and Hurley (2010), examined medical errors intercepted by critical care nurses. Participants were recruited via e-mail and health care-related listservs. To capture a wider sample, the researchers contacted these initial contacts, or those who managed these systems, and asked them to forward the links to other potential participants in related critical care settings. This can be useful in hard-to-access populations or in situations where recruitment is slow, but can lead to potential selection bias, as participants.

Conclusion

Cardiovascular diseases continue to be a major area of burden in terms of health care resources, economic expenditure, morbidity and mortality (World Health Organization, 2007). There is need for ongoing research to support the development of new knowledge to improve patient care and outcomes. Understanding the potential impact that correct sample selection may have on the generalizability of research results cannot be underestimated. Effective knowledge of sampling techniques permits the nurse to critically evaluate the quality of the research evidence. Moreover, understanding the appropriate use of sampling technique(s) may further enhance the clinical utility and uptake of knowledge in current clinical practice for both health care providers and patients alike. ♥

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