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DESCRIBING POPULATIONS AND SAMPLES IN DOCTORAL STUDENT RESEARCH

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ABSTRACT

Aim/Purpose	The purpose of this article is to present clear definitions of the population structures essential to research, to provide examples of how these structures are described within research, and to propose a basic structure that novice researchers may use to ensure a clearly and completely defined population of interest and sample from which they will collect data.
Background	Novice researchers, especially doctoral students, experience challenges when describing and distinguishing between populations and samples. Clearly defining and describing research structural elements, to include populations and the sample, provides needed scaffolding to doctoral students.
Methodology	The systematic review of 65 empirical research articles and research texts provided peer-reviewed support for presenting consistent population- and sample-related definitions and exemplars.
Contribution	This article provides clear definitions of the population structures essential to research, with examples of how these structures, beginning with the unit of analysis, are described within research. With this defined, we examine the population subsets and what characterizes them. The proposed writing structure provides doctoral students a model for developing the relevant population and sample descriptions in their dissertations and other research.
Findings	The article describes that although many definitions and uses are relatively consistent within the literature, there are epistemological differences between research designs that do not allow for a one-size-fits-all definition for all terms. We provide methods for defining populations and the sample, selecting a sample from the population, and the arguments for and against each of the methods.

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Recommendations for Practitioners	Social science research faculty seek structured ways in which to present key research elements to doctoral students and to provide a model by which they may write the dissertation. The article offers contemporary examples from the peer-reviewed literature to support these aims.
Recommendations for Researchers	Novice researchers may wish to use the recommended framework within this article when developing the relevant section of the dissertation. Doing so provides an itemized checklist of writing descriptions, ensuring a more complete and comprehensive description of the study population and sample.
Impact on Society	The scientific method provides a consistent methodological approach to researching and presenting research. By reemphasizing the definitions and applications of populations and samples in research, and by providing a writing structure that doctoral students may model in their own writing, the article supports doctoral students' growth and development in using the scientific method.
Future Research	Future researchers may wish to further advance novice researcher knowledge in developing models to guide dissertation writing. Future studies may focus on other essential areas of research, including studies about recruitment methods and attrition strategies, data collection procedures, and overall research alignment. Additionally, future researchers may wish to consider evaluating doctoral student foundational knowledge about populations and samples as part of the research process.
Keywords	population of interest, target population, sampling frame, sample, unit of analysis, unit of observation

INTRODUCTION

As novice researchers, doctoral students are new to the processes, procedures, and philosophical principles of developing research. Doctoral students experience challenges including, but not limited to, difficulties in selecting a research topic (Simui et al., 2018), recruiting participants (Marks et al., 2017), developing interview protocols (Wohlfart, 2020), and data analysis (Lewis, 2020). An additional challenge is adequately describing the population and sample of the study. To generalize results, one must be able to infer or transfer those results to the appropriate group. However, the grouping of individuals can be complex and unpredictable, individuals may or may not want to be scrutinized and the characteristics being examined may change from day to day or even from hour to hour (Hammersley & Mairs, 2004). Human characteristics are often hidden from superficial examination, presenting a challenge for the researcher in selecting an appropriate group to study. As such, researchers are challenged with the task of identifying the characteristics of groups to be studied, and then describing the boundaries – the features that determine one's inclusion or exclusion to that group – and doing so in a relevant context (Porzsolt et al., 2019).

The challenge of defining and describing populations and samples becomes even more confusing to novice researchers. The purpose of this article is to present clear definitions of the population structures essential to research, to provide examples of how these structures are described within the literature, and to propose a basic structure that novice researchers may use to ensure they have clearly and completely defined the population they wish to study and the sample from which they will gather data. In this article, we begin with the fundamental building block of any population: the unit of analysis. With this defined, we examine the population subsets and what characterizes them. We then examine methods for selecting a sample from the population and the arguments for and against each of the methods. Finally, we propose a fundamental outline to aid novice researchers in developing and describing the individuals, groups, or organizations being studied. We use Bakibinga et al.'s (2019) research of slums across four countries to illustrate the approaches used to describe various populations and sampling methods discussed within this paper.

UNIT OF ANALYSIS

Social sciences often explore individual characteristics, such as psychological constructs, perceptions, and behaviors. Derived from the appropriate theoretical framework or model, the data operationalize those constructs, perceptions, and behaviors, as measured by instruments or via symbol-based means. The data are then used to describe the unit of analysis, which in social sciences is often the individual. Throughout a given research process, the unit of analysis – the individual – is the entity being examined and ultimately analyzed to provide a conclusion that explains the outcome and addresses the research problem. The individual described or measured by the study variables represents the unit of analysis (Salkind, 2010). More specifically, the *unit of analysis* is the entity described by the data collected and about which the analysis is conducted. It is what the data are about for the purpose of addressing the research problem and defines the boundaries of what is examined or ignored within the study (Ritella et al., 2020). The importance of clearly understanding and defining the unit of analysis cannot be overstated. The unit of analysis has been written about as the "most important part of any research…as the whole research is based upon the unit of analysis" (Khan, 2014, p. 228), and as the "key to developing concepts, empirically measuring or observing concepts, and using data analysis" (Neuman, 2013, p. 69).

For example, one may examine how student characteristics – whether student performance (e.g., grades, test scores), individual constructs (e.g., self-efficacy, personality traits, motivation), or behaviors (e.g., responses to stimuli, disruptive conduct) – may compare from one environment to the next. In such cases, the measures apply to the individual student, and the results are applied to individuals. The individual student is the unit of analysis with all data describing the individual student characteristics. It should also be no surprise that the theoretical frameworks supporting these types of investigations are oriented toward individual characteristics (e.g., Bandura's [1977] social learning theory, McCrae and Costa's [2003] five-factor theory of personality traits, and Deci and Ryan's [2008] self-determination theory).

In contrast, if one is comparing organizational cultures between different companies, one would aggregate the measures from throughout each company, and then compare the composite measures between organizations (Kumar, 2018). One would examine the entirety of organizational behaviors when examining activities, such as mergers and acquisitions. In this case, the organization is the unit of analysis with the data describing characteristics of the organization, which is then used in the analysis. Consequently, the results describe organizational differences or relationships. The theoretical framework from which the variables are developed for such a study are oriented toward organizational characteristics (e.g., transaction cost economics [Coase, 1937], and organizational commitment theory [Meyer & Allen, 1997]). Regardless of what constitutes the unit of analysis, whether using dyads (e.g., father-child relationships [Kenny et al., 2006]), schools, or politically bounded units (e.g., municipalities, county, state, providence, or national governments), the data are collected, and the study variables apply to the entity being examined. Consequently, the results are then applicable to the broader population of the same units of analysis (Campbell, 1986).

In qualitative designs, the data are collected to explore the unit of analysis, which may be a phenomenon, lived experience (Dieumegard et al., 2019), case, individual, or group (Yin, 2014), depending upon the nature of the research design and of the research problem. Although one must allow for researcher flexibility in determining the unit of analysis based upon the research problem, there are some examples from the literature modeling the use of units of analysis within qualitative research. Recalling that the unit of analysis is the unit about which data are collected, Colorafi and Evans (2016) describe the data as being applied toward understanding the phenomenon of interest, while Magilvy and Thomas (2009) describe the data analysis for making sense and understanding the phenomenon of the study. In each case, the phenomenon is what the data are about within these descriptions of qualitative descriptive research designs.

Within case study research, the unit of analysis is regularly described as the case with the phenomenon occurring within the bounded context of the case (Baxter & Jack, 2008). Case studies may examine individuals, groups, processes, events, decisions, programs, or any other phenomena that are encased by temporal and spatial boundaries (Yin, 2014). The boundaries of the case place necessary restrictions on what data will be collected and the context in which the data will be analyzed to prevent too broad of an analysis and too unwieldy a research project. Based upon the working definition that the unit of analysis is what the data are about, the case certainly qualifies to be characterized as the unit of analysis. It is worthy of note that not all authors agree that the case is the unit of analysis, instead further defining the unit of analysis as being embedded within the case layers as to be the event of interest or phenomenon about which the case is centered, with the potential for multiple units of analysis within an embedded case design (Grünbaum, 2007).

Giorgi (2006) describes the theme, or central focus, of the descriptive phenomenological investigation as *the object* – the event that is taken up by the experiencer, which may also be described as the lived experience (Dieumegard et al., 2019). Within ethnographic studies, the unit of analysis is regularly defined as the ethnos, a description of the nation, tribe, or people (Erickson, 1984). Erickson goes on to argue that the ethnos may extend to any social network, necessitating a clear definition of the network's boundaries, just as one must describe the limitations of the nation, tribe, or group of people being studied. Within narrative research design, the discrete story is the unit of analysis, in which it is data that describe the sequence and consequence of events that are analyzed and shared with the reader (Riessman & Quinney, 2005). Grounded theory research design is used to explore the process, action, or interaction between many individuals in which the process, action, or interaction is the unit of analysis (Khan, 2014). Regardless of the research design, the definition of the unit of analysis must be clearly delineated so the researcher and participants understand who or what is included within the unit and who or what is excluded from the unit to understand what the research problem is addressing.

SLUMS EXAMPLE

Bakibinga et al. (2019) provides an excellent example of population and sample descriptions within the research, beginning with a description of the unit of analysis. In preparation of a quantitative study, Bakibinga et al. identify the need to collect data about the residents of slums across the globe and set about describing the process by which this was achieved. A first order of business was precisely describing the unit of analysis, which was the household within the slum. The research problem dictated the data were to be collected about the individual household and the analyses were to draw conclusions about the households within slums. The authors then defined what constitutes the unit of analysis, the household, which was described as the residents of a residential dwelling within a slum, as identified by the head of household's name.

From the examples provided, it is clear that identifying and describing the unit of analysis is one of the first steps of any research study. Together with clearly defined variables or phenomena of interest, the unit of analysis helps build the foundation for ensuring the selection of a sample most representative of the population of interest to adequately address the research problem. Since the unit of analysis is the entity about which all variables apply and the entity that is described by the data collected, we must also consider the source of the data collected.

UNIT OF OBSERVATION

While the unit of analysis is the entity about which the data are reported, the unit of observation is the entity that is the source of data about the unit of analysis. The unit of observation may include the participant, who is self-reporting, in which case the unit of observation and unit of analysis are the same (Kumar, 2018). However, these are not always the circumstances. The unit of observation may include a parent who provides data about their child (unit of analysis), an employee (unit of observation) reporting characteristics of a manager (unit of analysis), a primary instrument, such as standardized assessments (e.g., SAT scores, state-level assessments), instrument-measured events (e.g., blood pressure, eye movement tracking), or financial reports, recording and reporting physical measurements about the unit of analysis.

Our experiences are that doctoral students sometimes incorrectly list a self-report instrument as the unit of observation. The self-report instrument is the tool that aggregates the subdata (e.g., responses to each item on the instrument) and calculates the construct based upon the perceptions, judgments, and measures made by the individual. As such, the judgement, or measure, is provided by the participant, which is the unit of observation reporting via the instrument about the unit of analysis, the entity about which the data are collected. In this case, the participant is both the unit of observation and unit of analysis.

POPULATION OF INTEREST

The population of interest for the study is comprised of the individuals, dyads, groups, organizations, or other entities one seeks to understand and to whom or to which the study results may be generalized or transferred and is the principal group about which the research is concerned. Populations create boundaries for the scope of a study and provide environmental and context cues for the reader. Such boundaries place natural delimitations upon the research to afford the researcher the proper focus so as not to present a one-size-fits-all set of results. The definition of boundaries also allows the researcher to clearly identify subpopulations, such as the target population, sampling frame, and sample, and to ensure alignment between these groups within the research (Salkind, 2010).

Clear definitions of boundaries and other considerations are essential to describing each respective group. It is incumbent upon the researchers to define the boundaries used in their study to avoid compelling the reader to assume a definition; otherwise, the incorrect definition – and, therefore, the incorrect population – may be presumed by the reader. Additionally, boundaries described by social or political constructs may vary by geographical area (Bakibinga et al., 2019) or by researcher or theoretical perspective. Such populations may be heterogeneous, requiring further identification and description of the population to be studied. Needless to say, a rich and thorough description of each group to be studied is required. Defining the population of interest provides context for who may be characterized by and interested in the results of the study. Providing a rich description of the population of interest allows the community of readers and practitioners to associate the research with the appropriate entities, whether they are people or organizations. The overall results are that the population becomes better informed about itself.

Boundaries for the population of interest may include geography, race/ethnicity, age, gender, sexual orientation, marital status, education, income, household composition, occupation, business sector, number of employees, school district, dyadic relationship type, government-defined, and so forth (Sudman, 1976). The boundaries are developed such that the variables or experience of interest are operationalized within those boundaries. To operationalize the boundaries for the population of interest, one should choose characteristics that are easily identifiable or recognizable and that are associated with the variables or experiences of interest. Doing so may include some individuals or entities who do not exhibit the characteristics in which one is interested and may exclude others who do exhibit those characteristics, but, in general, the population represents the individuals to whom the results apply and matter.

It is easy to swing the pendulum too far to one side when describing the population. Caution is recommended to avoid over-defining the population of interest, as it (often unnecessarily) restricts the applicability of the study and the ability to obtain a sample, actions that increase the time required to complete the study, as well as the costs to do so. When examining general psychological constructs, such as personality traits, selecting, describing, and examining broad populations seem naturally appropriate, such as Soto and John (2017), whose updated Big Five Inventory (BFI-2) was tested ($N = 1{,}137$) to measure personality traits and facets for Western, English-speaking adults.

However, for studies of narrower focus, such as Ojala et al. (2014), a study conducted using a phenomenological method to study of the effects of chronic pain upon the whole person ($N = 34$), the population of interest is reduced somewhat. Although the study was conducted in Finland, the general results from the patients' experience of the phenomenon are transferrable to an international audience of chronic pain sufferers, which was the population of interest.

Slums Example Continued

When examining individuals living in slums, Bakibinga et al. (2019) defined the boundaries of the population of interest within the first paragraph of their article to illustrate the households and conditions examined by the research. The description of the population of interest began with a definition of the boundaries, which in the article's case included defining the conditions of a slum, as well as factors that assist in identifying those who live in slums. By quickly and thoroughly identifying the population of interest, the reader is aware of who is affected by the study's outcome and which groups may be interested in the results of such research. The description provides a clear delineation of what entities are included within the population of interest and which entities are not. The authors also leverage these descriptions as they continue describing the target population.

Target Population

The target population is the specific, conceptually bounded group of potential participants to whom the researcher may have access that represents the nature of the population of interest. To be successful in defining the target population, one must examine all the boundary considerations in an iterative manner to ensure that the end description of the target population is inclusive enough to provide sufficient data to the study. The target population must also be exclusive enough to avoid having participants who do not represent the study's needs, which will misrepresent the population of interest. Much like the population of interest, the boundaries of the target population must be defined such that the researcher and other stakeholders understand the nature and extent of the group to be studied. Such considerations are important not only for ensuring the efficacy of the research, but also assist in budgeting resources for investigating the research problem. A well-defined target population describes inclusion and/or exclusion criteria for who or for which entities may participate in the study. The target population must be a complete subset of the population of interest – members of the target population must also be described by the boundaries of the population of interest. Additionally, the target population is further restricted such that the researcher may clearly operationalize the boundaries for participation (Kalleberg et al., 1990). It is from the target population that the sampling frame is developed.

To determine the target population, one must operationalize the unit's characteristics of interest based upon the study variables or the qualitative experience so the results of the study may be accurately inferred or transferred back to the population of interest (Ackerman et al., 2019). Operationalizing the characteristics also benefits both the researcher and potential participants so they may recognize each participant's eligibility for the study. Very often the initial characteristics are relatively easy to apply, and this description gives the researcher insight into the target population and the population of interest, as a whole. However, more detail is required to fully define and operationalize the boundaries for the target population.

A critical step in operationalizing the criteria is clearly defining the key terms and ensuring the defining words are unambiguous. For example, Gross et al. (2018), who examined approaches to mental health and sport performance in female collegiate athletes, were very clear on the boundaries for inclusion within the study. The authors clearly defined and limited participation to current National Collegiate Athletic Association Division III female athletes.

Additionally, the target population must incorporate an additional set of boundaries that include time and space to anchor and identify the group of individuals who will be asked to participate in the study. The temporal element restricts the timeframe that the participants have exhibited the operationalized inclusion variables – many professional athletes were once collegiate athletes but should not be included in the Gross et al. (2018) example. A difference that distinguishes the two is time. By stating that the potential participant must *currently be* a member of intercollegiate athletic squad, one establishes the time-based restriction that is necessary to operationalize the sampling frame boundaries. The temporal framing also eliminates individuals who are still in college but no longer play for an intercollegiate team, and who are not currently experiencing the phenomenon being examined.

The spatial boundary is often a matter of research logistics. Although it would seem desirable to create a target population that includes all female intercollegiate athletes across the nation's universities, it is not logistically practical to do so. One must place spatial restrictions on the target population to accommodate responsible research. The restrictions often take the form of geographical descriptions, such as within the United States, Australia, or United Kingdom, within a specific pre-defined sports conference, or more narrowly, at a specific university, as was the case with Gross et al. (2018). The spatial boundary of the target population may be as narrow as is necessary provided that the units of analysis within those boundaries are *representative* of the population of interest and are not unique as compared to the population of interest, and there are sufficient members of the target population to ensure a suitably sized sample frame can be developed.

Slums Example Continued

Bakibinga et al. (2019) narrowed the research for collecting data from slum residents by operationalizing the boundaries for the study. A difficulty identified by the researchers for identifying a target population was that slum sites are often within complicated urban areas and lack official definition, recognition, or boundaries, which makes operationalizing the target population difficult. This obstacle was overcome by utilizing seven preidentified slum sites in four countries – Nigeria, Kenya, Pakistan, and Bangladesh – for which boundaries had been clearly established. The use of these slum sites allowed the researchers to be reasonably assured that the residents within these areas met the predefined criterion of residing in a slum, and with that requisite characteristic, those residents were reasonably believed to exhibit the features being examined within the study (i.e., inadequate housing, lack of basic services, at-risk for disease, and so forth). To collect data from the target population, the researchers developed a sampling frame.

Sampling Frame

The sampling frame is an operationalized representation of the target population and is the group of units from which the sample is recruited. It is the precise group of units – often individuals – that will be solicited for their participation in the study. Sampling frames may be organized using telephone numbers, names of persons, physical addresses, email addresses, social media groups, organizational lists, or geographical units (Kölln et al., 2019). The nature of the sampling frame is directly related to the sampling method, as the sampling frame is the operationalized structure through which the sample is recruited (Prandner & Weichbold, 2019).

Although not desired, it is possible that the sampling frame may extend beyond the boundaries of the target population and the population of interest, as units that potentially do not meet the inclusion/exclusion criteria may errantly be included. For example, if a human resources department sends an email participation request to all line employees, it is possible for non-line employees to be included in the list (e.g., recent promotions, furloughed employees). Such differences between the sampling frame and the target population (and population of interest) may account for outliers within the data (Tabachnick & Fidell, 2018). Because the characteristics of natural groups tend to exhibit normal distributions, data points outside of the normal distribution may be indicative of a participant who is distinctly different than the natural group. To mitigate the issue of non-qualified units of analysis participating in the study, one must clearly define the sampling frame from which the sample is selected.

A critical characteristic of the sampling frame is that it must include a sufficient number of units that will support the collection of a complete data set. If the sampling frame is not large enough, the researcher runs the risk of not obtaining sufficient data, resulting in imprecise measures of effect size for quantitative studies (Hackshaw, 2008) or not reaching data saturation for qualitative studies (Fusch & Ness, 2015). The size of the sampling frame is a function of the minimum a priori sample size and the anticipated participation rate.

$$N_{sf} = \frac{N_{min}}{r_{part}}$$

Where,

N_{sf} - minimum sampling frame size

N_{min} - minimum a priori sample size

r_{part} - participation rate

The first parameter to determine is the minimum sample size, the description and calculation of which are detailed in the next section. A common way to determine the minimum sample size for a quantitative study is using an a priori power analysis based upon the study parameters and the anticipated statistical test. The second parameter is the estimated participation rate. The most accurate way to determine the participation rate is to examine the literature of similar studies that use similar sampling methods as what is proposed. Participation rates vary greatly with general internet advertising yielding potentially very low rates of less than 1% (Casteel, 2016) to recruitment amongst affiliated organizations occasionally yielding very strong participation rates, such as 79% rates experienced in hospital-based research (Bochud et al., 2017). If the literature reports a wide range of participation rates and one is not able to determine the circumstances that are most aligned with the research, a recommendation is to underestimate the participation rate and to use the lowest reported rate. In the absence of any reported participation rates, based on our personal research experience, a guideline for general recruitment methods is to expect a 5% to 10% participation rate from the sampling frame.

By way of example, a calculation to determine the minimum sampling frame size requirements for a study examining the extent to which household turnover rates differ between slum sites. The parameter of minimum sample size, as determined by a priori power analysis and extended to accommodate outliers and the potential for non-parametric testing, is 148 households. Using an expected participation rate of 5%, the sampling frame size calculation becomes:

Sampling frame size = 148/.05 = 2,960 households

The calculation means that within the fully described boundaries of the sampling frame, there should be a minimum of 2,960 eligible potential households meeting the criteria of being located within a designated slum site, the residents meet the criteria outlined within the description of the target population, and there is a means by which the researcher may contact the potential participant, to include door-to-door solicitation. There is a great deal to consider when developing and describing the sampling frame. However, the benefit is the time and effort invested into examining and considering all the elements of sampling frame development will inevitably be rewarded with a well-defined data set that is appropriate and complete.

Based upon these considerations, the description of the sampling frame should include the operationalized boundaries of the group, incorporating how the prospective participants are listed, and a description of how the sampling frame aligns with the sampling method. One must clearly describe the size of the sampling frame and demonstrate that the sample recruited from the sampling frame will meet the study data collection requirements.

Slums Example Continued

Because the operational nature of the slum settings was unclear, the sampling frame was developed by creating a detailed map of all structures in conjunction with a listing of all known households within the conceptual boundaries defined by the target population (Bakibinga et al., 2019). Critical to forming the sampling frame was working in cooperation with local authorities and community groups within the slum sites to accurately identify the legitimate, operational boundaries of the sampling frame so that these physical boundaries could be mapped. The initial drafts of the maps were then validated by research assistants, who compared satellite-mapped features with on-ground observations. This laborious process was repeated throughout all the study sites to create an accurate, operational map of slum households. Once all structures identified as households were physically identified and verified via map and visual survey, the development of the sampling frame was complete.

Sampling Methods

The approach one uses to obtain the members of the sample is the sampling method. The sample is recruited from the sampling frame in one of two general ways: probability sampling and nonprobability sampling. Common methods used to obtain probability and nonprobability samples are outlined below.

Probability Sampling

Probability sampling describes methods used to develop the sample based upon known probabilities, allowing one to make inferences about the population of interest following analysis (Sudman, 1976). Probability sampling is used primarily for quantitative research. Because the sample is developed at random, the nature of the sample is that it has a probabilistic representation of the population of interest in which each member of the population has an equal chance of selection (Etikan & Bala, 2017). Below are some of the predominant probability sampling methods used in dissertation research.

Simple random sample

The simple random sample method is akin to pulling names out of a hat to develop the sample. However, there are two types of simple random sampling one may use. The first is *sampling with replacement*. Sampling with replacement is characterized by selecting the unit, recording its characteristics of interest, and then placing the unit back in the pool where it is potentially able to be selected in the future. Sampling with replacement maintains the probability of any unit being selected equally throughout the selection process, at $1/N$. One would draw n times to obtain the sample characteristics.

In social sciences, one does not often want to replace the unit back in the target population because the purpose is to research each unit in more detail, which may include applying a condition or treatment to the unit. If one selects a specific participant twice, it is difficult in practice to include it in the sample. In fact, doing so would violate many parametric statistical tests due to the assumption of independence of observations (Tabachnick & Fidell, 2018). In lieu of sampling with replacement, one would employ *sampling without replacement*. Sampling without replacement begins with the same scenario as before; there are N units in the sampling frame and a sample of n is required. The first participant has a $1/N$ chance of being selected. This individual's characteristics are recorded; however, the individual is no longer eligible for further participation. The probability of an individual being selected next is $1/(N\text{-}1)$ because the sampling frame was reduced by one member, which has been set aside. The chance of any one individual being selected during the third drawing is $1/(N\text{-}2)$, because the other two individuals are set aside as part of the sample. Once the sample size of n is drawn, the sampling is concluded. The sample has n units and the remaining sampling frame has $N - n$ units.

Practically speaking, selection of random participants is accomplished via random number generator. Using a random number generator, each name is associated with a value. The values and names are then sorted using the values and the first n names on the sorted list become the random sample.

Systematic sampling

Another method to probabilistically select the sample is systematic sampling. Using this method, one determines the sample size, n, and the sampling frame, N. Using an ordered list, such as names in a directory or email addresses in a listserv, one divides the sampling frame into groups of k participants, where $k = N/n$. Selecting a random number between 1 and k identifies the first selection of the sample, then every kth unit on the list becomes a part of the sample. For example, if $N = 200$ and $n = 20$, then $k = 200/20 = 10$, meaning that there are 20 groups of $k = 10$ members each. Selecting a random integer between 1 and k, where $k = 10$, may yield a value of 7. The 7th name on the list becomes the first member of the sample. The second selection is $7 + k$, or number 17 on the list. One continues down the list from 7, 17, 27, 37, …, 197, in which the sample has $n = 20$ members.

Systematic sampling is also employed in group selection for experimental research. For example, to form four separate experimental condition groups, the members are listed, and then every fourth member goes to the same group.

Stratified sampling

When the sampling frame has two or more groups of interests, or strata, then stratified sampling assists in ensuring that each group of interest is proportionally represented (Sudman, 1976). One first determines the proportion of each group of interest within the sampling frame. For example, at an undergraduate university, first-year students may represent 33% of the undergraduate student population, sophomores 28% of the undergraduate population, juniors may be 22%, and seniors may represent 17% of the population. Because the first-year students outnumber the graduating seniors nearly 2:1, it is appropriate that any sample of undergraduate students include nearly twice as many first-year students as seniors. This may occur if one used simple random sampling; however, the researcher can ensure the proportions are met using stratified sampling.

In stratified sampling the proportions are determined, and then simple random sampling occurs within each stratum until the proportionate sub-sample size is reached. The simple random sampling within each stratum allows for probabilistic representation of other (secondary) characteristics that may not be of interest to the study, while the stratified sampling ensures a probabilistic representation for undergraduate class, which is a characteristic of interest for the study. For a study seeking a sample of 200 undergraduate students and using the undergraduate proportions stated above, one multiplies the total sample size, N, by the proportion to determine the subsample size. For first-year students, $n_1 = .33(200) = 66$.

Cluster sampling

When a sampling frame is large and diverse, it may at times be economically advantageous to administer cluster sampling. Cluster sampling occurs when one divides the sampling frame into natural clusters, which are most often geographically bounded areas. Instead of attempting to conduct a simple random sample of a large, spread out city like Phoenix, Arizona, one might instead divide the city into clusters, such as by postal zip code. If one selects a random set of postal zip codes to study, one will be able to use the data within each cluster (zip code) to probabilistically infer information about the entire city of Phoenix. Phoenix has 47 postal zip codes that cover the city's 1.45 million inhabitants. One could select eight of the postal zip codes at random. The households within each of the eight selected postal zip codes are part of the sample. One should note that cluster sampling is often used to collect large volumes of data and is often used in marketing research, as well as community-based research.

NON-PROBABILITY SAMPLING

Some populations can be hidden from plain sight and do not allow for probability or random sampling. Instead, non-probability sampling is more suited to addressing these populations (Bacher et al., 2019). Such groups may include ethnic groups, sexual minorities, stigmatized populations, substance abusers, mobile populations, and others that do not readily identify themselves or that do not present themselves as distinct or organized populations. To investigate these populations, non-probability sampling methods are more practical for finding and collecting data to complete research. The benefit of these sampling methods is that they afford access to the necessary groups of people; but this access is not without shortcomings, as the results of studies that utilize non-probability sampling methods are not generalizable to the broader population of interest. For example, those who choose to participate may differ in important ways from those who choose not to participate, providing an imbalanced or biased view of the population of interest (Kitchenham & Pfleeger, 2002).

Convenience sampling

Convenience sampling is characterized by selecting participants based upon their proximity to the researcher in which the researcher recruits from an opportune sampling frame. An issue arising from the use of convenience sampling is that the sample rarely represents the population of interest, as it does not offer the randomness and diversity that exists within the population of interest. Convenience samples often are from the same geographic region, share similar socioeconomic characteristics, and regularly have similar racial or ethnic backgrounds (Emerson, 2015). As such, the results and conclusions derived from the analysis of a convenience sample may not be generalizable. However, there are some arguments for limited generalizability based upon the concept of *proximal similarity* in which the results are generalizable to a broader audience to the extent that population exhibits similar characteristics to the sample (Campbell, 1986). A common example of convenience sampling is the undergraduate class that provides data for their professor. Although such a population makes the data collection convenient to the researcher, it is not always beneficial to the scientific community. Meta-analyses examining the differences between college students and nonstudents in research reveal some stark contrasts in the effects that are reported, both in magnitude and direction, suggesting that college students are not representative of the adult population as a whole (Peterson, 2001), demonstrating an obvious weakness of convenience sampling.

Volunteer sampling

Volunteer sampling seeks out participants for a study based upon the participant's self-selection to provide data. Unlike convenience sampling in which the localized sampling frame is proactively recruited by the researcher for participation, volunteer sampling occurs when the individual comes across the opportunity to participate in the research and opts into the study (Fricker, 2016). The characteristic of opting-in to a study is unique to volunteer sampling, as the participant chooses themselves to provide data, often based upon an open advertisement or broad-based solicitation for participants. All other sampling methods select the participant to participate, and then the participant can opt-out of the study either by non-response to the participation offer or by non-participation in part or in whole once included in the study. Volunteer sampling is associated with self-selection bias, which is a threat to the external validity of the study.

Snowball sampling

Also known as chain sampling, chain-referral sampling, or network sampling, snowball sampling describes the non-probability sampling method of study participants recruiting future subjects from amongst those within their sphere of influence (Sharma, 2017). Snowball sampling is effective at reaching populations that are hard-to-reach or hard-to-ask, allowing members of the hidden population to conduct the recruiting on the researcher's behalf. Snowball sampling is accomplished by the identification of one or more individuals that represent the population of interest. These individuals are then asked to seek participation from others that are like them. The snowball (or chain) continues as the second-generation participant recruits a third tier of participants meeting the criteria, and so forth until data collection is complete. There are, however, challenges with snowball sampling. Individuals who are a part of a hidden population may not be comfortable openly discussing the topic they are keeping hidden. There is risk to the individual should the topic of study be associated with their identity, such that the individual may not participate. Researchers may find it difficult to gather data from individuals who have been referred due to a lack of relationship with or lack of relatability to the potential participant (Waters, 2015). As with other non-probability samples, the results obtained from snowball sampling are not generalizable to the population of interest due to threats to external validity. When considering snowball sampling, one must examine the reason for its use and weigh the risks and challenges that one should expect with its implementation.

Purposive sampling

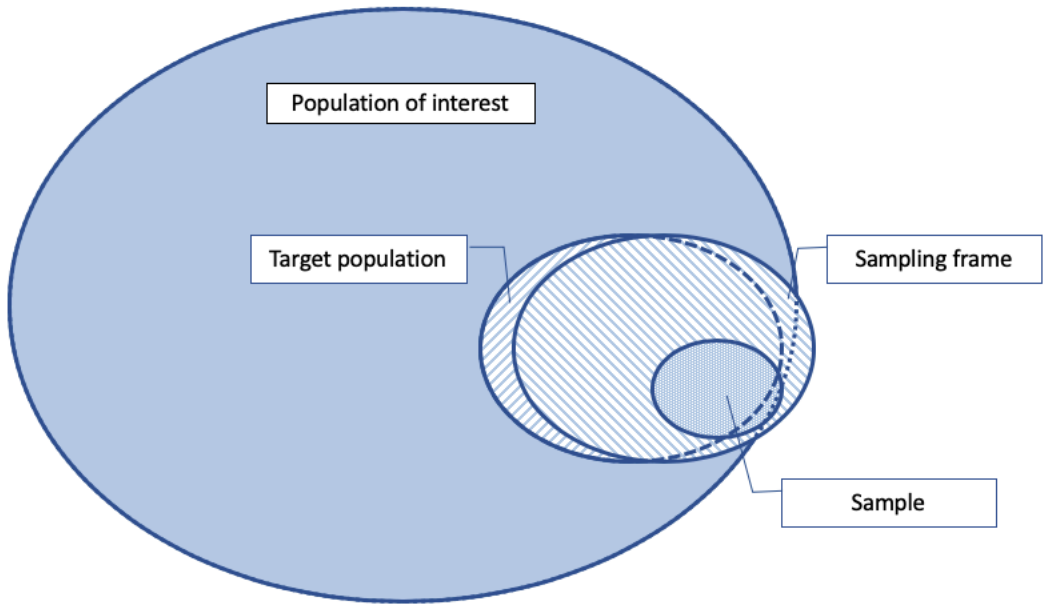
Also known as judgement sampling, purposive sampling is the intentional selection of a participant because of the characteristics and qualities the individual possesses (Etikan et al., 2016). The criteria for selecting the individual may vary, including seeking a specific narrative to explore, a common experience with a phenomenon, membership in a culture, or being in position to assist in developing a theory (Creswell, 2013). The common denominator is that each individual is selected because that individual is known to have a specific quality that is of interest to the investigator. Due to the nature of the sampling method, purposive sampling is most often seen within qualitative research designs (Patton, 2015). It bears repeating that purposive sampling methods do not contribute to generalizing results to the population of interest.

Slums Example Continued

Because of the desire for study results to generalize to the population of interest, Bakibinga et al. (2019) selected a probability sampling method to remove bias. An initial consideration was to use a random geometrically based sample; however, such an approach would have resulted in uneven spatial coverage – an important consideration in the study. In lieu of the random geometric approach, an inhibitory sampling method was used. Inhibitory sampling is an approach in which locations are selected at random, subject to specific spatial constraints allowing for households in densely populated areas to be adequately represented in the data collection. Initial households were selected at random, and then a constraint was placed on subsequently selected households; namely, the next household selected could not be within a selected distance of the first household. An additional constraint was added to the inhibitory design to accommodate density packing. The new constraint required the inclusion of a close pair – a second household within a short distance of the first – to augment the data collection and to account for factors within the slum due to location density. The selected method afforded the researchers to use a probability sample that did not bias against densely populated areas while favoring isolated households, resulting in maximizing spatial variation between subject households.

Sample

The sample is the set of units selected to represent the population of interest (Gravetter & Wallnau, 2017). The data provided about the sample will be analyzed and the results inferred (quantitative) or transferred (qualitative) to the population of interest. The sample should be representative of that population of interest, a requirement addressed by prescribing the correct sampling frame and by using an appropriate sampling method. When selecting a sample, there are two primary considerations: how many units must be in the sample (sample size) and how will these units be selected (sampling methods). Figure 1 depicts how a researcher identifies a sample from the population of interest and the target population within the sampling frame.



Note. In the two center ellipses, the target population is depicted by right to left diagonal lines and the sampling frame is depicted by left to right diagonal lines. The sampling frame intersects the target population. The sample and sampling frame described extends outside of the target population and population of interest as occasionally the sampling frame may include individuals not qualified for the study.

Figure 1. The relationship between populations within research

Sample Size for Quantitative Designs

One of the most challenging aspects of research – particularly dissertation research – is obtaining enough data to conduct an appropriate data analysis. In quantitative research, there are two primary approaches for determining the appropriate sample size.

The first and most common approach in hypothesis testing is using an a priori power analysis to determine the minimum required sample size. The purpose of an a priori power analysis is for the researcher to determine in advance the minimum sample size required to provide sufficient statistical power to the analysis based upon anticipated or predetermined parameters, including the ability to measure a desired effect size with statistical significance.

Once the minimum sample size is determined, it must be described within the research document. As a general guideline, the description should include the parameters used to calculate the sample size and a statement of the minimum sample size. It is highly recommended to label the number with the appropriate unit of analysis. As an example,

> The minimum sample size was calculated using a priori power analysis for an independent-measures *t*-test (two tails). Based upon an estimated medium effect ($d = .50$), level of significance of .05, and a minimum power of .80 with evenly sized groups ($N2/N1 = 1$), the minimum sample size is 128 individual licensed practitioners, with a minimum of 64 in each group.

The minimum sample size calculation states that if you have exactly the predetermined number of participants (e.g., $N = 128$), and if those participants were split equally into two groups ($n_1 = 64$, $n_2 = 64$), and if the effect size is exactly as predicted (e.g., $d = .50$), then the statistical power of the comparison is .80. However, the likelihood of this occurring is very low, not because of poor planning – the calculations are correct – but because real recruiting and data collection, and real effect sizes rarely work out so perfectly. A good rule of thumb is to seek a minimum sample size that is at least

15% greater than the calculated minimum sample size from the a priori power analysis. Using the previous example, this means the sample size of 128 becomes 148 (128 * 1.15 = 147.2, round up to the nearest whole number). Recruiting to this sample size accommodates two primary considerations:

1. Data often include outliers, which may be removed to conform to parametric analysis assumptions, thus reducing the effective sample size. Outlier data may also be transformed to conform to the data as a preferred alternative to removing data (Tabachnick & Fidell, 2018). If one were to have collected the exact-calculated minimum sample size and outliers occur and are removed, one begins the analysis with a statistical power deficit due to a smaller-than-anticipated sample size.
2. The data may be non-parametric, requiring the use of a non-parametric analysis. In the case where the data violate one or more of the assumptions for the selected parametric test, the use of the non-parametric alternative may be required. Because non-parametric tests are based upon rank ordering rather than distributions and the associated probability functions, a larger sample size is required to achieve the same statistical power as its parametric counterpart. A sample size that is 15% greater than the calculation for the parametric a priori power analysis provides the equivalent statistical power for the associated non-parametric test (Lehmann, 1973). For example, the minimum sample size based upon the power analysis for an independent measures *t*-test (two tails) may be $N = 128$ with a power of .80, and a Mann-Whitney *U* test requires $N = 148$ to achieve the same power of .80 (min relative efficiency), provided all other parameters are equal (e.g., level of significance, effect size).

The second method of determining sample size is mostly used within quantitative descriptive designs in which one is interested in describing the characteristics of the population of interest and when representing all members of that group are a priority. This second method uses confidence level calculations, which provides the minimum sample size one must recruit to meet the desired statistical constraints; namely, the sample represents the characteristics of interest for the entire population of interest.

A confidence level describes the extent to which the selected sample probabilistically represents the population of interest. Naturally, the higher the confidence level, the higher the probability the sample is representative of that population. Of course, the limitation on sampling at a higher confidence level is that it requires a larger sample size, which imposes restrictions upon one's resources (e.g., finances, time, people). Regardless of the approach – unless sampling the entire population of interest, such as the U.S. Census – there will be errors due to the probabilistic nature of the sampling. The errors associated with the variation between samples due to chance are called *sampling error*. The smaller the sampling error, the less variation between random samples from the same population of interest. However, to achieve smaller sampling errors, one must increase the sample size from the population of interest (Cohen, 2013). The margin of error is the maximum expected error based upon the level of confidence.

To calculate the sample size based upon confidence levels, one may use the following equation:

$$N = \frac{z^2 \times \hat{p}(1 - \hat{p})}{\varepsilon^2}$$

where,

Confidence level desired (z) – The probability, as expressed by the z-score, the selected sample represents the population of interest

Margin of error (ε) – The variation between samples selected from the same population of interest, a percentage expressed as a probability (e.g., $\varepsilon = .05$).

Population of interest size (*N*) – The measured or estimated size of the population of interest

Population proportion ($\hat{p}$) – The percentage of a population that has a characteristic of interest. In most cases of research – particularly preliminary research – this value is unknown. In these cases, it is appropriate to use a population proportion of .5 ($\hat{p}$ = .5).

SAMPLE SIZE FOR QUALITATIVE DESIGNS

A fundamental difference between quantitative and qualitative designs is the type of data that are collected. Quantitative designs rely upon numerical data that allow one to conduct statistical tests to compare groups or examine relationships between variables. As a result, large samples are required to provide sufficient data. The nature of qualitative designs is distinctly different, which affects the size of the sample. Using non-numerical forms of data, the requirements for sample size are also less numerically based.

A note of caution before beginning

Prior to launching an extended discussion of determining recommendations for an a priori sample size, we acknowledge that determining an a priori sample size is not well-aligned with the inductive nature of qualitative methodology (Blaikie, 2018). There have been numerous discussions on the topic, which are summarized by Sim et al. (2018), who identified four general approaches for determining qualitative a priori sample sizes and arguments against doing so. These approaches include rules of thumb, conceptual models based upon the study characteristics, numerical guidelines as developed from similar research, and statistical approaches. Regardless of the approach, it is well-accepted that the real sample size cannot be predetermined; rather, the sample size is dependent upon the nature of the research and the adaptive needs to the emerging themes. The true nature of qualitative methodology requires the researcher to continue to collect data until the research problem has been addressed. This imperative often requires an iterative approach to data collection, which may require including new participants in the study. Most certainly, inductive research does not provide for a stopping point in collecting data simply based upon reaching a predetermined number of participants. Although the intention of the guidelines presented herein are to provide a numerical starting point and expectation for participant recruitment in qualitative research, the imperative answer from the literature of how many participants a study requires is, "It depends" (Sim et al., 2018, p. 620). With this in mind, the following is presented to provide some numerical guidance to novice researchers of the sample sizes one may expect when conducting research using qualitative designs and is based primarily upon a conceptual models approach (Sim et al., 2018) to satisfy the need to achieve data saturation (Fusch & Ness, 2015).

The sample size for qualitative research is the number of participants required to address the research problem. That is, when enough thick and rich data have been collected so the ability to obtain additional new information is no longer present and when further coding does not present new codes or lead to new themes, the data collection should terminate (Fusch & Ness, 2015). The decision to terminate data collection, thus ceasing to recruit new participants, is based upon having thoroughly developed the themes with which the researcher can fully address the research problem in the context presented. Of course, identifying when data saturation has been reached is valuable to know within the process of data collection; however, the question still remains of how many people to recruit and include within the sample to achieve the goal of data saturation.

In a review of 55 qualitative descriptive (generic qualitative) design articles, Kim et al. (2017) found sample sizes of 8 to 1,932 participants, with approximately 75% of those having sample sizes of 29 or less, and 60% of studies having 20 or fewer participants. A principal distinction between the articles surveyed by Kim et al. is that the data sources for the smaller samples were individual open-ended interviews and focus group interviews, while the largest of the sample sizes used survey instruments and written responses to open-ended questions. Within this survey, there was an apparent relationship between the data source and the number of participants required to obtain sufficient data to reach saturation, with the principal measure for determining how many participants will be needed before data saturation is reached being the amount of data collected and how rich with information it is.

Although this rationale may seem overly simplistic, it is nonetheless the case. Research that incorporates lengthy individual open-ended interviews as a principal source of data will achieve data saturation with fewer participants than a study solely relying upon written responses from its participants. Because interviews – as compared to written responses or other survey data sources – enable the researcher to ask specific questions to guide the discussion and provide opportunities for real-time exploration of participant responses, interview data will tend to be of much richer quality than written sources. Of course, the cost of obtaining rich sources of data, such as individual interviews and focus groups, is the time expenditure of the researcher and participant to develop a quality set of data. An additional consideration is the skillset and experience of the interviewer to conduct the interview, notice opportunities to explore openings in the participant's descriptions, ask probing questions to investigate the nature of the phenomenon, pick up on participant nonverbal cues, and to measure the development and repetition of themes real-time to guide the discussion and recognize natural conclusion points (McGrath et al., 2019; Tracy, 2019). The depth of information required by the research problem and research design, the source(s) of data, and the skills of the researcher are all important considerations, amongst others, in determining the number of participants one would anticipate needing to reach the goal of data saturation.

The scope of the research problem also must be considered in determining the number of participants one would likely need to develop quality themes. Topics that are narrow in scope, seek relatively superficial levels of examination, and have low inference, such as in descriptive designs, require only a moderate amount of data (Sandelowski, 2000). Therefore, the themes are likely to be developed and reach saturation after modest participation. Alternatively, examination of deep, rich, and meaningful phenomena requires a greater amount of data to understand the core experience. Such examination is a balance between sample size and the amount of data collected via interview. The study of cultures through ethnography requires larger sample sizes with moderate interview lengths to achieve the necessary depth and breadth of cultural understanding (Bernard, 2013). Similarly, grounded theory research typically involves a moderate number of participants, as the purpose is to develop a well-saturated theory. (Creswell, 2013). Phenomenological studies tend to focus upon depth of understanding of the lived experience, requiring significant contact time between the researcher and participant (Marshall et al., 2013). The natural focus tends to limit the number of participants involved in phenomenological studies while emphasizing the number, length, and depth of interviews. Narrative study, by nature, involves few participants, but engages in deep examination of the story to be shared (Riessman & Quinney, 2005). However, larger studies examining broader experiences are certainly evident in the literature (e.g., N = 18; Gray et al., 2002). Case studies are a somewhat unique in that the unit of analysis is the case, as opposed to the phenomenon. As such, sample selection for case studies depends upon the nature of the case. In some circumstances, the case is limited to the experiences of a single person (Yin, 2014), while other cases may be centered around events, groups, communities, programs, decision points, implementations of new processes, or other experiential inflection points. The number of participants required for each case is clearly dependent upon the nature of the case itself.

Because these guidelines are developed with the novice researcher in mind, the skills of the researcher will be considered as beginning level. Therefore, the research design and the source of data will be the primary considerations for describing recommendations for sample recruitment in qualitative research.

Descriptive. Kim et al. (2017) pointed out that a majority of descriptive design studies (60%) included the data of 20 or fewer participants, with 44% of the surveyed studies having between 11 and 20 participants. The synthesis of the literature survey and the nature of the design suggest that a range of 11 to 20 participants is an appropriate starting point for recruitment in descriptive research studies that use interviews or focus groups as primary sources of data. This recommendation also aligns with the writings of Lincoln and Guba (1985), who suggest 12-20 participants for interview studies. Although interview lengths will depend upon the research problem, the superficial nature of the design suggests that 45-75 minutes of dialogue should provide adequate data for novice researchers.

Case study. With a predominance of cases being single individuals (Yin, 2014), it is feasible to recruit one person as the sample. However, small sample sizes are often too small to support development of claims, provide informational redundancy, or acquire theoretical saturation (Sandelowski, 1995). Creswell (2013) recommends selecting "cases that show different perspectives on the problem, process or event" (p. 100), suggesting multiple participants must be included, while also recommending multiple cases to be used to investigate the problem. Marshall et al. (2013) go on to recommend that saturation often occurs at 30 interviews. Because case study highly recommends the use of multiple additional sources to corroborate the data, reliance upon the interview as the sole source of data is not required; therefore, the number of interview participants can be lower than recommended by Marshall et al. As an accommodation between the need for extensive interview data and the use of additional sources of data to seek saturation, including 12-15 participants are recommended to provide multiple perspectives of the case phenomenon while using additional sources of data to support the findings. Interview lengths may be similar to those of descriptive research, ranging from 45-75 minutes.

Phenomenology. The guidelines for participant recruitment for phenomenological studies vary across the literature, with Marshall et al. (2013) reporting ranges from 6-10 participants as a recommendation. It is also shared in the literature that samples sizes of one for phenomenological study are not rare (Sim et al., 2018). Smith and Osborn (2003) note that five or six participants have been recommended as an appropriate size for student studies using interpretive phenomenology and go on to offer their own recommendation of three participants for first-time researchers. The consensus amongst the phenomenological authors suggests a recommendation of 3-10 participants recruited as part of a phenomenological design for novice researchers with consideration given to having at least six complete data sets (participants). Contact time with participants will be extensive within phenomenological designs. Expect for interviews to be a minimum of 90-120 minutes; longer, if fewer participants are interviewed. Conducting multiple interviews with the same participant is a regular characteristic of the design.

Ethnography. The recommendations of Bernard (2011) are for 30-60 participants in ethnographic studies to provide the broad range of views required to achieve cultural understanding. However, Bernard (2013, p. 175) also intimates that "10-20 knowledgeable people are enough to uncover and understand the core categories in any well-defined cultural domain or study of lived experience." Novice researchers would be well-suited to consider between 20-30 participants when examining a core principle; more if the construct of examination is broader. Interviews may be between 60-120 minutes with follow-up interviews with the same participants for clarification and to fill in gaps in the social and cultural patterns.

Grounded theory. Because grounded theory seeks to develop a unified theoretical explanation of a process (Corbin & Strauss, 2007), a larger number of participants is requisite to develop and support the emerging theory. A minimum recommendation for sample sizes of 20-30 participants is put forth by Creswell (2013), while Charmaz (2014) advocates for larger samples. Grounded theory uses interviews with the study participants to initially develop the data from which the theory is created, and then requires regular and repeated contacts with the same participants to compare findings, fill gaps, and add to the framework. Initial interviews may last 60-120 minutes with follow-up interviews ranging in time from 15-60 minutes.

Narrative. Narrative research seeks to tell the story of an individual or small group so as to provide a sequence to events and explain the consequences and connections of those events (Riessman & Quinney, 2005). Creswell (2013) recommends two to three participants for narrative research, as the interviews tend to be longer in duration. Groleau et al. (2006) report interview lengths averaging 120 minutes for narrative study.

It should be noted that the recommendations from the literature are the participation requirements to obtain sufficient data to complete a thorough data analysis. Some colleges and universities may require their graduate students to obtain a greater minimum sample size than is recommended above, and for good reason. Learning programs, such as masters and doctoral curricula, seek to ensure that the student learns the appropriate interview skills, which is something that does not happen without practice. Therefore, the inclusion of additional participants affords the novice researcher the opportunity to learn interviewing skills as the research progresses. Additionally, these minimum sample sizes are put in place to ensure that the student has sufficient data to conduct an analysis. It is not uncommon for students to come back from the field with interviews that are too short or have extensive transcripts of the interviewer speaking and minimal contribution from the participant. Although the use of appropriate interview and re-interview methods should alleviate the need for these minimums, and field tests assist in developing interview skills, the minimums are set in place as a stop gap to mitigate the risk of insufficient data for analysis. Table 1 provides an overview of qualitative designs with recommended sample sizes and sources for each.

Table 1. Recommended a priori sample size for qualitative research designs

Research design	Recommended a priori sample size	References
Descriptive	10-20	Kim et al., 2017; Lincoln & Guba, 1985
Case study	12-15	Creswell, 2013; Marshall et al., 2013; Sandelowski, 1995; Yin, 2014
Phenomenology	3-10	Marshall et al., 2013; Sim et al. 2018; Smith & Osborn, 2003
Ethnography	20-30	Bernard (2011; 2013)
Narrative	2-3	Creswell, 2013
Grounded theory	20-30	Charmaz, 2014; Creswell, 2013

STANDARDS FOR DISSERTATION RESEARCH

Dissertation research is noticeably different than traditional research in that the doctoral student has an increased requirement to justify their decisions. One could argue a dual purpose of the dissertation is to not only accomplish research and present the results, but to demonstrate the doctoral student's knowledge and mastery of the research process. With this in mind, we offer the following guidance based upon the literature, as well as our own experiences as dissertation committee members and peer reviewers, of how a doctoral student may clearly articulate the population and sample structures within the dissertation.

Begin the development of the Population and Sample section, or other relevant section based upon the college's requirements, by outlining the primary groups as described in this article. Consideration should be given to writing a full paragraph describing each element. To accommodate and organize this process, we recommend using level 3 headings for each group, presented as the topic in Table 2. We also recommend ordering the discussion as shown in Table 2. By following the prescribed order, doctoral students not only present the information in an organized structure, but the activity of using heading levels and the requirement for a full paragraph following them compels a more thorough description. Paragraphs do not need to be overly lengthy, but they must be of sufficient length to richly discuss each topic and to defend those choices. When developing the description and justification of the population and sample selection, consider addressing the criteria outlined in Table 2.

Table 2. Description standards for population and sample selection

Topic	Description	Standard
Population of interest	The population of interest for the study is comprised of the individuals, dyads, groups, or organizations that are potential units of analysis and to whom or to which the study results may be generalized or transferred	• Identifies the population of interest • Describes the operationalized boundaries of the population of interest • Describes additional characteristics of the population of interest (e.g., approximate size, demographics, unique characteristics that are not part of the boundary conditions) • Justifies why the population of interest is appropriate for studying the research problem

Target population	The target population is the specific, conceptually bounded group of potential participants that represents the nature of the population of interest	• Describes the conceptual boundaries for inclusion or exclusion from the research
		  ○ Study variables/phenomenon
		  ○ Time constraints
		  ○ Spatial constraints
		• Describes the operational boundaries to identify the group from which the sampling frame is developed

Sampling frame	The sampling frame is an operationalized representation of the target population and is the group of units from which the sample is recruited	• Describes the operationalized boundaries of the sampling frame • Identifies the sampling frame, including the specific format of the sampling frame list • Describes how the sampling frame was developed • Estimated number of units within the sampling frame and a demonstration the sampling frame is large enough to accommodate sufficient data collection
Sampling method	The sampling method is the process, method, or technique by which the sample is selected	• Identify the sampling method • Describe the process by which the sampling method will be applied • Describe the benefits of the sampling method • Describe limitations of the sampling method
Sample	The sample is the group of units of analysis in the study about what or whom data are provided	• Identify the sample • Describe the minimum a priori sample requirements, including the parameters used to determine the minimum sample size • Justify the sample size based upon examples from the literature

Topic	Description	Standard
Unit of analysis	The unit of analysis is the entity described by the data collected and about which the analysis is conducted—it is what the data are about for the purpose of addressing the research problem and defines the boundaries of what is examined or ignored within the study	• Identify the unit of analysis • Describe the unit of analysis, including inclusion and exclusion criteria • Describe how each of the variables (quantitative) or the data (qualitative) apply directly to the unit of analysis
Unit of observation	The unit of observation is the entity that is the source of data about the unit of analysis	• Identify the unit(s) of observation (there may be more than one) • Describe the unit(s) of observation and how each unit of observation is the source of data for the unit of analysis

CONCLUSION

Social science research is the study of people, organizations, groups, or networks of people, and to effectively conduct such studies, one must effectively and thoroughly define and describe what is being examined. The descriptions of the population and sample, as well as the defining elements, such as the unit of analysis and unit of observation, serve as a foundation from which the rest of the study is designed. Using an intentional approach of defining and describing each element within the dissertation aids doctoral students in clearly describing the subject of research, as well as demonstrates strong understanding of how population and samples apply to general research design.

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