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ABSTRACT

Data saturation is a cornerstone concept in qualitative research, ensuring that data collection ceases once no new themes, insights, or patterns emerge. This concept is critical for achieving methodological rigor, as saturation enhances the credibility and completeness of research findings. Despite its central role, debates persist regarding the point at which saturation is achieved, especially as it varies across qualitative methodologies such as grounded theory, phenomenology, and ethnography. Contemporary scholars argue for a flexible approach to sample sizes and saturation criteria, balancing comprehensive data gathering with respect for emerging themes and contextual sensitivity. This article explores the theoretical foundations, practical applications, and controversies surrounding data saturation. Additionally, it offers recommendations for researchers on determining sample sizes and 16-items checklist for achieving saturation, aiming to improve research quality while addressing the methodological challenges inherent in qualitative research.

1. Introduction

Qualitative research has become a cornerstone of social sciences, offering a means to explore complex human experiences, behaviors, and societal structures in ways that quantitative methods may not fully capture [1]. Unlike quantitative research, which prioritizes the measurement of variables and statistical analysis, qualitative research seeks to understand the "why" and "how" of human behavior through deep exploration of lived experiences [2]. Methods such as in-depth interviews, focus groups, and participant observations allow researchers to gather rich, contextual data that can offer nuanced insights into cultural, social, and psychological phenomena [3–5]. The flexibility of qualitative research is one of its strengths, allowing for adjustments in methodology as the research unfolds [6]. This adaptability is particularly important when investigating topics where predefined hypotheses may not fully capture the complexities of human interaction. However, despite the strengths of qualitative approaches, they also present challenges—particularly around the adequacy of data collection [7]. One critical element in addressing these challenges is the concept of data saturation, which ensures that data collection has been sufficient to capture all relevant perspectives and themes.

Data saturation is a pivotal concept in qualitative research methodology, referring to the point at which no new information, themes, or patterns emerge from the data [8]. Achieving data saturation indicates that the researcher has adequately explored the study's phenomenon and can cease data collection without the risk of overlooking critical insights. This concept is essential not only in determining sample size but also in enhancing the credibility and validity of qualitative research [9,10]. Without reaching data saturation, researchers may risk

presenting incomplete or superficial findings, which could lead to inaccurate or unreliable conclusions [7]. Moreover, saturation acts as a guideline for methodological rigor in qualitative studies, ensuring that the research process is thorough, systematic, and reflective of diverse participant experiences [11]. Although reaching saturation can vary depending on the research design, the nature of the research question, and the richness of the data, it remains an indispensable criterion for concluding data collection in qualitative studies [7,12].

The primary objective of this article is to provide a comprehensive exploration of data saturation within the framework of qualitative research. By examining the theoretical foundations and practical implications of saturation, this article aims to clarify the critical role it plays in ensuring the rigor and completeness of qualitative studies. Specifically, it will address how researchers can determine when saturation has been achieved, the methodological strategies that can be employed to reach this point, and the potential challenges faced in practice. In doing so, the article will offer recommendations for qualitative researchers on how to apply the concept of saturation effectively to improve the quality and trustworthiness of their findings. Additionally, it seeks to contribute to ongoing discussions in the field regarding how best to balance depth and breadth in qualitative inquiry, ultimately ensuring that the research provides a rich and accurate portrayal of the phenomena under study.

2. Defining saturation and their types

In qualitative research, saturation refers to the point at which additional data collection no longer yields new insights, codes, or themes [13]. There are several distinct types of saturation, each addressing

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different aspects of data adequacy. Theoretical saturation, rooted in grounded theory, occurs when further data no longer contributes to refining or expanding the theoretical framework being developed [11, 14,15]. Data saturation emphasizes the breadth of the dataset, achieved when no new patterns or categories emerge during analysis, ensuring comprehensive coverage of the phenomenon under study [14,16,17]. Code saturation focuses on the granularity of analysis, indicating the point where no additional codes are required to describe the data fully [7,11,17,18]. Finally, meaning saturation extends beyond the identification of themes to ensure a deep and nuanced understanding of participants' experiences, prioritizing the richness and depth of interpretation [19,20].

Data saturation is a cornerstone of qualitative research, representing the point at which further data collection no longer yields new insights, themes, or categories relevant to the research question. Originating from grounded theory, Glaser and Strauss [21] introduced saturation as a key step in theory generation, ensuring that theoretical constructs are sufficiently developed and exhaustive [21]. Over time, the concept has evolved and found application across various qualitative methodologies, though its definition varies. For example, grounded theory emphasizes theoretical saturation—where categories are fully fleshed out in terms of their properties and relationships [22]. While phenomenological research focuses on reaching a saturation point where the essence of participants' lived experiences can be fully understood without new information emerging [23]. In ethnographic and narrative research, saturation is often linked to the adequacy of data to represent a comprehensive and coherent understanding of the cultural or narrative context [9,24]. The operationalization of data saturation can be achieved through systematic approaches such as thematic analysis, where researchers iteratively review and refine data to ensure that themes are consistently observed and no new patterns emerge [16]. The PRICE model, introduced by Naem et al. (2024), emphasizes a structured framework to enhance transparency in operationalizing data saturation. This model outlines five key components—Perspectivation, Recapitulation, Integration, Crystallisation, and Edification—each contributing to a thorough saturation process by refining or expanding existing quotations, codes, themes, and concepts as necessary [25]. However, the number of interviews or data points required to reach saturation is not fixed and may vary depending on the study's aims, population, and methodology. Guest et al. (2006) argue that data saturation in homogeneous populations can be achieved with as few as 12 interviews, while more complex research designs may necessitate larger sample sizes [8]. Additionally, Malterud et al. [26] proposed the concept of "information power," suggesting that the more relevant a sample is to the research question, the fewer participants are needed to achieve saturation [26]. Across qualitative traditions, the concept remains crucial to ensuring that data collection is thorough, analysis is robust, and the findings are theoretically sound and methodologically rigorous [11,27].

3. Debates and controversies surrounding data saturation

3.1. Differing perspectives on the necessity of saturation

The concept of data saturation, which refers to the point at which no new information emerges from data collection, has become a central topic of discussion in qualitative research. Supporters of strict saturation standards argue that achieving saturation is essential for ensuring the comprehensiveness and depth of the data collected [13]. This viewpoint posits that saturation serves as a crucial indicator of methodological rigor, particularly in studies utilizing phenomenological or grounded theory approaches [8]. According to these proponents, reaching saturation ensures that the researcher captures the full spectrum of participants' experiences and perspectives, which is vital for producing rich, meaningful findings. In their study, Braun and Clarke (2013) highlight that saturation is often employed as a benchmark for rigor, suggesting that when researchers collect data until saturation is reached, they

enhance the reliability and validity of their results [28]. Moreover, proponents assert that saturation mitigates the risk of premature termination of data collection, which could lead to incomplete or biased findings [16]. This perspective is particularly pertinent in exploratory research where understanding complex phenomena demands comprehensive data gathering. Researchers such as Fusch and Ness (2015) emphasize that a thorough approach to data saturation not only strengthens the findings but also fosters a sense of accountability and transparency in qualitative research [9]. However, critics question the concept's validity and its practical application across various research contexts. They argue that an overemphasis on saturation can lead to rigid methodological practices that may not suit all qualitative studies. For instance, some researchers contend that insisting on saturation may lead to the collection of superfluous data, diluting the focus on critical insights [16]. Critics argue that human experiences are inherently complex and nuanced, making it unrealistic to expect complete saturation within any given sample [29]. This viewpoint challenges the notion that saturation can serve as a one-size-fits-all measure, suggesting that researchers should prioritize depth and richness over numerical targets. Furthermore, some scholars, such as McLafferty (2004), assert that the pursuit of saturation may inadvertently lead researchers to overlook unique or divergent perspectives, particularly in studies involving marginalized populations [30]. This critique highlights the ethical implications of adhering too strictly to saturation criteria, as it may perpetuate dominant narratives while silencing minority voices [31]. As a result, it is essential to consider the context of the research and the specific goals of the study when determining the relevance of saturation in qualitative data collection.

3.2. Consequences of saturation on research quality and findings

The debate over data saturation has significant implications for the credibility and rigor of qualitative research [1,7,16]. Advocates argue that reaching saturation enhances the trustworthiness of findings, as it suggests that the researcher has thoroughly engaged with the data and captured a representative range of perspectives [9]. The concept of saturation is frequently cited as a hallmark of methodological rigor, reinforcing the credibility and dependability of research findings. Achieving saturation not only strengthens the validity of the results but also enhances the study's acceptance within the academic community. Furthermore, researchers such as Malterud et al. [26] emphasize that the quality of qualitative research is often judged by the saturation achieved, which in turn influences the overall impact of the research within the field [26]. However, the potential impacts on interpretation and analysis are significant when saturation is either overemphasized or disregarded. If researchers become too focused on achieving saturation, they may unintentionally overlook emerging themes or novel insights that are crucial to understanding the research phenomenon [32]. This fixation can limit the flexibility of qualitative methodologies, hindering researchers' ability to adapt their approaches in response to the evolving nature of qualitative data [33]. Additionally, the pressure to reach saturation may lead researchers to adopt rigid data collection procedures, potentially stifling creativity and reducing the richness of the qualitative experience. Conversely, disregarding saturation can result in superficial analyses that compromise the depth and validity of the findings [34]. Researchers who overlook saturation may fail to capture the full complexity of participants' experiences, leading to incomplete interpretations that do not accurately reflect the study's context [35]. Thus, the challenge lies in finding a balance between achieving saturation and maintaining analytical depth and flexibility, ensuring that data collection and analysis remain responsive to the unique characteristics of the research context. Ultimately, a nuanced understanding of saturation and its implications for qualitative research is essential for researchers seeking to produce meaningful and impactful findings.

4. Sample size recommendations in qualitative research

4.1. Current practices for determining appropriate sample sizes

In qualitative research, sample size determination is not only critical for the validity of the findings but also reflects the underlying theoretical framework of the study. Traditional qualitative research practices often utilize fixed numerical thresholds—commonly suggesting sample sizes ranging from 5 to 30 participants per group [8]. However, such arbitrary thresholds can misrepresent the depth and complexity inherent in qualitative data. This limitation is particularly pronounced when qualitative studies aim to uncover nuanced experiences or perspectives across diverse populations [36]. Current evidence-based recommendations advocate for a more flexible and context-sensitive approach to sample size determination. Fusch and Ness (2015) emphasize that the sample size should align with the specific research questions, theoretical frameworks, and the diversity of the target population [9]. In qualitative research, the goal is not merely to reach a numerical threshold but to ensure that data collection yields rich, meaningful insights. A study by Suri (2011) suggests that sample sizes can vary significantly depending on the research design, the complexity of the phenomenon under study, and the availability of resources [35]. Several factors significantly influence sample size decisions in qualitative research as depicted in Fig. 1. One primary factor is the study design. For instance, exploratory studies often benefit from smaller, focused samples that facilitate in-depth exploration of participants’ lived experiences. A qualitative study examining the experiences of caregivers for individuals with dementia might involve in-depth interviews with 10–15 participants, as these numbers can provide sufficient depth to identify key themes [2]. Conversely, descriptive qualitative studies, which aim to capture a broader array of perspectives within a population, may necessitate larger samples [37,38]. For example, a study exploring community attitudes toward mental health could require 20–40 participants to ensure diverse viewpoints are represented adequately. Another critical factor is population characteristics. Diverse populations may require larger sample sizes to ensure representation across various demographic factors, including age, gender, socioeconomic status, and cultural background. For example, a study investigating health behaviors across different ethnic groups might involve 30–50 participants from each group to capture the diversity of experiences adequately. The Table 1 provides a summary of suggested sample sizes for various qualitative research designs.

4.2. Strategies for achieving saturation

Achieving data saturation is a fundamental objective in qualitative research, representing the point at which no new information or themes emerge from data collection. Data saturation is not a static concept but rather a dynamic process that can be influenced by various factors, including the research design, the homogeneity of the sample, and the data collection methods employed [7]. The Table 2 offers a structured approach (16items checklist) for researchers aiming to achieve data

Table 1
Recommended sample sizes for various qualitative research designs.

Qualitative research design	Recommended sample size	References
Thematic Analysis	12–20 participants	[27]
Focus Groups	4–12 focus groups	[39,40]
Case Study	4–10 cases or single-case in-depth analysis	[41,42]
Grounded Theory	20–30 participants or until theoretical saturation	[21,43]
Phenomenology	5–25 participants	[2]
Narrative Inquiry	3–10 narratives	[44]
Ethnography	30–50 participants	[45,46]
Participatory Action Research (PAR)	10–15 participants	[47,48]
Delphi Study	10–18 experts	[49,50]
Content Analysis	Varies depending on text volume	[51]
Discourse Analysis	15–30 texts	[52,53]
Autoethnography	1–2 participants	[54,55]
Life History Research	3–5 participants	[56,57]

saturation in qualitative studies, enhancing both rigor and depth. It guides researchers through essential steps, from defining saturation objectives and selecting appropriate sampling strategies to documenting final saturation decisions (Fig. 2 and Table 2).

One effective strategy for achieving data saturation is the use of iterative sampling methods. This approach involves continuously collecting and analyzing data until saturation is reached. Charmaz (2014) suggests that researchers should engage in a cyclical process of data collection, analysis, and reflection, enabling them to adjust their sampling strategies based on emerging insights [22]. For instance, if initial interviews reveal specific themes, the researcher can purposefully sample additional participants to explore these themes further, ensuring a comprehensive understanding of the topic. Variability in data collection techniques is another critical aspect of achieving data saturation. Qualitative researchers often employ a mix of methods, such as individual interviews, focus groups, and observational techniques, to gather data. Each method offers unique advantages that can enhance the depth and richness of the findings. For example, individual interviews may elicit detailed personal narratives, while focus groups can stimulate discussions that reveal collective beliefs and group dynamics [40]. According to Liamputtong (2011), using a combination of qualitative methods can lead to more comprehensive insights [58]. In a study exploring patients’ experiences with chronic illness, employing both interviews and focus groups allowed the researchers to triangulate data, leading to a more nuanced understanding of the participants’ challenges and coping mechanisms. This triangulation is particularly beneficial in complex research contexts, such as studies addressing health disparities or social determinants of health.

Moreover, the selection of data collection techniques should be closely aligned with the research objectives. For exploratory studies seeking to develop new theories, in-depth interviews might be more appropriate, whereas focus groups could be better suited for

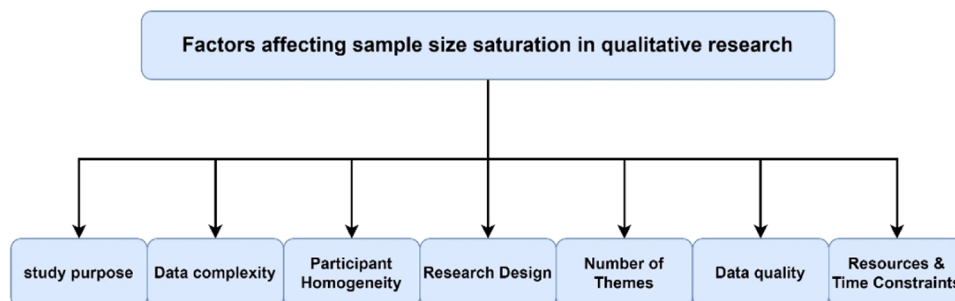


Fig. 1. Factors affecting sample size saturation in qualitative research.

Table 2
16-items checklist for ensuring data saturation in qualitative research.

Checklist Item	Description
1. Define saturation goals	Decide the type of saturation needed (e.g., code saturation, meaning saturation) based on the study's design and research questions.
2. Select a sampling strategy	Choose a sampling method that aligns with the study's objectives (e.g., purposeful, theoretical, maximum variation) to ensure relevant perspectives are included.
3. Set an initial sample size	Start with a sample size based on prior literature and expected variability, with flexibility to expand as needed to achieve saturation.
4. Plan for iterative data collection	Use an iterative approach, collecting and analyzing data in cycles to refine sampling and interview questions as new themes emerge.
5. Keep a saturation monitoring log	Maintain a log or journal to track progress toward saturation, noting when themes or insights start recurring without new information.
6. Probe for data depth	In each interview or interaction, ask follow-up questions to gain depth and ensure that each theme is thoroughly explored.
7. Use data analysis software (Optional)	Use software like NVivo or ATLAS.ti to track theme and code recurrence, helping visualize and monitor progress toward saturation.
8. Practice reflexivity	Regularly assess how personal biases or assumptions may influence data collection and interpretation, adjusting the approach as necessary to capture new insights.
9. Balance breadth and depth	Ensure a broad range of perspectives is included while fully exploring each theme, aiming for both variety in views and depth in understanding.
10. Consider participant diversity	For diverse groups, a larger sample may be necessary to achieve saturation, while more homogeneous groups may require fewer participants.
11. Define clear saturation indicators	Set specific indicators for saturation (e.g., no new codes or themes after three consecutive interviews) to know when data collection can end.
12. Periodically review Saturation criteria	Adjust saturation criteria if new themes emerge or if additional sampling is required. This flexibility ensures that saturation is meaningfully achieved.
13. Use triangulation (if feasible)	Combine different data sources (e.g., interviews, focus groups) to confirm themes from multiple perspectives, enhancing data validity.
14. Document final decision for saturation	Clearly document the rationale for stopping data collection, including the point at which no new information was observed.
15. Address practical constraints	Consider any limitations like time, budget, or participant availability, setting realistic goals for saturation and noting potential impacts on findings.
16. Predefine a saturation stopping point	Before data collection, set a specific criterion (e.g., no new themes after a set number of interviews) to establish consistency in methodology.

understanding shared experiences within a community [59]. By strategically employing different data collection methods, researchers can enhance the richness and validity of their findings, ultimately supporting a more robust understanding of the research topic. Reflexivity is crucial in qualitative research, as it encourages researchers to remain sensitive to emerging themes and adjust their data collection approach accordingly [60,61]. This adaptability is especially important when investigating nuanced or evolving topics, as it allows for a dynamic approach to saturation. Researchers should remain vigilant to new patterns or insights that may not align with preconceived hypotheses, especially in exploratory studies or when working with diverse populations [62]. Reflexive journaling and ongoing critical discussions with research teams can help maintain an awareness of saturation progress, reducing bias and enhancing data richness [63]. Qualitative data analysis software, such as NVivo or ATLAS.ti, can assist researchers in systematically identifying themes and sub-themes within large datasets [64]. These tools enable researchers to track code frequencies, visualize theme networks, and monitor saturation progress, which can be especially helpful in studies with high volumes of text data. While software should not replace the interpretative skills of the researcher, it can offer valuable structure and support in assessing when saturation is reached [65]. Maximum variation sampling seeks to capture a wide range of perspectives within a study, particularly useful when the research question addresses diverse or multi-faceted phenomena [66]. By including participants with varied backgrounds, experiences, or viewpoints, this approach ensures that saturation encompasses the breadth of the phenomenon under study. This method has been effective in public health and cross-cultural research, where diverse participant pools offer rich, multilayered insights [37]. Establishing explicit criteria for saturation helps researchers maintain transparency and rigor in the saturation process. These criteria may include specific thresholds for code recurrence, thematic redundancy, or the number of new themes per additional interview. Defining saturation benchmarks in advance and documenting decisions throughout the process supports methodological transparency and accountability, making the research process more replicable [11].

5. Conclusion

Data saturation remains a vital criterion for methodological rigor in qualitative research, yet its application is complex and context-dependent. Scholars emphasize that saturation should not be viewed as a strict endpoint but rather as a guiding principle that varies by study design, sample diversity, and research objectives. Achieving saturation is often facilitated by iterative data collection and methodological triangulation, which enrich data quality and enhance the validity of findings. While debates around saturation continue, researchers are encouraged to adopt a flexible, reflective approach, tailoring sample sizes and data collection strategies to the specific needs of their study. By doing so, they contribute to more robust, nuanced, and ethically sound qualitative research, ultimately advancing the field's ability to capture complex human experiences.

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The ethical approval was not required, as the study conducted did not involve any ethical concerns or issues.

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Clear Stages for Reaching Data Saturation in Qualitative Research

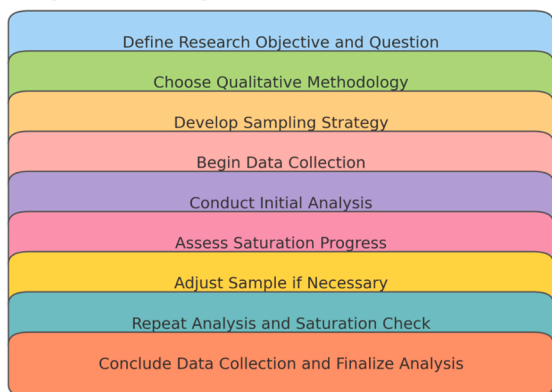


Fig. 2. Stages for reaching data saturation in qualitative research.

Declaration of Competing Interest

The author declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Data Availability

No data were used in the research described in this article.

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