



INTERNATIONAL JOURNAL OF ADVANCE RESEARCH, IDEAS AND INNOVATIONS IN TECHNOLOGY

ISSN: 2454-132X

Impact Factor: 6.078

(Volume 10, Issue 1 - V10I1-1268)

Available online at: <https://www.ijariit.com>

Key disparities between quantitative and qualitative research methodologies

Dr. S. K. Mohanasundari

roshinikrishitha@gmail.com

All India Institute of Medical Sciences
Hyderabad, Telangana

Pratheeba S.

pratheebasathianathan@gmail.com

All India Institute of Medical Sciences
Hyderabad, Telangana

Preethi S.

preethisathianathan@gmail.com

All India Institute of Medical Sciences
Hyderabad, Telangana

Dr. Vasanth Kumar Kasturi

naiduvasanthkumar@gmail.com

All India Institute of Medical Sciences
Hyderabad, Telangana

Maggie Peter

maggiepeter2000@gmail.com

All India Institute of Medical Sciences
Hyderabad, Telangana

Guru P.

gurupk560@gmail.com

All India Institute of Medical Sciences
Hyderabad, Telangana

Era Deepika Dayal

era_tng@yahoo.com

All India Institute of Medical Sciences Hyderabad, Telangana

ABSTRACT

This comprehensive review explores the key disparities between quantitative and qualitative research methodologies, aiming to enhance researchers' comprehension and facilitate informed decision-making in study design. The article underscores the significance of understanding these methodologies for researchers, emphasizing their distinct frameworks, tools, and philosophical underpinnings. The review spans the period from 2000 to 2024, systematically surveying English-language literature across prominent databases. Employing a strategic search strategy and Boolean operators, the investigation focuses on discerning significant characteristics of qualitative research methodologies, including research paradigms, data collection, and analysis methods. MeSH terms were applied in PubMed, and strict inclusion criteria were set for articles, resulting in the evaluation of 44 selected papers. The collected material, organized based on scientific content, provides a wealth of information on the characteristics of both quantitative and qualitative research methodologies.

The characteristics of qualitative research are elucidated through illustrative examples, emphasizing its naturalistic, inductive, and bottom-up approach. This method explores phenomena in-depth, using unstructured or semi-structured data collection, and often culminates in a descriptive report. However, concerns about reliability, validity, and time-consuming data gathering are acknowledged. In contrast, quantitative research, characterized by its scientific, deductive, and top-down approach, employs laboratory settings and structured data collection methods, concluding with statistical reports and emphasizing reliability and validity. The review recognizes the need for larger sample sizes in quantitative research and highlights its controlled, structured, and less time-consuming data collection methods.

Key words: *Qualitative research, Quantitative research, scientific research, naturalistic research, inductive approach and deductive approach.*

I. INTRODUCTION

Research is a systematic process of inquiry that aims to expand our understanding of phenomena, explore relationships, and answer questions that drive knowledge forward. Within the realm of research methodologies, two primary paradigms emerge: qualitative and quantitative approaches. Each approach offers distinct frameworks, tools, and philosophies that researchers employ to investigate and comprehend diverse aspects of the world [1].

Qualitative research involves a nuanced exploration of social phenomena through in-depth observations, interviews, and analysis of non-numerical data. It focuses on understanding the complexities and contexts surrounding human behaviour, culture, and experiences. This methodology values subjective interpretations and aims to generate rich, descriptive insights that illuminate the intricacies of the studied subject [2].

On the other hand, quantitative research adopts a structured and objective approach to gather numerical data, employing statistical analysis to identify patterns, correlations, and cause-effect relationships. It emphasizes measurement, objectivity, and generalizability of findings across broader populations, enabling researchers to quantify and analyse phenomena in a more standardized and precise manner [3,4].

Both qualitative and quantitative research methods play pivotal roles in advancing knowledge across various disciplines. While qualitative research dives deep into the meanings, contexts, and complexities of human experiences, quantitative research employs statistical rigor to measure, test, and predict phenomena [5]. The choice between these methodologies often depends on the research question, the nature of the phenomenon under study, and the preferred approach to gather and analyse data [6]. Understanding these methodologies and their unique characteristics is fundamental for researchers for several reasons such as; helps in choosing the appropriate research design for a study based on the nature of the research question, enables researchers to align their chosen methodology with the goals and objectives of their research. Guides the selection of suitable data collection methods, whether quantitative (surveys, experiments) or qualitative (interviews, focus groups) [7]. It Provides insight into the strengths and limitations of different data collection approaches and aids in selecting the right analysis techniques for the type of data collected (statistical analysis for quantitative data, thematic analysis for qualitative data) [8]. Understanding the fundamental principles of each methodology ensures accurate and meaningful interpretation of results. It enhances awareness of the underlying philosophical assumptions and paradigms associated with each methodology (e.g., positivism for quantitative, constructivism for qualitative) [9] It contributes to the overall rigor and validity of the research by ensuring that the chosen methodology aligns with the research objectives and helps in avoiding methodological pitfalls and biases that may arise from a mismatch between the research question and methodology [10]. It also enables researchers to leverage the strengths of both quantitative and qualitative approaches in mixed methods research And facilitates the integration of diverse data sources to gain a more comprehensive understanding of the research problem [11]. it improves the quality of grant proposals by demonstrating a thoughtful and informed choice of research methodology and enhances the chances of successful publication in peer-reviewed journals by ensuring that the research design and methodology align with scholarly standards [12].

This review article is conducted to elucidate the key disparities between Quantitative and Qualitative Research Methodologies, supported by illustrative examples. Its primary objective is to enhance comprehension of these methodologies, facilitating the selection of the most appropriate approach for research studies. The article aims to provide clarity, enabling researchers to make informed decisions regarding the application of suitable methodologies in their studies.

II. MATERIALS AND METHODS

This exhaustive review systematically surveyed English-language literature spanning the period from 2000 to 2024. The investigation employed electronic searches across well-established databases, including Scopus, PubMed, ScienceDirect, Web of Science, Google Scholar, UpToDate, Embase, ResearchGate, ScienceDirect and Ovid Medline. The primary focus of the search was on discerning significant characteristics of qualitative research methodologies. Key terms utilized for the search encompassed a broad spectrum of topics, such as research methodologies, quantitative research, qualitative research, methodological differences, research design, data collection, data analysis, research paradigms, qualitative characteristics, quantitative characteristics, mixed methods research, research approaches, comparative research, laboratory research, confirmatory research, naturalistic research, field research, inductive research, deductive research, hypothesis testing, hypothesis developing, scientific research, positivist research, evidence-based research, flexible research, randomization, basic research, applied research, theory developing approach, generalizability of results in research, reliability and validity in research, numerical data in research, and descriptive data in research.

Boolean operators (AND, OR) were strategically employed to combine these keywords, resulting in phrases like "Quantitative AND Qualitative Research Methodologies," "Distinguishing Characteristics AND Research Methodologies," "Quantitative vs. Qualitative AND Research Design," "Qualitative Characteristics AND Data Analysis," and "Research Paradigms AND Methodological Differences." Additionally, MeSH terms were applied in the PubMed database, and strict inclusion criteria were established for articles. Only articles published in English with full text and released within the 20-year timeframe from 2003 to

2023 were considered. Accepted article types included review articles, systematic reviews, book chapters, and randomized controlled trials (RCTs).

During the initial evaluation, 98 paper abstracts were scrutinized, leading to the identification of 44 articles that met the established criteria for full-text assessment. In instances where full texts were inaccessible, attempts were made to contact authors for the missing content. The selected articles then underwent a comprehensive evaluation by a dedicated research team, with any discrepancies resolved through the intervention of a third evaluator. The final compilation of 44 papers yielded an extensive wealth of information regarding the characteristics of both quantitative and qualitative research methodologies. The collected material was meticulously organized and categorized based on its scientific content within their respective thematic areas.

III. CHARACTERISTICS OF QUALITATIVE RESEARCH

1. **Naturalistic method:** Qualitative research often employs a naturalistic approach, observing subjects in their natural environments. For instance, an anthropologist studying a remote tribe might live among its members to understand their culture, rituals, and social dynamics firsthand [8].
2. **Field research:** This method involves conducting research in real-world settings. For example, a researcher studying the impact of urbanization might gather data by interacting with residents in urban areas, observing changes in lifestyle and community structures [13].
3. **Inductive reasoning/analysis:** Qualitative research often uses inductive reasoning, developing theories or concepts based on observed data. For instance, after analyzing interviews with patients about their experiences with chronic illness, researchers might develop theories about coping mechanisms [14].
4. **Bottom to top approach:** Qualitative research typically begins with specific observations and builds toward general principles or theories. For example, a linguist analyzing specific dialects and languages might derive broader linguistic principles from these specific cases [15].
5. **Drawing general conclusions from specific principles:** Qualitative researchers aim to draw broader conclusions from specific instances or cases. For instance, after analyzing various case studies of successful community projects, researchers might draw general conclusions about factors contributing to community development [16].
6. **Data's less purity, more complex and chance of bias in interpretation:** Qualitative data often consists of rich, detailed, and context-dependent information. For instance, qualitative data from interviews might contain nuanced details and subjective interpretations of experiences. Qualitative research involves subjective interpretation, and researchers' personal biases or preconceptions may influence how they analyze and interpret data [17].
7. **Reliability and validity concerns:** Due to its subjective nature and reliance on interpretation, qualitative data may face challenges in reliability and validity. For example, different researchers might interpret the same interview data differently, leading to subjective outcomes [18].
8. **Subjective nature of data:** Qualitative data collection involves subjective interpretation, as researchers bring their perspectives and interpretations to the analysis of data. For example, in analyzing artworks for an art history study, different researchers might interpret the symbolism differently [19].
9. **Data in descriptive form:** Qualitative data is often descriptive, consisting of words, images, or narratives. For instance, in a study on youth experiences in marginalized communities, researchers might collect narratives and photographs to capture their stories [20].
10. **Aim to develop concepts:** Qualitative research focuses on generating concepts or theories. For example, in studying the experiences of survivors of traumatic events, researchers might develop new concepts related to resilience [8].
11. **Aim to develop hypothesis & theories:** While qualitative research often aims to generate concepts, it can also lead to the development of hypotheses and theories. For example, after conducting interviews with teachers about their experiences with student motivation, a researcher might develop a hypothesis about the relationship between teaching styles and student engagement [19].
12. **It is a generative approach:** Qualitative research is generative in nature, allowing researchers to generate new ideas, theories, or concepts. For instance, through ethnographic research studying the culture of a remote community, a researcher might generate new theories about the social structures and values of that community [21].
13. **Requires less sample:** Qualitative research often involves smaller sample sizes compared to quantitative research. For instance, in a phenomenological study exploring the lived experiences of caregivers, a researcher might conduct in-depth interviews with only a handful of participants to deeply understand their experiences [22].
14. **It is basic research:** Qualitative research often focuses on fundamental understanding rather than immediate practical applications. For example, a qualitative study exploring the perceptions of consumers about sustainable products contributes to understanding consumer behavior without immediate commercial implications [23].
15. **Flexible in research design:** Qualitative research offers more flexibility in its design and execution. For instance, in a case study examining a company's organizational culture, researchers may adapt their approach based on emerging insights during the research process [24].
16. **More sensitivity to context:** Qualitative research is highly sensitive to context, emphasizing the importance of understanding the specific circumstances surrounding a phenomenon. For example, in a cultural anthropology study, the researcher emphasizes understanding cultural nuances and their influence on behaviors [25].

17. Ends with a descriptive report: Qualitative research often culminates in a descriptive report, presenting detailed findings without statistical analysis. For instance, after conducting interviews and observations on community resilience after a natural disaster, the researcher might present a detailed narrative describing the community's coping mechanisms [26].
18. No randomization presence: Qualitative research does not typically involve random sampling or random assignment. For example, in a qualitative study exploring entrepreneurs' motivations, participants are purposefully selected based on their expertise and experiences [27].
19. Follows non-standardized steps: Qualitative research methods often vary in their approach and sequence of steps. For instance, in a grounded theory study exploring leadership styles, the process of data collection and analysis evolves iteratively as themes emerge from the data [8].
20. It explores phenomena: Qualitative research aims to explore and understand underlying phenomena. For example, in a study examining social stigma, researchers might use interviews and observations to explore the experiences of individuals living with a stigmatized condition [8].
21. No generalization to the population: Qualitative research findings is typically not generalized to broader populations due to the focus on depth rather than breadth. For instance, findings from an ethnographic study on a specific cultural group may not be applicable to other cultural contexts [28].
22. Data gathering is more time-consuming: Qualitative data collection often requires more time due to in-depth interviews, observations, and the iterative nature of analysis. For example, ethnographic research involving prolonged engagement with a community necessitates substantial time commitments [19].
23. Use unstructured or semi-structured methods of data collection: Qualitative research commonly utilizes unstructured or semi-structured data collection methods such as open-ended interviews or participant observation. For instance, in a study exploring the experiences of refugees, researchers might use open-ended interviews to allow participants to share their stories freely [29].
24. Review of literature done during or after the data collection: In qualitative research, literature review may be an ongoing process, with researchers reviewing relevant literature during or after data collection to enrich the analysis and interpretation [30].

IV. CHARACTERISTICS OF QUANTITATIVE RESEARCH

1. Scientific method/positivist: Quantitative research aligns with the scientific method, emphasizing empirical investigation and objectivity. For instance, a study measuring the effects of a new drug on blood pressure adheres to scientific principles through systematic data collection and analysis [9].
2. Laboratory research: This method often involves controlled experiments conducted in laboratory settings. For example, a psychology study measuring reaction times might take place in a controlled lab environment to minimize external influences [31].
3. Deductive reasoning/analysis: Quantitative research typically employs deductive reasoning, starting with a hypothesis and then collecting data to test that hypothesis. For instance, a study hypothesizing a correlation between exercise and stress levels collects data to either support or refute that hypothesis [32].
4. Top to bottom approach: It starts with general principles or theories and then tests them through specific observations. For example, a study testing the principles of Newton's laws of motion through controlled experiments follows a top-down approach [33].
5. Drawing specific conclusions from general principles: Quantitative researchers aim to draw specific conclusions based on established principles or theories. For instance, a study investigating the impact of economic policies on unemployment rates draws specific conclusions derived from economic theories [34].
6. Data's more purity and less complex and no or less bias in interpretation of result: Quantitative data tends to be more standardized and objective. For example, data collected through surveys with fixed-choice questions generates numerical responses that are less subject to a different interpretation. Quantitative research aims for objectivity, minimizing subjective influences in data collection, analysis, and interpretation. Statistical techniques help reduce bias [35].
7. Reliable and valid data: Quantitative research emphasizes the reliability and validity of data collected through rigorous methodologies and standardized measures. For instance, a well-designed survey using validated scales ensures reliable and valid responses [36].
8. Objective nature of data: Quantitative data collection aims for objectivity, minimizing subjective influences. For example, in a study measuring the effect of a vaccine on disease prevention, researchers rely on numerical data such as infection rates [37].
9. Data in numerical form: Quantitative research collects data in numerical form, facilitating statistical analysis. For instance, a study analyzing stock market trends collects numerical data on stock prices and market indices [37].
10. Aim to identify concepts: Quantitative research focuses on identifying and measuring concepts through numerical data. For example, in sociology, quantitative research may aim to measure and quantify concepts like social inequality through statistical analysis [38].
11. Aim to test hypotheses & theories: Quantitative research aims to test hypotheses or theories through empirical evidence. For instance, a study testing Einstein's theory of relativity might gather data through experiments to validate or invalidate the theory [38].
12. Confirmative approach: Quantitative research seeks to confirm or refute existing theories or hypotheses through systematic data collection and analysis. For example, a study testing the efficacy of a specific treatment confirms or refutes its effectiveness based on numerical data [39].

13. Requires more sample: Quantitative research often requires larger sample sizes to achieve statistical significance and generalize findings. For instance, a nationwide survey on voting preferences might require a large sample to represent the entire population [40].
14. Basic/Applied research: Quantitative research can be both basic (purely theoretical) and applied (practical). For instance, theoretical physics research exploring fundamental laws (basic) versus a study on developing a new medical device (applied) [23].
15. Structured design: Quantitative research often follows a structured research design with predefined methodologies. For example, a longitudinal study assessing the long-term effects of a drug follows a structured design to gather data over time [41].
16. Controlled setting: Studies often take place in controlled environments to minimize variables that could influence outcomes. For instance, a study assessing the effects of temperature on plant growth might occur in a controlled greenhouse [41].
17. Ends with a statistical report: Quantitative research concludes with statistical analyses and reports that present numerical findings. For example, a study on consumer behavior might conclude with statistical analyses of purchasing patterns [23].
18. Randomization present: Quantitative research often involves random sampling or random assignment to control for bias and generalize findings. For instance, in a clinical trial, participants may be randomly assigned to different treatment groups [23].
19. Follows standardized steps: Quantitative research follows standardized steps in data collection, analysis, and reporting. For example, a study adhering to established survey methodologies follows standardized steps to ensure reliability and replicability [42].
20. It explains phenomena: Quantitative research aims to explain phenomena through numerical data and statistical analyses. For instance, a study on climate change might use statistical models to explain the correlation between greenhouse gas emissions and global temperatures [42].
21. Generalization to the population is done: Quantitative research aims to generalize findings to broader populations based on statistical inference. For example, a survey conducted on a representative sample of a country's population might generalize findings to the entire population [43].
22. Data gathering is less time-consuming: Quantitative research often involves efficient data collection methods, such as surveys or experiments, that require less time compared to qualitative methods [44].
23. More structured method of data collection: Quantitative research often uses structured methods like surveys with closed-ended questions or experiments following a predefined protocol to collect data systematically and uniformly [44].
24. Review of literature done before the data collection: In quantitative research, the review of literature typically occurs before data collection to inform the development of hypotheses, study design, and research questions. This ensures that the study builds on existing knowledge and theories [30].

Table-1: Key differences between qualitative and quantitative research methodologies

| Qualitative Research methodologies | Quantitative research methodologies |
|---|---|
| 1. Naturalistic method | 1. Scientific method/positivist |
| 2. Field research | 2. Laboratory research |
| 3. Inductive reasoning/analysis | 3. Deductive reasoning/analysis |
| 4. Bottom to top approach | 4. Top to bottom approach |
| 5. Draw general conclusion from specific principles. | 5. Draw specific conclusion from general principles. |
| 6. Data are less pure in nature and more complex | 6. Data are more pure and less complex |
| 7. Data are not reliable & not valid | 7. Data are reliable and valid. |
| 8. More chance of bias in the interpretation of result | 8. Less or No bias in the interpretation of result |
| 9. Data are subjective in nature | 9. Data are objective in nature |
| 10. Data are in descriptive form | 10. Data are in numerical form |
| 11. Aim to develop concept | 11. Aim to identifying concept |
| 12. Aim to develop hypothesis & theories | 12. Aim to test hypothesis & theories |
| 13. It is a generative approach | 13. It is a confirmative approach |
| 14. Requires less sample | 14. More sample |
| 15. It is basic research | 15. Basic /Applied research |
| 16. Flexible research design | 16. Structured research design |
| 17. More sensitivity on Context | 17. Controlled setting |
| 18. Ends with descriptive report | 18. Ends with statistical report |
| 19. No randomization presence | 19. Randomization presents |
| 20. Follows non standardized steps | 20. It follows standardized steps |
| 21. It explores phenomena | 21. It explains phenomena |
| 22. No generalization to population is done. | 22. Generalization to population is done |
| 23. Data gathering is more time consuming | 23. Data gathering is less time consuming |
| 24. Use unstructured or semi structured method of data collection | 24. More structured method of data collection |
| 25. Review of literature done during or after data collection | 25. Review of literature done before data collection. |

V. CONCLUSION

This comprehensive review has shed light on the distinctive characteristics of qualitative and quantitative research methodologies, offering researchers valuable insights into their philosophical foundations, tools, and applications. By exploring the nuanced nature of qualitative research and the structured objectivity of quantitative research, the article emphasizes the complementary roles these methodologies play in advancing knowledge across disciplines. The review underscores the importance of aligning the chosen methodology with research objectives, guiding researchers in selecting appropriate data collection methods and analysis techniques.

Furthermore, the study highlights the need for a thoughtful and informed choice of methodology to ensure research rigor, validity, and avoidance of potential biases. The understanding of underlying philosophical assumptions, such as positivism for quantitative and constructivism for qualitative research, adds depth to researchers' methodological considerations. Additionally, the review advocates for the integration of both methodologies in mixed methods research, enhancing the comprehensiveness of insights.

By conducting an exhaustive literature survey from 2000 to 2024, this review provides a contemporary perspective on the key disparities between qualitative and quantitative research. It aims to serve as a valuable resource for researchers in making informed decisions and contributes to the ongoing discourse on refining research methodologies for robust scientific inquiry.

Conflict of interest: No

Acknowledgement: AIIMS Bibinagar supportive systems

Source of funding: No funding.

VI. REFERENCES

1. Slot DE, Mettes TD, Van der Weijden F. Research methods. *J Am Dent Assoc.* 2016 Apr;147(4):231-3. doi: 10.1016/j.adaj.2016.02.007.
2. Otani T. [What Is Qualitative Research?]. *Yakugaku Zasshi.* 2017;137(6):653-658. Japanese. doi: 10.1248/yakushi.16-00224-1
3. Abramson EL, Paul CR, Petershack J, Serwint J, Fischel JE, Rocha M, Treitz M, McPhillips H, Lockspeiser T, Hicks P, Tewksbury L, Vasquez M, Tancredi DJ, Li ST. Conducting Quantitative Medical Education Research: From Design to Dissemination. *Acad Pediatr.* 2018 Mar;18(2):129-139. doi: 10.1016/j.acap.2017.10.008.
4. Essentials of nursing research: methods, appraisal, and utilization Denise F Polit Essentials of nursing research: methods, appraisal, and utilization, Cheryl Tatano Beck Lipincott Williams and Wilkins 554 £24.95 0781749727 0781749727. *Nurse Res.* 2006 Jul 1;13(4):91-92. doi: 10.7748/nr.13.4.91.s11.
5. Mohanasundari S.K. Padmaja A. Evidence Based Practice—A Core Concept to Achieve Quality of Nursing Care. *IJNER.* 2018 6 (3). 295-298. DOI: [10.5958/2454-2660.2018.00071.6](https://doi.org/10.5958/2454-2660.2018.00071.6).
6. Streefkerk, R. *Qualitative vs. Quantitative Research | Differences, Examples & Methods*. Scribbr. [updated on 2023, June 22]. [Accessed on 2024 February 11, 2024. Available from <https://www.scribbr.com/methodology/qualitative-quantitative-research/>
7. Garg R. Methodology for research I. *Indian J Anaesth.* 2016 Sep;60(9):640-645. doi: 10.4103/0019-5049.190619.
8. Tenny S, Brannan JM, Brannan GD. Qualitative Study. [Updated 2022 Sep 18]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK470395/>
9. Park Y S, Konge L, Artino A R. The Positivism Paradigm of Research. *Academic Medicine.* 2019 Nov; 95(5):1. DOI: [10.1097/ACM.0000000000003093](https://doi.org/10.1097/ACM.0000000000003093)
10. Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic Analysis: Striving to Meet the Trustworthiness Criteria. *International Journal of Qualitative Methods, 16*(1). <https://doi.org/10.1177/1609406917733847>
11. Fetters MD, Curry LA, Creswell JW. Achieving integration in mixed methods designs-principles and practices. *Health Serv Res.* 2013 Dec;48(6 Pt 2):2134-56. doi: 10.1111/1475-6773.12117. Epub 2013 Oct 23.
12. Demicheli V, Di Pietrantonj C. Peer review for improving the quality of grant applications. *Cochrane Database Syst Rev.* 2007 Apr 18;2007(2):MR000003. doi: 10.1002/14651858.MR000003.pub2.
13. O'Sullivan BG, Cairns A, Gurney TM. Understanding the field of rural health academic research: a national qualitative, interview-based study. *Rural Remote Health.* 2020 Sep;20(3):6116. doi: 10.22605/RRH6116. Epub 2020 Sep 3.
14. Al-Busaidi ZQ. Qualitative research and its uses in health care. *Sultan Qaboos Univ Med J.* 2008 Mar;8(1):11-9.
15. Priya, A. Case Study Methodology of Qualitative Research: Key Attributes and Navigating the Conundrums in Its Application. *Sociological Bulletin,* 2021; 70(1). 94-110. <https://doi.org/10.1177/0038022920970318>
16. Austin Z, Sutton J. Qualitative research: getting started. *Can J Hosp Pharm.* 2014 Nov;67(6):436-40. doi: 10.4212/cjhp.v67i6.1406.
17. Wong L. Data analysis in qualitative research: a brief guide to using nvivo. *Malays Fam Physician.* 2008 Apr 30;3(1):14-20.
18. Leung L. Validity, reliability, and generalizability in qualitative research. *J Family Med Prim Care.* 2015 Jul-Sep;4(3):324-7. doi: 10.4103/2249-4863.161306.
19. Sutton J, Austin Z. Qualitative Research: Data Collection, Analysis, and Management. *Can J Hosp Pharm.* 2015 May-Jun;68(3):226-31. doi: 10.4212/cjhp.v68i3.1456.

20. Kim H, Sefcik JS, Bradway C. Characteristics of Qualitative Descriptive Studies: A Systematic Review. *Res Nurs Health*. 2017 Feb;40(1):23-42. doi: 10.1002/nur.21768. Epub 2016 Sep 30.
21. Ugwu, Chinyere. N. and Eze Val, H. U. Qualitative Research. *Idosr Journal Of Computer And Applied Sciences*.2023; 8(1):20-35. <https://www.idosr.org/qualitative-research/>
22. Vasileiou, K., Barnett, J., Thorpe, S. et al. Characterising and justifying sample size sufficiency in interview-based studies: systematic analysis of qualitative health research over a 15-year period. *BMC Med Res Methodol* 18, 148 (2018). <https://doi.org/10.1186/s12874-018-0594-7>
23. Basic Research vs. Applied Research: What's the Difference? Indeed. [updated 2023 August 1st]. [Accessed 2024 Feb 10th]. Available from: <https://www.indeed.com/career-advice/career-development/basic-research-vs-applied-research>
24. Johnson JL, Adkins D, Chauvin S. A Review of the Quality Indicators of Rigor in Qualitative Research. *Am J Pharm Educ*. 2020 Jan;84(1):7120. doi: 10.5688/ajpe7120.
25. Howarth E, Devers K, Moore G, et al. Contextual issues and qualitative research. In: Raine R, Fitzpatrick R, Barratt H, et al. Challenges, solutions and future directions in the evaluation of service innovations in health care and public health. Southampton (UK): NIHR Journals Library; 2016 May. (Health Services and Delivery Research, No. 4.16.) Essay 7. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK361256/> doi: 10.3310/hsdr04160-105
26. Doyle L, McCabe C, Keogh B, Brady A, McCann M. An overview of the qualitative descriptive design within nursing research. *J Res Nurs*. 2020 Aug;25(5):443-455. doi: 10.1177/1744987119880234. Epub 2019 Dec 18.
27. Pannucci CJ, Wilkins EG. Identifying and avoiding bias in research. *Plast Reconstr Surg*. 2010 Aug;126(2):619-625. doi: 10.1097/PRS.0b013e3181de24bc.
28. Polit DF, Beck CT. Generalization in quantitative and qualitative research: myths and strategies. *Int J Nurs Stud*. 2010 Nov;47(11):1451-8. doi: 10.1016/j.ijnurstu.2010.06.004.
29. Jamshed S. Qualitative research method-interviewing and observation. *J Basic Clin Pharm*. 2014 Sep;5(4):87-8. doi: 10.4103/0976-0105.141942.
30. Paré G, Kitsiou S. Chapter 9 Methods for Literature Reviews. In: Lau F, Kuziemsky C, editors. *Handbook of eHealth Evaluation: An Evidence-based Approach* [Internet]. Victoria (BC): University of Victoria; 2017 Feb 27. Available from: <https://www.ncbi.nlm.nih.gov/books/NBK481583/>
31. Fiske W D, Fiske T S. Laboratory Studies. *Encyclopedia of Social Measurement*. Elsevier, 2005; Pages 435-439. ISBN 9780123693983. <https://www.sciencedirect.com/science/article/pii/B0123693985004072>
32. Barroga E, Matanguihan GJ, Furuta A, Arima M, Tsuchiya S, Kawahara C, Takamiya Y, Izumi M. Conducting and Writing Quantitative and Qualitative Research. *J Korean Med Sci*. 2023 Sep 18;38(37):e291. doi: 10.3346/jkms.2023.38.e291.
33. Stevens KB. From top to bottom: gridded human population estimates in data-poor situations. *Rev Sci Tech*. 2023 May;42:111-119. English. doi: 10.20506/rst.42.3354.
34. Sheard J, *Quantitative data analysis, Research Methods (Second Edition)*, Chandos Publishing, 2018. 429-452, ISBN 9780081022207. <https://www.sciencedirect.com/science/article/pii/B9780081022207000182>
35. Simundić AM. Bias in research. *Biochem Med (Zagreb)*. 2013;23(1):12-5. doi: 10.11613/bm.2013.003.
36. Surucu L, Maslakci A. Validity and Reliability in Quantitative Research. *Business And Management Studies An International Journal*, 2020 Oct. 8(3):2694-2726. DOI: [10.15295/bmij.v8i3.1540](https://doi.org/10.15295/bmij.v8i3.1540)
37. Mohajan H K. Quantitative Research: A Successful Investigation in Natural and Social Sciences. *Journal of Economic Development Environment and People*. 2021 Jan; 9(4). DOI: [10.26458/jedep.v9i4.679](https://doi.org/10.26458/jedep.v9i4.679)
38. Bauer G R, Churchill S M, Mahendran M, Walwyn C, Lizotte D, -Rueda A A, V. Intersectionality in quantitative research: A systematic review of its emergence and applications of theory and methods. *SSM - Population Health*. 2021; 14. ISSN 2352-8273. <https://www.sciencedirect.com/science/article/pii/S2352827321000732>
39. Barroga E, Matanguihan GJ. A Practical Guide to Writing Quantitative and Qualitative Research Questions and Hypotheses in Scholarly Articles. *J Korean Med Sci*. 2022 Apr 25;37(16):e121. doi: 10.3346/jkms.2022.37.e121.
40. Mohanasundari S.K. Sonia M. The Relationship between components of sample size Estimate and Sample Size. *AJNER*. 2022; 12(3): 317-324. DOI: 10.52711/2349-2996.2022.00066.
41. Žukauskas P, Vveinhardt J, Andriukaitienė R. Structure of Research Design: Expert Evaluation [Internet]. *Management Culture and Corporate Social Responsibility*. InTech; 2018. Doi: 10.5772/intechopen.70630.
42. Lakshman M, Sinha L, Biswas M, Charles M, Arora NK. Quantitative vs qualitative research methods. *Indian J Pediatr*. 2000 May;67(5):369-77. doi: 10.1007/BF02820690.
43. Nikolopoulou, K. *What Is Generalizability? | Definition & Examples*. Scribbr. [Updated on 2023, March 03]. [Accessed on 2024 Feb 12]. Available from: <https://www.scribbr.com/research-bias/generalizability/>
44. Saddler D. A comparison of quantitative and qualitative research terms. *Gastroenterol Nurs*. 2007 Jul-Aug;30(4):314-6. doi: 10.1097/01.SGA.0000287208.74720.77.