

How to Guide Thesis

A Handbook for
Post-Graduate Thesis Supervisors



Bangladesh Medical University

How to Guide Thesis



Bangladesh Medical University

Shahbag, Dhaka-1000, Bangladesh

How to Guide Thesis A Handbook for Post-Graduate Thesis Supervisors



Bangladesh Medical University
Dhaka, Bangladesh

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Suggestions for Improvement of this Handbook

The Bangladesh Medical University (BMU) authority welcomes comments, suggestions, and constructive criticism for improving this handbook. Such feedback will be carefully considered in preparing future editions. Readers are encouraged to send their suggestions to the author via email using the subject line **“Suggestion for Handbook.”**

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FOREWORD

Professor Dr. F. M. Siddiqui

Vice-Chancellor

Bangladesh Medical University

It gives me immense pleasure to introduce *How to Guide Thesis: A Handbook for Postgraduate Thesis Supervisors*. This publication marks a significant milestone in our continuing efforts to strengthen postgraduate medical education, research quality, and academic excellence at Bangladesh Medical University (BMU).

Research forms the foundation of evidence-based healthcare, and the thesis is a cornerstone of postgraduate medical training. Through the process of conducting research, postgraduate students develop critical thinking, analytical skills, scientific reasoning, and the ability to generate knowledge that contributes to improving health systems and patient care. Effective supervision is therefore indispensable in ensuring that this process is both academically rigorous and professionally rewarding.

Traditionally, thesis supervision has often depended on individual experience and informal practices. While such experience remains valuable, the increasing complexity of modern research demands a more structured and standardized approach. This handbook responds to that need by providing practical guidance, clear expectations, and contextually relevant recommendations for supervisors and students alike. It serves as a comprehensive resource for planning, implementing, monitoring, and successfully completing postgraduate research.

The handbook addresses the full spectrum of thesis supervision, from identifying meaningful research questions and selecting appropriate methodologies to maintaining scientific integrity and ensuring high standards of thesis writing and presentation. Its emphasis on research ethics, responsible data management, plagiarism prevention, publication ethics, and compliance with ethical review procedures is particularly relevant in today's rapidly evolving academic environment. Beyond guiding research projects, supervisors play a pivotal role in nurturing professionalism, intellectual curiosity, ethical conduct, and a culture of scholarly excellence among future researchers and healthcare leaders.

I commend the authors, contributors, and editorial team for their dedication and hard work in developing this valuable resource. Their efforts reflect BMU's commitment to strengthening research capacity and fostering a vibrant academic culture. I also gratefully acknowledge the technical support provided by the World Health Organization Country Office for Bangladesh, whose collaboration has enhanced the quality and global relevance of this handbook.

As Vice-Chancellor, I firmly believe that high-quality research is essential to advancing healthcare and improving health outcomes for the people of Bangladesh. Every well-conducted and well-supervised thesis contributes not only to the growth of medical science but also to the development of evidence-informed policies, improved clinical practice, and stronger health systems.

I therefore encourage all thesis supervisors, faculty members, and postgraduate students to use this handbook as a practical guide and a reference throughout the research process. I am confident that this publication will make a lasting contribution to enhancing the quality of postgraduate research, strengthening supervisory practices, and promoting a robust research culture within BMU and beyond.

I congratulate everyone involved in the preparation of this handbook and wish it every success in supporting the next generation of researchers and academic leaders.



Professor Dr. F. M. Siddiqui

FOREWORD

Professor Dr. Md. Abul Kalam Azad

Pro Vice Chancellor (Administration)

Bangladesh Medical University

High-quality research supervision is fundamental to the success of postgraduate medical education and the advancement of scientific knowledge. Effective supervisors do more than oversee thesis completion; they mentor young researchers, foster critical thinking, uphold scientific integrity, and guide students in generating evidence that can contribute to improving healthcare and public health. It is therefore a pleasure to introduce *How to Guide Thesis: A Handbook for Postgraduate Thesis Supervisors*, an important resource developed to strengthen the quality and consistency of thesis supervision at Bangladesh Medical University (BMU).

Research is one of the core missions of any university. The quality of research produced by postgraduate students is closely linked to the quality of guidance they receive throughout the research process. While many supervisors acquire their skills through experience and practice, the increasing complexity of modern research demands a more structured and systematic approach to supervision. This handbook addresses that need by providing practical guidance for supervisors at every stage of the thesis journey.

The handbook covers the full spectrum of postgraduate research, from identifying research problems and formulating research questions to reviewing literature, selecting appropriate study designs, collecting and analyzing data, presenting results, and preparing the final thesis. It also addresses essential topics such as research ethics, responsible data management, plagiarism prevention, scientific writing, publication practices, and effective communication of research findings. By bringing these elements together in a single resource, the handbook provides a practical framework for ensuring high standards in postgraduate research.

From the perspective of Research and Development, this initiative represents an important step toward strengthening the University's research culture and enhancing institutional research capacity. Consistent and high-quality supervision contributes not only to better theses but also to improved research productivity, stronger publication outputs, greater research collaboration, and the development of future academic leaders. Investments in research capacity building are investments in the long-term growth and reputation of the University.

I am particularly encouraged by the collaborative approach adopted in developing this handbook. The contributions of faculty members from diverse disciplines, combined with feedback obtained through supervisory training sessions, have helped ensure that the guidance provided is practical, relevant, and responsive to the needs of supervisors and students alike.

I extend my sincere appreciation to the authors, contributors, and members of the Editorial Board for their dedication and hard work in producing this valuable resource. I also gratefully acknowledge the technical support provided by the World Health Organization Country Office for Bangladesh, whose collaboration has enhanced the quality and international relevance of this publication.

I hope that this handbook will serve as a trusted companion for thesis supervisors across the University and beyond. By promoting good supervisory practices, strengthening research quality, and supporting academic excellence, it has the potential to make a lasting contribution to postgraduate education and research in Bangladesh.



Professor Dr. Md. Abul Kalam Azad

FOREWORD

Professor Dr. Md. Mujibur Rahman Hawlader

Pro Vice Chancellor (Research & Development)

Bangladesh Medical University

It gives me great pleasure to introduce *How to Guide Thesis: A Handbook for Postgraduate Thesis Supervisors*, an important academic resource that reflects Bangladesh Medical University's commitment to strengthening research quality, research capacity, and scholarly excellence.

Research is one of the fundamental pillars of a university. Through research, new knowledge is generated, existing practices are challenged and improved, and solutions are developed for the complex health problems faced by society. Within postgraduate medical education, the thesis serves as a vital platform through which students acquire the skills necessary to become independent researchers, critical thinkers, and contributors to evidence-based healthcare. The quality of this process, however, depends substantially on the quality of supervision provided throughout the research journey.

Effective research supervision requires more than technical expertise in a particular discipline. It involves guiding students in identifying important research questions, applying appropriate methodologies, maintaining scientific integrity, interpreting findings critically, and communicating results effectively. This handbook has been developed to support supervisors in fulfilling these responsibilities with greater confidence, consistency, and effectiveness.

The handbook provides practical guidance across all stages of thesis development, from conceptualization and protocol preparation to data collection, analysis, thesis writing, and dissemination of findings. It also addresses key issues related to research ethics, plagiarism prevention, scientific writing, publication practices, and quality assurance. By promoting structured and evidence-based supervision, the handbook contributes to enhancing the overall quality and impact of postgraduate research.

From the perspective of Research and Development, this initiative represents an important investment in strengthening the University's research ecosystem. High-quality supervision leads to better research outputs, stronger publications, greater opportunities for collaboration, and improved translation of research findings into policy and practice. Building supervisory capacity is therefore an essential component of developing a vibrant research culture and advancing institutional research excellence.

I am particularly encouraged by the collaborative efforts that have gone into the development of this handbook. The incorporation of feedback from faculty members across disciplines has helped ensure that the guidance provided is practical, relevant, and responsive to the needs of supervisors and students within diverse academic settings.

I hope that this handbook will serve as a valuable reference for supervisors, researchers, and postgraduate students throughout the University. By supporting high-quality supervision and fostering a culture of scientific rigor, it has the potential to make a meaningful contribution to the advancement of research and innovation at Bangladesh Medical University and beyond.

I wish this publication every success and trust that it will contribute significantly to strengthening postgraduate research and academic scholarship in Bangladesh.



Professor Dr. Md. Mujibur Rahman Hawlader

FOREWORD

Professor Dr. Md. Nazrul Islam

Pro Vice Chancellor (Academic)

Bangladesh Medical University

It gives me great pleasure to introduce *How to Guide Thesis: A Handbook for Postgraduate Thesis Supervisors*, a timely and valuable resource developed to strengthen the quality of postgraduate education and research supervision at Bangladesh Medical University (BMU). The publication of this handbook reflects the University's continuing commitment to academic excellence, scholarly development, and the promotion of high-quality research across all disciplines.

The thesis is a fundamental component of postgraduate education. It provides students with an opportunity to develop critical thinking, scientific reasoning, analytical skills, and the ability to generate evidence that contributes to knowledge and practice. However, the success of this process depends greatly on effective supervision. Supervisors play a pivotal role in guiding students through the complexities of research while fostering intellectual curiosity, academic integrity, and professional growth.

In an increasingly competitive and knowledge-driven academic environment, research supervision requires more than subject expertise alone. It demands a clear understanding of research methodology, ethical standards, scientific communication, and effective mentorship. This handbook addresses these needs by offering practical guidance throughout the entire thesis process, from identifying research problems and formulating research questions to designing studies, analyzing data, interpreting findings, and preparing a well-structured thesis.

One of the notable strengths of this handbook is its emphasis on both academic rigor and practical applicability. In addition to methodological guidance, it addresses important topics such as research ethics, plagiarism prevention, responsible data management, scientific writing, publication practices, and effective communication between supervisors and students. Such guidance is essential for maintaining academic standards and ensuring the quality and credibility of postgraduate research.

From an academic perspective, this handbook contributes directly to the University's mission of enhancing teaching, learning, and research excellence. By promoting a more structured and consistent approach to supervision, it will help strengthen research competencies among postgraduate students and support supervisors in fulfilling their important academic responsibilities. Ultimately, the benefits will extend beyond individual theses to the broader development of a strong research and learning culture within the University.

I also acknowledge with appreciation the technical support provided by the World Health Organization Country Office for Bangladesh. Such collaboration contributes to aligning our academic practices with internationally recognized standards and reinforces our commitment to continuous improvement in postgraduate education and research.

I am confident that this handbook will serve as a valuable reference for supervisors, faculty members, and postgraduate students. Its practical guidance and academic insights will contribute significantly to improving the quality of postgraduate research and strengthening academic standards at Bangladesh Medical University and beyond.

I congratulate all those involved in the development of this important publication and wish it every success in advancing research excellence and academic scholarship.



Professor Dr. Md. Nazrul Islam

FOREWORD

Professor Dr. Nahreen Akhtar

Treasurer

Bangladesh Medical University

It is a pleasure to welcome the publication of *How to Guide Thesis: A Handbook for Postgraduate Thesis Supervisors*. This handbook represents an important institutional resource that will support the continuous improvement of postgraduate education and research at Bangladesh Medical University (BMU).

Universities invest in many forms of academic development, including infrastructure, technology, laboratories, libraries, and human resources. Equally important, however, is investment in academic systems and processes that ensure quality, consistency, and excellence. Effective thesis supervision is one such area. By providing clear guidance and practical tools for supervisors, this handbook contributes to building a stronger and more sustainable research environment within the University.

High-quality supervision not only improves individual research projects but also enhances the overall efficiency and effectiveness of postgraduate training. When supervisors and students share a common understanding of expectations, responsibilities, ethical standards, and research procedures, the quality of academic outputs improves significantly. This handbook therefore serves as a valuable reference that can help reduce avoidable delays, strengthen research management, and promote good scholarly practices.

I am particularly pleased to note that the handbook addresses practical aspects of supervision, including planning research activities, monitoring student progress, ensuring ethical compliance, maintaining research records, and supporting the preparation of high-quality theses and scientific publications. Such guidance is essential for maintaining academic standards and maximizing the value of the time, effort, and resources invested in postgraduate research.

The development of this handbook reflects the dedication and collaborative efforts of faculty members, academic leaders, and contributors from across the University. It demonstrates BMU's commitment to strengthening institutional capacity and creating an enabling environment for research and innovation. I also gratefully acknowledge the technical support provided by the World Health Organization Country Office for Bangladesh, whose collaboration has enriched the quality and usefulness of this publication.

As Treasurer, I recognize that investments in academic quality yield long-term benefits for institutions, students, and society. A well-supervised research project contributes not only to the educational development of a student but also to the generation of knowledge that can inform healthcare practice, policy, and future research. Strengthening supervision today is therefore an investment in the future of medical science and healthcare in Bangladesh.

I congratulate the authors, editors, and all those involved in the preparation of this handbook. I am confident that it will serve as a valuable resource for supervisors and postgraduate students and will contribute meaningfully to the continued advancement of research excellence at Bangladesh Medical University.



Professor Dr. Nahreen Akhtar

Acknowledgement

First and foremost, we express our deepest gratitude to all our past and present students, who have been the primary inspiration behind the development of this handbook. Their relentless efforts in pursuing academic excellence, continuous search for appropriate guidance, and tireless dedication to research and scholarly activities highlighted the need for a comprehensive supervisory guide. Their experiences, challenges, and perseverance motivated us to undertake the preparation of this handbook, which we hope will serve future generations of postgraduate students and supervisors alike.

This handbook would not have attained its present form without the engagement, commitment, and support of many colleagues at Bangladesh Medical University (BMU). We extend our sincere gratitude to all who contributed to its development.

We are deeply grateful to the 110 professors from various departments of the University who participated in the supervisory training sessions. Their insightful observations and constructive feedback, drawn from diverse clinical and academic disciplines, were carefully considered in developing the content of this handbook and have contributed significantly to its relevance and practical value.

We wish to place on record our profound gratitude to the present administrative leadership of Bangladesh Medical University, particularly our honorable Vice Chancellor, Professor Dr. F. M. Siddiqui, for his valuable support and encouragement in the completion and publication of this handbook.

We are equally indebted to Professor Dr. Md. Shahinul Alam, Chairman, Department of Hepatology, whose visionary leadership as the then Vice Chancellor of the University provided the institutional foundation and wholehearted support under which this handbook was conceived and developed.

We gratefully acknowledge the honorable Pro Vice Chancellor (Administration), Professor Dr. Md. Abul Kalam Azad, for his kind cooperation and support throughout the preparation of this handbook. We also express our sincere appreciation to Professor Dr. Md. Mujibur Rahman Hawlader, Pro Vice Chancellor (Research and Development), Professor Dr. Md. Nazrul Islam, Pro Vice Chancellor (Academic) and Professor Dr. Nahreen Akhtar, Treasurer, for their encouragement, guidance, and support in accomplishing this important task.

We sincerely thank the honorable Deans and Course Directors of all faculties of Bangladesh Medical University for their continued support throughout the editorial process. Their active involvement across the faculties helped ensure that the handbook addresses the supervisory needs of different disciplines and reflects the broader academic context of postgraduate medical education at BMU.

Finally, we express our heartfelt appreciation to Professor Dr. Fariha Haseen, Dr. Bijoy Kumer Paul, and Dr. Md. Maruf Haque Khan of the Department of Public Health and Informatics for their valuable assistance and unwavering support in preparing this handbook. Their contributions have been indispensable and are deeply appreciated.

Finally, we extend our thanks to all colleagues and well-wishers whose direct and indirect support made this work possible.



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Preface

The advancement of medical science depends on the generation of knowledge, the critical appraisal, and the application of high-quality evidence. In postgraduate medical education, the thesis is one of the most important platforms through which future clinicians, academicians, and researchers acquire the skills necessary to contribute to evidence-based practice. It is not merely an academic requirement; rather, it is a structured process that cultivates scientific thinking, analytical reasoning, ethical research conduct, and lifelong engagement with inquiry.

Over the past decade, the landscape of health research has undergone a profound transformation. The rapid expansion of scientific literature, the emergence of advanced statistical and analytical methods, increasing emphasis on research ethics and integrity, the widespread availability of digital research tools, and the growing expectation for publication-quality research have collectively reshaped the way postgraduate theses are conceived, conducted, and reported. These developments have created new opportunities, but they have also introduced new challenges for both students and supervisors.

This book, *How to Guide Thesis*, has been prepared to serve as a practical and comprehensive resource for thesis supervisors, co-supervisors, postgraduate students and academic leaders involved in research training. Building upon established principles of scientific methodology, the handbook integrates contemporary approaches to protocol development, literature review, study design, data management, statistical analysis, scientific writing, publication planning, and research dissemination. Particular attention has been given to areas that frequently challenge postgraduate researchers, including the formulation of research questions and hypotheses, sample size determination, the selection of appropriate study designs, the management of bias and confounding, the interpretation of statistical findings, the preparation of tables and figures, ethical considerations, and the avoidance of plagiarism and research misconduct.

Unlike many traditional research manuals that focus solely on technical procedures, this guide emphasizes the entire thesis journey—from identifying a meaningful research problem to communicating findings that can influence clinical practice, public health policy, and future research. The objective is not simply to help students complete a thesis, but to enable them to conduct scientifically sound, ethically responsible, and socially relevant research.

The preparation of this handbook has benefited from the collective experience of senior faculty members, researchers, statisticians, epidemiologists, clinicians, and educators across diverse disciplines. It reflects the multidisciplinary nature of modern health research and addresses the needs of trainees from medicine, surgery, pediatrics, preventive and social medicine, dentistry, nursing, medical technology, basic and paraclinical sciences, and allied health disciplines.

We are grateful to all individuals and institutions who have contributed to strengthening research capacity and postgraduate education in Bangladesh. Their commitment to fostering a culture of scientific excellence has helped shape the principles embodied in this handbook.

This book is intended to function as a practical companion rather than a rigid rulebook. Research methodologies, reporting standards, and analytical techniques continue to evolve, and supervisors and students must remain adaptable, curious, and committed to continuous learning. We therefore encourage readers to use this handbook as a foundation upon which they can build discipline-specific expertise and respond effectively to emerging scientific challenges.

As Bangladesh continues to strengthen its academic and healthcare institutions, the quality of postgraduate research will play an increasingly important role in addressing national health priorities and contributing to global scientific knowledge. Every well-conducted thesis has the potential to improve understanding, inform decision-making, and ultimately contribute to

better health outcomes. We hope that this handbook supports that vision by empowering researchers and supervisors to pursue excellence in scientific inquiry and evidence generation.



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On behalf of the Editorial Board

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List of Abbreviations

Abbreviation	Full Form
ADA	American Diabetes Association
ASD	Autism Spectrum Disorder
BMJ	British Medical Journal
BMD	Bone Mineral Density
BMI	Body Mass Index
BMU	Bangladesh Medical University
BP	Blood Pressure
CAPI	Computer-Assisted Personal Interviewing
CBT	Cognitive Behavioural Therapy
CDC	Centres for Disease Control and Prevention
CDSR	Cochrane Database of Systematic Reviews
CI	Confidence Interval
CONSORT	Consolidated Standards of Reporting Trials
COPE	Committee on Publication Ethics
COPD	Chronic Obstructive Pulmonary Disease
COVID-19	Coronavirus Disease 2019
CPR	Cardiopulmonary Resuscitation
CTRI	Clinical Trials Registry of India
CVD	Cardiovascular Disease
DASS-21	Depression, Anxiety and Stress Scale – 21 items
DNA	Deoxyribonucleic Acid
EM	Expectation–Maximization
FBG	Fasting Blood Glucose
FFQ	Food Frequency Questionnaire
GPAQ	Global Physical Activity Questionnaire
GPS	Global Positioning System
GS	General–Specific
H ₀	Null Hypothesis
H ₁	Alternative Hypothesis
HbA1c	Glycated Haemoglobin
HIV	Human Immunodeficiency Virus
ICMJE	International Committee of Medical Journal Editors

Abbreviation	Full Form
IDF	International Diabetes Federation
IMRD	Introduction, Methods, Results, and Discussion
IQR	Interquartile Range
IRB	Institutional Review Board
ITT	Intention-to-Treat
IU	International Unit
MAR	Missing at Random
MCAR	Missing Completely at Random
MEDLINE	Medical Literature Analysis and Retrieval System Online
MeSH	Medical Subject Headings
MLE	Maximum Likelihood Estimation
MNAR	Missing Not at Random
MS	Microsoft
NSAIDs	Non-Steroidal Anti-Inflammatory Drugs
OPD	Out-patient Department
PICOT	Population, Intervention, Comparison, Outcome, Time
PPBG	Post-prandial Blood Glucose
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
RAS	Renin–Angiotensin System
RBG	Random Blood Glucose
RCT	Randomised Controlled Trial
SD	Standard Deviation
SE	Standard Error
SGLT2	Sodium–Glucose Cotransporter 2
SMART	Specific, Measurable, Achievable, Relevant, Time-bound
STROBE	Strengthening the Reporting of Observational Studies in Epidemiology
UGC	University Grants Commission
ViDA	Vitamin D Assessment Study
VITAL	Vitamin D and Omega-3 Trial
WHO	World Health Organization
WHO ICTRP	World Health Organization International Clinical Trials Registry Platform

Executive Summary

Overview

At Bangladesh Medical University (BMU), postgraduate supervisors play a central role in guiding students through the protocol and thesis preparation process.¹ To support supervisors in fulfilling this responsibility, the *How to Guide Thesis* has been developed as a practical handbook aligned with BMU academic regulations and postgraduate training standards.

It covers all key phases of supervision, from protocol development to publication, and provides practical guidance for effective mentoring.

Key themes and structure

The guide is divided into several sections, each offering step-by-step guidance on essential aspects of supervision. These include:

Preparation for supervision

- Familiarization with supervision responsibilities and academic expectations.
- Understanding supervision workload, frequency of meetings, and university-provided resources.
- Reviewing past theses to gain insights into expected research quality.

Collaboration with co-supervisors

- Guidelines for effective teamwork in shared supervision arrangements.²
- Strategies to manage differing opinions and avoid conflicting guidance for students.
- Establishing clear areas of expertise among supervisors.

Conducting supervision meetings

- Setting expectations in the initial meeting, including thesis scope, authorship agreements, and progress tracking.
- Structuring interim and follow-up meetings to ensure students stay on track.
- Maintaining effective communication and meeting documentation.

Delivering effective feedback

- Guidelines for providing constructive, detailed, and actionable feedback.
- Emphasizing content, structure, and coherence of arguments rather than stylistic issues in early drafts.
- Encouraging students to incorporate feedback systematically.

Guiding the research process

- Developing a strong research question using the PICOT model (Population, Intervention, Comparison, Outcome, Time) for trials.³

- Framing clear research objectives that align with the study's theoretical framework.
- Ensuring SMART (Specific, Measurable, Achievable, Relevant, Time-bound) objectives for clarity and feasibility.⁴

Assisting with literature review

- Teaching students how to search, evaluate, and structure literature reviews.
- Using library databases, search strategies, and reference management tools.
- Encouraging logical structuring and progressive narrowing of research focus.

Defining supervisor-student boundaries

- Differentiating between student-led and supervisor-assisted tasks.
- Maintaining academic integrity by offering guidance rather than completing tasks.
- Setting clear expectations for involvement in research execution, analysis, and interpretation.

Formalizing agreements and expectations

- Establishing documented agreements on supervision frequency, feedback formats, and communication modes.
- Addressing challenges through renegotiable supervisor-student contracts.
- Outlining guidelines for joint authorship and project resource allocation.⁵

Writing the thesis

- Writing the thesis using the IMRD format (Introduction, Methods, Results, and Discussion) ⁶

Box 1. Structure of a scientific paper: The IMRD format

IMRD stands for Introduction, Methods, Results, and Discussion, a standard format commonly used in scientific writing:

- Introduction: Provide a brief description of the research background, rationale, and research question or hypothesis or objective.
- Methods: Clearly outlines the research design, participants, procedures, instruments, and analytical techniques.
- Results: Presents key findings objectively through texts, tables, and figures without interpretation.
- Discussion: Interprets the findings, explains their significance, compares with existing literature, acknowledges limitations, and suggests implications for future research.

- References should follow the **Vancouver referencing style**.

Preparation for publication

The supervisor will guide the student in manuscript preparation, selecting an appropriate journal, submitting the manuscript, effectively responding to reviewers' comments, and completing all necessary steps to achieve successful publication.

Conclusion

The *How to Guide Thesis* serves as a practical resource for both new and experienced thesis supervisors. It outlines key procedural aspects of supervision while also presenting best practices for fostering a productive, ethical, and well-structured research environment. The guide supports supervisors in organising their mentoring responsibilities and ensures that postgraduate students conduct and complete their research in accordance with the academic standards of Bangladesh Medical University (BMU). By clarifying expectations for both supervisors and students, the guide contributes to the production of high-quality scholarly work and promotes professional development throughout the research process.

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Section 1. Supervising the Thesis: General Rules

1.1 Introduction

Supervising students can be one of the most fulfilling aspects of an academic career. It offers an opportunity to work closely with postgraduate students over an extended period, support their development as researchers, and contribute to their academic growth. ¹ If you are new to supervising students, this guide is intended to assist you in this role.

This guide presents general information for novice supervisors in residency/non-residency programmes. It is organised to provide helpful insights at different stages of the thesis supervision process. Each phase begins with a brief introduction, followed by a checklist, potential tools, and pointers to further information, where applicable. ¹

Please note that the information in this guide may require adjustments or extensions to align with the specific requirements of your academic discipline or the thesis level you supervise.

1.2 General Characteristics of Supervisory Practice

Effective supervision plays a crucial role in the academic and professional success of postgraduate students. In the context of Bangladesh, where the higher education system is evolving to meet global standards, effective supervisory practices are essential. A supervisor should:

1. Inspire and motivate: Aim to inspire, motivate, and guide students to achieve their full scholarly potential while nurturing their intellectual curiosity and research skills.
2. Provide clear academic guidance for thesis: Guide students through the academic requirements of their residency/non-residency programme, ensuring they understand the expectations at each stage, from research protocol development to thesis submission.
3. Create a supportive environment: Foster a work environment that is both supportive and challenging, encouraging students to engage deeply with their discipline while learning essential research methodologies, concepts, and academic culture.
4. Offer fair, honest, and constructive feedback: Provide timely, clear, and honest feedback on students' research progress, focusing on their strengths while identifying areas for improvement. Ensure feedback is constructive and aimed at enhancing the quality of their work.²
5. Promote high-quality research and recognition: Encourage students to pursue high-quality and impactful research. Support them in disseminating their findings through academic publications, conferences, and seminars, ensuring

they receive appropriate recognition for their work.

6. Introduce professional networks: Facilitate the student's integration into the broader academic and professional community by introducing them to relevant networks, conferences, and scholars within their field.
7. Emphasize academic integrity: Instil a strong sense of academic integrity, stressing the importance of ethical research practices, avoiding plagiarism, and adhering to professional standards.³
8. Address emerging problems and challenges with compassion and clarity: Address emerging challenges with compassion and clarity by promptly handling academic, personal, or administrative issues with empathy, ensuring fair and well-communicated solutions that prioritise student well-being. Additionally, supervisors must understand the local research context in Bangladesh, acknowledging limitations in funding, resource access, and technological constraints, and proactively assisting students in navigating these barriers through practical solutions and alternative approaches.
9. It is strongly recommended that all supervisors have a clearly defined area of research expertise, which will contribute to the university's growth in knowledge generation and academic excellence.
10. During the first week of Phase B admission in the residency course or any other designated phase for thesis work, the Chairman or Head of the Department will share a list of potential supervisors along with their specific research areas to the students. This list will be prepared in consultation with the department's potential supervisors. Based on this list, each student will submit a wishlist of three preferred research areas related to their proposed thesis topic. By the second week, the Chairman will convene a meeting with all supervisors to assign students to supervisors, taking into account students' preferences. This process ensures that students have the opportunity to pursue their preferred field of research and select a supervisor aligned with their academic interests.
11. A supervisor will dedicate at least 3% of their official working time to supervising each student.
12. Preparing for supervision
 - Define your research areas in which students may be assigned thesis topics.
 - Careful planning is the first step to effective supervision.
 - Get to know about the programme's formal supervision requirements, duties and responsibilities as a supervisor.
 - Additionally, familiarize yourself with the distinctions between a poor, average, and outstanding thesis in the academic programme.
 - Search for preexisting documents, such as guides for students or supervisors specific to the programme.
 - Learn the university rules about

- How many students are you expected to supervise?
- Recommended frequency of supervision meetings.
- Key milestones throughout the supervision period include submission deadlines for the research protocol, literature review, and final thesis, as well as any scheduled presentation dates.
- Responsibilities of supervisors and students of the residency programme.
- Opportunity for co-supervision (one co-supervisor, preferably a junior faculty member, may be assigned by the supervisor).
- Guidelines governing authorship on research publications from research projects leading to a thesis within your department.
- Review a range of previous theses (a centralized collection may be accessible for this purpose) to familiarize yourself with the types of projects undertaken and the structure and format of a thesis.
- Identify the resources offered by the university to support students facing obstacles, such as counselling services, writing assistance, and statistical aid.

1.3 Collaborating with a Co-Supervisor

1. Co-supervision is a collaborative method in which supervisors share the responsibility for guiding a student.⁴
2. Co-supervision allows inexperienced supervisors to acquire training, mentorship, and assistance from experienced supervisors.⁴
3. However, co-supervision may occasionally bring certain challenges. Differences in perspectives and feedback among co-supervisors can sometimes create confusion for students or place them in a position of balancing varied expectations. To help minimise such situations, it is helpful for supervisors to maintain open communication and collaboratively reach a shared understanding regarding the student's progress and future direction. Key considerations include-
 - Define the specific areas of expertise for each supervisor.
 - Establish a mutual understanding of the co-supervision style.
 - Determine a shared approach for addressing varying opinions and feedback.

1.4 Supervision Meeting

1.4.1 Supervision meeting arrangement

Supervision meetings serve as platforms for evaluating progress, addressing concerns,

resolving disputes, and determining the direction of research projects. ¹

A supervision meeting will be held in the **third week of every alternate month**, during which students and all supervisors will discuss the progress of the student's thesis work.

The co-supervisor will be responsible for maintaining documentation and preparing a progress report in a prescribed format based on the student's research progress. The supervisor will preserve this progress report, and a copy will be submitted to the Chairman/Head of the department.

The student will also prepare a progress report summarising activities since the previous meeting and submit it to the supervisor.

In addition to this formal monthly meeting, the supervisor and co-supervisor should maintain regular contact with the student to facilitate and support ongoing research activities.

1.4.2 The initial supervision meeting

- a) The primary purpose of the initial supervision meeting is to establish a professional partnership, clarify expected outcomes, and set supervision parameters. (Annex 1)
- b) Students and supervisors should discuss their respective roles and expected outcomes during this meeting.
- c) Supervisors expect students to work independently, take responsibility for their thesis, show genuine interest in their research topic, and stay committed to the research process.
- d) Another area that should be addressed during the initial meeting is the allocation of authorship for publications resulting from the research.
- e) Students should also prepare a manuscript derived from the thesis for journal submission.
- f) It is imperative to conclude the meeting by discussing plans for the subsequent meeting and ensuring a comprehensive understanding of the tasks to be accomplished during the interim period. Tasks that may be assigned before the next meeting include:
 - i. Creating a thesis timeline that outlines key milestones (e.g., submission of literature review, research protocol, and thesis).
 - ii. Literature search.
 - iii. Familiarize oneself with MS Word reference, Mendeley, EndNote, or other referencing software.
 - iv. Format documents, including styles and headings, for the literature review, research protocol, and thesis.
- g) Reviewing two or three theses from previous years, paying close attention to: Structure, Development of the rationale, Format, Referencing, and Gaps.

- h) Preparing a one-page document to bring to the next meeting, which should include:
 - A paragraph outlining current ideas for the study.
 - A paragraph explaining the study's significance.
 - Any questions or concerns.

1.4.3 Interim period between supervision meetings

- a) Students will have varying needs for assistance between meetings.
- b) During the initial meeting, it is crucial to establish an agreement regarding the frequency and mode of contact between meetings (e.g., the acceptability of phone calls and emails).
- c) Prior to the upcoming meeting, make sure that:
 - You have received the report of the previous meeting signed by the students and the co-supervisor.
 - Any actions you are responsible for, as outlined in the meeting summary, have been fulfilled.
 - You have taken a quick look at any essential articles or materials provided by the student.

1.4.4 Upcoming supervision meetings

- a) Unless otherwise specified, the prior meeting summary is a valuable starting point for each meeting.
- b) Students provide written updates on their activities and should feel encouraged to ask questions or express any concerns about the project or their progress.
- c) Subsequently, the current status of the research should be assessed, and discussions should focus on the necessary steps to keep it on track.
- d) After each meeting, students and supervisors should collaborate to define tasks to be completed before the next meeting and request a meeting report to document the discussion.

1.5 Delivering Feedback

1. Offering feedback to students regarding their work and progress is a fundamental aspect of supervision.
2. Feedback can be provided through formal written comments on drafts and informal input during meetings, which may be verbal or written.
3. Every supervisory meeting should include informal input, and it is essential to evaluate project progress compared to the established timeline.
4. Feedback should acknowledge achievements and address areas for improvement or potential delays, focusing on reaching an agreement on how to resolve concerns.

5. Students typically prefer direct and actionable feedback. Feedback should be clear, specific, detailed, descriptive, and centred on the work rather than the individual.
6. Feedback on early drafts should focus on organization, content, coverage, and relevance rather than writing style. ²

1.6 References

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Section 2. Supervising the Thesis: Guiding the Thesis

2.1 Supervisor Guidance for Thesis Development

The supervisor plays a key role in helping students transform their initial research ideas into a clear, feasible thesis project that can be completed within the time and resource constraints of the residency programme.

The research protocol is an essential document because it outlines how the student plans to conduct the study during the thesis period. A well-prepared protocol serves as a roadmap for the entire thesis and should therefore be carefully reviewed and refined before the research begins.

One of the most important components of a thesis protocol is the title. The title introduces the research topic, communicates the focus of the study, and attracts the reader's attention. The following guidance outlines how supervisors can assist students in developing clear, concise, and meaningful thesis titles.^{1,2}

2.2 Guiding the Development of a Thesis Title

A title is an important element of any academic document. It is usually distinguished from the main text by its size, font style, or formatting. A title serves three key functions: to captivate the reader, inform the reader, and introduce the subject of the thesis.^{1,2}

To help students develop a meaningful and appropriate thesis title, supervisors should guide them by focusing on the following aspects: (Appendix-2)

1. Make the title clear and descriptive

A clear, descriptive title communicates the main focus, population, and outcome without sounding vague or overly complex, helping readers immediately grasp what the research is about.^{1,2,3}

Example:

Instead of “A Study of Biomarker Status Among Stroke Patients in Tertiary Care Hospitals,”

use “Biomarker Status Among Hospital-Based Stroke Patients.”

2. Keep the title concise and avoid unnecessary complex wording

A concise title removes lengthy or complex phrasing while preserving the core message, making it easier to read, remember, and index.^{1,2,3}

Example:

Instead of

“A comprehensive and complex evaluation of the efficacy of rapid antigen detection test in diagnosing streptococcal pharyngitis in children: comparison

with throat culture, clinical examination, and clinical scoring system in 100 paediatric patients at Dhaka Medical College Hospital,”

use

“Rapid Antigen Test for Diagnosing Streptococcal Pharyngitis in Children.”

3. Reflect the central focus of the thesis

The title should reflect the core idea connecting all the chapters of the thesis and convey the overall narrative of the research.

Example: For a thesis on the health impacts of stress on parents of children with neurodevelopmental disorders, suggest a title like -

"Stress and Psychological Wellbeing in Parents of Children with Neurodevelopmental Disorders."

4. Avoid unnecessary phrases

Common phrases such as "A study on," "The role of," or "An analysis of" are often redundant and rarely add value.^{4,5}

Examples of unnecessary phrases:

- " A study on the effects of sleep deprivation on memory retention.”
- "Role of antibiotics in treating urinary tract infections."
- "An analysis of the relationship between hypertension and cardiovascular disease."

Alternatively, presenting the title in the following manner can make it both informative and precise:

- "Vitamin D and Bone Health in Older Adults: A Randomised Controlled Trial"
- "Antibiotics for Urinary Tract Infections: Assessing Treatment Efficacy and Resistance Patterns"
- "Hypertension and Cardiovascular Disease: Exploring the Link and Clinical Implications"

5. Be strategic in emphasis

Guide students to highlight aspects of their research that align with their future academic or professional goals. If they aim to shift to a new field or career, help them use terms that make the research relevant to that area.

Example:

“The Impact of Exercise on Mental Health in Adolescents”

Strategic emphasis example:

1. Focusing on preventive health: "Promoting Mental Wellbeing in Adolescents Through Physical Activity: A Preventive Health Approach."

2. Targeting school-based interventions: "Physical Activity in Enhancing Mental Health Among School-aged Adolescents."
3. Highlighting long-term effects: "Long-Term Mental Health Benefits of Regular Exercise in Adolescents."

Each variation strategically emphasizes a different aspect of the research, tailored to the desired focus or audience.

6. Avoid declarative titles

"Ventricular Septal Defect is the Most Common Acyanotic Heart Lesion in Children." Titles like these, which directly state the conclusion or hypothesis, should be avoided. Additionally, a declarative title reflects bias in data interpretation.⁴

A more balanced alternative would be:

"Prevalence of Ventricular Septal Defect in Children with Acyanotic Heart Disease." This phrasing presents the title in a neutral and unbiased manner.

7. Avoid question-style titles

Thesis titles should not be written as questions.⁴ The title should be written as a clear statement that directly describes the study.

Example:

Do not write: "Does Early Physiotherapy Improve Recovery After Lumbar Disc Surgery?"

Write: "Effect of Early Physiotherapy on Recovery After Lumbar Disc Surgery."

8. Avoid abbreviations or acronyms in titles

Refrain from using abbreviations or acronyms in thesis titles, even if they are commonly known. Terms like "ECG" or "COPD" may be familiar, but using their full forms ensures clarity, consistency, and comprehensiveness for a diverse audience.^{1, 4}

Examples of abbreviation-free titles:

- Original: "ECG Changes in Patients with Myocardial Infarction"
Revised: "Electrocardiographic Changes in Patients with Myocardial Infarction"
- Original: "COPD Prevalence in Smokers"
Revised: "Prevalence of Chronic Obstructive Pulmonary Disease in Smokers"
- Original: "PCR for Detection of Dengue Virus"
Revised: "Polymerase Chain Reaction for Detection of Dengue Virus"
- Original: "TB in Immunocompromised Patients"
Revised: "Tuberculosis in Immunocompromised Patients"

Exceptional cases: Abbreviations allowed in titles

Use only when the abbreviation is:

- Standardized, globally recognized (e.g., DNA, RNA, WHO)
- Gene/protein symbols designated by official bodies
- Too lengthy if written in full and more readable in abbreviated form

Table 1. Examples of Acceptable Use of Standardized Abbreviations in Titles

Abbreviated title (Acceptable)	Why acceptable
TP53 Mutations and Chemotherapy Resistance in Breast Cancer	TP53 is a globally recognized gene
HIV Transmission Dynamics in High Risk Populations	HIV is universally known and widely accepted
BRCA1 and BRCA2 Expression in Ovarian Cancer	Gene names are standardized and meaningful
WHO Guidelines on Childhood Immunization Uptake	WHO is a global authority; the abbreviation is clear
DNA Methylation Patterns in Colon Cancer	DNA is a universally recognized scientific term

9. Using a subtitle

A subtitle adds precision to the main title without making it unnecessarily long or complex. While the main title presents the central topic of the research, the subtitle clarifies key elements such as the study design, population, setting, or scope. This two part structure improves clarity and helps readers quickly understand what the thesis specifically examined.⁵⁻⁷

Example

Main title only (less specific): ‘Impact of Mobile Health Interventions on Hypertension Control’

Title with subtitle (more informative): ‘Impact of Mobile Health Interventions on Hypertension Control: A Community-Based Quasi-Experimental Study in Bangladesh’

Key guidance for students

- Use a subtitle when important details cannot fit clearly into a single short title.
- Keep the main title concise and place methodological or contextual details after a colon.
- Avoid adding unnecessary information; the subtitle should clarify, not overload.

2.2.1 Title formatting rules⁶

1. Title case: Capitalise the first letter of all major words (nouns, pronouns, verbs, adjectives, and adverbs) and keep minor words (e.g., conjunctions, prepositions, and articles) lowercase, unless they are the first word of the title.
2. Centred: The title should be centred on the title page.
3. Bold font: Use bold font for the title.
4. 1.5-line spacing
5. No italics or underlining: Do not italicise or underline the title.

References

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2.3 Guiding Students in Writing the Introduction

2.3.1 Structure of the introduction

Both the student and supervisor should understand that the introduction serves several purposes: it introduces the research problem, provides background information, explains why the study is important, and outlines the thesis structure.

Several rhetorical structures can be used to write thesis introductions, including the broad-to-narrow “funnel” approach, the general-specific (GS) approach, and the problem–contrast method.¹⁻⁴

The *introduction* is the opening chapter of the main body of the thesis and should offer a concise overview of the background information on the research topic. It must also articulate a strong rationale for the study, underscoring its significance, relevance, and originality.

The **Introduction** of a thesis/research paper typically follows a **funnel-shaped structure**, beginning with a broad overview of the research topic and gradually narrowing down to the specific focus of the study. This approach starts by presenting the general background and rationale, then reviews relevant empirical literature to establish context, and finally introduces the precise research question, objective, or thesis statement. This structure helps readers understand the significance of the study and guides them toward its core purpose.

1. **Start with a broad background**

Introduce the broader context or the general topic of the study. This can include a global health problem, statistics, or general knowledge about the medical condition or treatment being focused on.

2. **Narrow the focus**

Gradually move from the broad context to more specific aspects of the research.

Highlight the particular population, condition, or treatment relevant to the study.

3. **State the research gap or problem**

Introduce the gap in knowledge, the research problem, or the motivation for the study. This section should justify the need for the research.

4. **Thesis statement or objective**

End with a clear thesis statement or the specific objective of your thesis.

Box 2. Illustrative example of a thesis introduction (Hypothetical example 1)

Title of the study: Combined Lifestyle and Pharmacological Interventions in Managing Hypertension in Rural Adults: A clinical trial	
Broad opening	Cardiovascular disease (CVD) remains the leading cause of death globally, accounting for an estimated 18 million deaths annually.
Narrower context	Among various risk factors, hypertension plays a critical role in the progression of CVD. Effective management strategies encompass both pharmacological treatments and lifestyle modifications; however, patient adherence remains a significant challenge.
Research gap/problem	Despite numerous studies on hypertension management, the impact of combined pharmacological and lifestyle interventions on long-term outcomes in hypertensive patients in low-resource settings is poorly understood.
Thesis statement	This thesis aims to examine/determine the efficacy of combined lifestyle and pharmacological interventions in reducing blood pressure and improving patient outcomes in hypertensive adults in rural settings.

Box 3. Illustrative example of a thesis introduction (Hypothetical example 2)

Title of the study: Prevalence and Risk Factors of Chronic Obstructive Pulmonary Disease in Bangladesh	
Broad opening	Chronic Obstructive Pulmonary Disease (COPD) is a leading cause of morbidity and mortality worldwide, accounting for approximately 3.2 million deaths annually, making it the third most common cause of death globally. Characterised by persistent respiratory symptoms and airflow limitation, COPD is primarily associated with long-term exposure to harmful particles or gases, especially from smoking and environmental pollutants. The disease burden is particularly high in low- and middle-income countries, where access to early diagnosis and proper management remains limited.

Narrower context	In South Asia, the prevalence of COPD has been steadily increasing due to rapid urbanization, rising tobacco consumption, and high exposure to indoor air pollution, particularly from the use of biomass fuels. Bangladesh, with its dense population and widespread use of solid fuels for cooking and heating, is particularly vulnerable. Additionally, the country faces a unique combination of risk factors—including poor occupational safety standards, second-hand smoke exposure, and limited healthcare resources—which may contribute to an elevated and under-reported COPD burden.
Research gap/problem	Despite the growing concern, epidemiological data on the actual prevalence of COPD in Bangladesh are fragmented and outdated. Moreover, little is known about the specific risk factors that are most strongly associated with the condition in this context. The lack of population-based, region-specific studies hinders the development of targeted interventions and public health policies. Understanding the current prevalence and its determinants is crucial for allocating resources effectively, raising awareness, and informing clinical and public health responses.
Thesis statement	Therefore, this study aims to determine the prevalence of COPD and identify its associated risk factors among adults in Bangladesh using a population-based cross-sectional approach. By addressing the existing gap in localised data, the research seeks to contribute to the evidence base necessary for shaping more effective prevention and management strategies in the country.

Note. As this example is prepared solely for students' guidance, the data used may not be authentic and is intended for educational purposes only. Therefore, in-text citations and references have been intentionally omitted.

2.3.2 Pitfalls in writing the introduction

Common pitfalls in writing the Introduction, along with practical solutions to avoid them:⁵⁻⁷

Table 2. Common pitfalls in writing the introduction and strategies to avoid them

Common pitfall	Description	Suggested solution
Excessive length	The introduction becomes too long or detailed, often including results.	Keep it concise (typically 500 600 words). Focus only on the background and rationale.
Including results information	Introducing findings prematurely instead of focusing on context.	Reserve all findings for the Results section. Use the Introduction only to set up the study's importance.
Verb tense inconsistency	Mixing past and present tenses improperly.	Use the past tense for background and prior studies and the present tense for the current study.
Lack of logical flow	Disjointed ideas that confuse the reader.	Use transitional phrases to connect concepts smoothly and maintain clarity.
Undefined abbreviations	Using abbreviations without explaining them.	Always define abbreviations on first use, followed by the shortened form in parentheses.
Unclear relevance or significance	Failing to demonstrate why the research matters.	Clearly state the importance, relevance, and novelty of the study to engage the reader.
Missing research question or objective	Not stating the specific focus or aim of the study.	Conclude the introduction with a straightforward research question, objective, or thesis statement.

2.3.3 Some important points

- i. Word count for the introduction is typically not more than 800 words. A lengthy introduction is likely to lose the reader's interest.
- ii. Spacing: 1.5-line spacing
- iii. Font: Serif font (e.g., Times New Roman)
- iv. Font size: 12 points
- v. References should be limited to a maximum of 20 and should primarily come from publications within the last 10 years, preferably within the last five years, depending on the availability of relevant references.

2.3.4 References

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2.4 Research Questions

A research question is a clearly formulated question that defines the phenomenon or relationship to be investigated in a study, and many studies involve multiple research questions. Developing a clear and focused research question or hypothesis is a central step in the research process, with supervisors playing an important role in guiding students through this stage.^{1,2} Students should begin by drafting preliminary research questions or hypotheses, which can then be refined through discussion with their supervisor and review of the relevant literature.¹

2.4.1 Guiding your student in crafting a research question

- A research question serves as the cornerstone of a scientific investigation, guiding and framing the entire research endeavour.
- The research question functions as a signpost, indicating the path of a study, and it is constructed based on the existing gaps in our knowledge.
- Assist your student in crafting a research question that is both feasible and suitable, following an agreement on a general research idea within their area of interest.
- Developing research questions for RCTs, the PICOT model is widely used. It can be used to help the student identify the key components necessary to specify a research question for experimental/quasi-experimental research:
 - P—Population/disease (i.e., age, gender, ethnicity, with a certain disorder).
 - I—Intervention or variable of interest (exposure to a disease, risk behaviour, prognostic factors).
 - C—Comparison (could be a placebo, no intervention, standard care, or routine practice).
 - O—Outcome (risk of disease, the accuracy of a diagnosis, rate of occurrence of an adverse outcome).
 - T—Time it takes to demonstrate an outcome (for how long the participants were observed?).^{1,2,3}

An example of a research question is given to understand a concept. Supposing you are planning to do research on ‘The role of hydroxychloroquine in preventing COVID-19 in health care workers.’ We will need to break this down into various components:

- Population—Health care worker
- Intervention—Hydroxychloroquine 400 mg once a week
- Comparison—Healthcare workers who receive a placebo
- Outcome—Healthcare workers who eventually develop COVID-19
- Time—6 weeks.

The research question should be framed as a question. The above example should be ‘Can hydroxychloroquine (400 mg), administered once weekly for six weeks, protect

healthcare workers against COVID-19 infection?’

Steps for framing a research question:

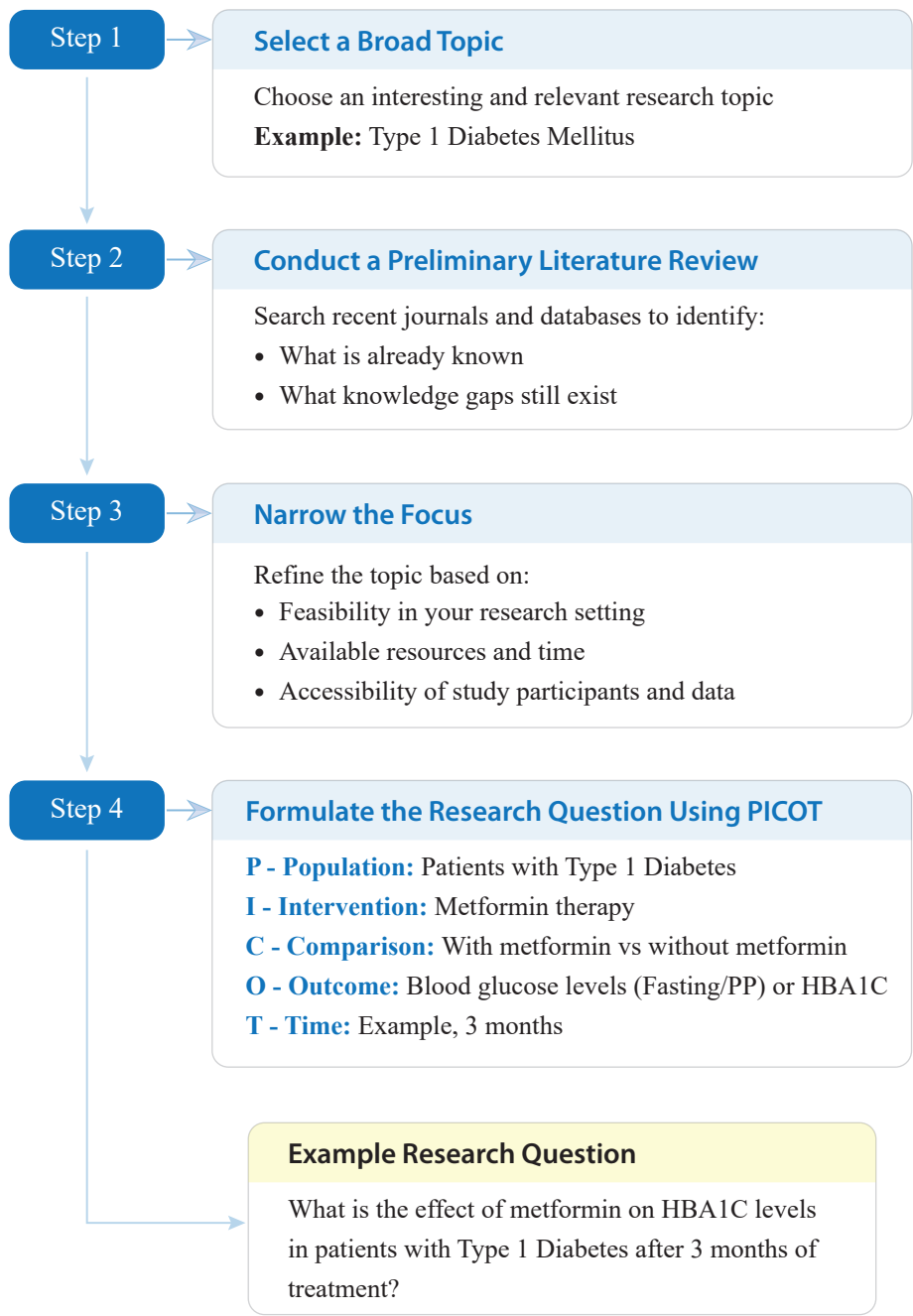


Figure 1. Stepwise process for developing a research question using the PICOT framework

2.4.2 Guiding the development of a research question: Key steps for supervisors¹⁻³

1. **Understand the research area**

Before guiding the development of a research question, the supervisor should have a clear understanding of the research area and the existing literature. This knowledge will help in ensuring that the research question is relevant and contributes to the field.

2. **Encourage curiosity and critical thinking**

Encourage the student to be curious and explore different aspects of the research area. Ask questions and engage in discussions to stimulate their thinking.

3. **Clarify research goals**

Ask the student to articulate their research goals and objectives. What do they want to achieve with the research? This will help in narrowing down the scope.

4. **Review existing literature**

Help the student conduct a thorough review of existing literature. This will help identify gaps in knowledge and inform the development of a research question.

5. **Narrow down the scope**

Research questions should be specific and focused. Help the student narrow down the scope of their research to ensure it is manageable within the available resources and time.

6. **Consider feasibility**

Ensure that the research question is feasible, given the available resources, data, and time. It should be something that can be realistically addressed.

7. **Test for originality**

Ensure that the research question is original and has not already been extensively addressed in the existing literature. It should contribute something new to the field.

8. **Consider the research design and ethics**

Discuss the research methods and design that will be used to answer the research question. Ensure that the methods are appropriate for the question and objectives.

9. **Check clarity and specificity**

The research question should be clear and specific. It should be understandable to someone who is not deeply involved in the field.

10. **Review and finalise**

Review the final research question or hypothesis to ensure that it aligns with the objectives, is feasible, original, and well-defined.

One important point to keep in mind is that formulating research questions is not mandatory, as a thesis may instead be guided by its objectives. However, if a thesis includes a research question, it must be answered, and the conclusion should clearly align with that answer.

Table 3. Example of research questions across different medical specialties along with suggested study designs to test and answer them.

Medical specialty	Research question	Study design
Internal Medicine	What is the effectiveness of intermittent fasting compared to calorie restriction in improving glycemic control in patients with type 2 diabetes?	Randomised Controlled Trial (RCT) comparing intermittent fasting and calorie restriction groups over 6-12 months measuring HbA1c levels.
Cardiology	What are the long-term cardiovascular outcomes of SGLT2 inhibitors compared to traditional beta-blockers in patients with heart failure and reduced ejection fraction?	Prospective cohort study tracking heart failure patients on SGLT2 inhibitors vs. beta-blockers over 5-10 years to assess cardiovascular outcomes.
Surgery	How does laparoscopic appendectomy compare to open appendectomy in terms of postoperative recovery time and complication rates in elderly patients?	Randomised Controlled Trial (RCT) comparing recovery time and complication rates between laparoscopic and open appendectomy groups in elderly patients.
Obstetrics and Gynaecology	What is the impact of low-dose aspirin on preventing preeclampsia in high-risk pregnant women?	Double-blinded RCT administering low-dose aspirin vs. placebo in high-risk pregnant women, tracking incidence of preeclampsia.
Paediatrics	Does early peanut introduction reduce the incidence of peanut allergies in high-risk infants?	Prospective cohort study following infants introduced to peanuts early vs. later to measure allergy development over 5 years.
Neurology	What is the impact of early physical therapy on functional recovery in stroke patients with hemiparesis?	Randomised Controlled Trial (RCT) assessing functional recovery using validated stroke scales in patients receiving early vs. standard physical therapy.
Oncology	How does neoadjuvant immunotherapy compare to standard chemotherapy in improving survival rates in patients with non-small cell lung cancer?	Phase III clinical trial comparing survival rates in lung cancer patients receiving neoadjuvant immunotherapy vs. standard chemotherapy.
Psychiatry and Mental Health	What is the effectiveness of cognitive behavioural therapy compared to pharmacotherapy in managing generalised anxiety disorder in adults?	Randomised Controlled Trial (RCT) comparing symptom improvement in anxiety patients undergoing CBT vs. pharmacotherapy over 6 months.

2.4.3 References

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2.5 Research Objectives

A research objective is a clear and concise statement that defines what a study aims to accomplish. It provides direction and focus, guiding the researcher's approach to data collection, analysis, and interpretation. Research objectives are typically divided into general and specific goals. The general objective expresses the study's overarching aim, providing a broad overview of its purpose. In contrast, specific objectives break down the general aim into smaller, measurable parts that address particular aspects of the research question. Together, well-defined research objectives ensure the study remains focused, relevant, and aligned with its intended outcomes, facilitating a structured, efficient research process.^{1,2}

The objectives should align with the research question and guide the research process.²

2.5.1 General objective

1. The general objective offers a broad statement of the research's aim, capturing the overall purpose or goal of the study and presenting a high-level view of the intended outcome.³ It outlines what the thesis seeks to achieve in addressing the research problem.
2. Encourage the student to draft general objectives.
3. Ensure that the general objectives are specific enough to guide the research but not so narrow that they limit the study.

2.5.2 Specific objectives

1. Specific objectives are targeted goals that break down the general objective into actionable, measurable parts, guiding the researcher in addressing particular aspects of the research question.¹ Using the SMART (Specific, Measurable, Achievable, Relevant, Time-bound) criteria, these objectives should be clearly defined to create a roadmap for the research.⁴
2. Encourage students to apply the SMART framework to develop specific objectives aligned with their general objectives. Collaboratively, create a list of these objectives, ensuring they are focused, measurable, and realistically attainable within the research timeline. This approach will help students achieve their broader research goals effectively and systematically.

2.5.3 Guiding the development of objectives: Key steps for supervisors^{1,2}

When checking students' write-ups on research objectives, supervisors should consider the following key points:

1. **Alignment with the research problem:** Verify that the objectives are directly related to the research problem and serve as steps toward resolving it. Each objective should clearly be connected to the broader purpose of the study.

2. **Clarity and precision:** Ensure that the objectives are clearly and concisely written. They should avoid vague language and be specific enough to provide clear direction for the research.
3. **SMART criteria:** Review the objectives to see if they follow the SMART framework (Specific, Measurable, Achievable, Relevant, and Time-bound). Objectives that meet these criteria are more likely to be effective and manageable.
4. **Ethical considerations:** Ensure objectives do not imply any unethical approaches. Discuss any potential ethical issues or dilemmas related to the objectives.
5. **Logical flow and organization:** Ensure that the objectives are logically organised, progressing naturally from one to the next. This flow helps readers understand how each objective contributes to solving the research problem.
6. **Relevance and contribution:** Confirm that each objective contributes meaningfully to the overall research aim. Irrelevant or redundant objectives can detract from the focus of the study.
7. **Progress measurement:** Check if each objective has criteria or indicators for measuring success. Clear criteria help students monitor their own progress and understand when an objective has been met.
8. **Flexibility:** While reviewing, discuss the possibility of adjusting objectives as the research develops. Encourage adaptability if new insights arise that necessitate changes.

2.5.4 Check whether students use action verbs in constructing objectives

Using action verbs such as describe, analyse, compare, evaluate, identify, examine, assess, and explore adds clarity and specificity to research objectives, ensuring each objective is clearly understood and actionable.⁵ This makes it easier to align objectives with research methods and accurately interpret findings.

a) **Describe**

Explanation: Use *describe* when aiming to give a detailed account of a clinical phenomenon, patient demographics, or disease patterns.

Example: To describe the demographic and clinical characteristics of patients with Type 2 diabetes at a regional hospital.

b) **Analyse**

Explanation: Use *analyse* when breaking down data or examining relationships within clinical information.

Example: To analyse the risk factors associated with postoperative complications in patients undergoing cardiac surgery.

- c) **Compare**
Explanation: Use *compare* when assessing different clinical treatments, patient outcomes, or interventions.
Example: To compare the effectiveness of traditional physical therapy versus virtual physical therapy on recovery outcomes in post-stroke patients.
- d) **Identify**
Explanation: Use *identify* to pinpoint specific challenges, outcomes, or characteristics within a clinical population or process.
Example: To identify the primary challenges faced by nursing staff in managing patients with dementia in a hospital setting.
- e) **Examine**
Explanation: Use *examine* when investigating the nature or relationship of clinical factors or outcomes.
Example: To examine the relationship between sleep quality and immune function in patients undergoing chemotherapy.
- f) **Assess**
Explanation: Use *assess* to determine the level of effectiveness, adequacy, or compliance of clinical practices or treatments.
Example: To assess the effectiveness of hand hygiene training programmes on reducing hospital-acquired infections in intensive care units.
- g) **Determine**
Explanation: *Determine* refers to the process of establishing, identifying, or concluding something based on analysis, observation, or evidence. It involves assessing factors, relationships, or outcomes to reach a clear decision or understanding.
Example: To determine the effectiveness of a new diabetes medication by analysing patients' blood sugar levels before and after treatment.
- h) **Measure**
Explanation: *Measure* refers to the process of assessing, evaluating, or quantifying specific variables or outcomes using systematic methods. It involves using tools, instruments, or criteria to collect and analyse data in a structured manner.
Example: To measure the impact of a health promotion campaign on community health outcomes.
- i) **Explore**
Explanation: Use *explore* to investigate under-researched areas in clinical settings, often without a specific hypothesis.
Example: To explore the psychological impact of prolonged hospitalization on paediatric patients with chronic illnesses.

Box 4. Example of some more action verbs used in objectives

- To demonstrate the proper technique for performing cardiopulmonary resuscitation (CPR).
- To apply evidence-based guidelines to develop a patient care plan for diabetes management.
- To develop a community outreach programme to promote mental health awareness.
- To construct a model illustrating the process of cellular respiration in the human body.
- To illustrate the effects of smoking on lung function using visual aids.
- To formulate a dietary plan tailored to the nutritional needs of a patient with chronic kidney disease.
- To investigate the relationship between physical activity and mental health in adolescents.
- To synthesise research findings to support a proposal for reducing hospital readmissions.

Box 5. An example of how we can break down a general objective into specific objectives.

Objective of the study

General objective

To improve the early recognition, management, and outcomes of patients diagnosed with sepsis in a hospital setting.

Specific objectives

1. To identify patients at high risk of developing sepsis using validated risk assessment tools during hospital admission.
 2. To implement a standardised sepsis protocol focusing on early recognition and timely initiation of evidence-based treatment interventions.
 3. To provide structured training programmes for healthcare professionals on the
 4. identification and management of sepsis based on current clinical guidelines.
 5. To monitor compliance with sepsis management protocols by conducting regular reviews and audits of medical records.
- To evaluate the effectiveness of the implemented interventions by measuring patient outcomes, such as time-to-antibiotics, length of hospital stay, and sepsis-related mortality rates.

2.5.5 References

1. Creswell JW, Creswell JD. Research design: qualitative, quantitative, and mixed methods approaches. 5th ed. Thousand Oaks (CA): SAGE Publications; 2018.
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4. Doran GT. There's a S.M.A.R.T. way to write management's goals and objectives. *Manage Rev.* 1981;70(11):35-6.
5. Doody O, Bailey ME. Setting a research question, aim and objective. *Nurse Res.* 2016;23(4):19-23. DOI:10.7748/nr.23.4.19.s5.

2.6 Formulating Hypotheses

2.6.1 Research hypothesis

- A research hypothesis is a focused, testable prediction about the relationship between variables. ¹ In medical research, a clear hypothesis keeps the study anchored to a defined problem and prevents the work from drifting into descriptive but inconclusive findings. ^{2,3}

Many weak theses and rejected papers share the same flaw: a vague or poorly constructed hypothesis.

- A general statement such as “Yoga makes people calmer” may spark interest, but it does not guide scientific inquiry. A research hypothesis must be specific and measurable. It identifies the variables, predicts how they relate, and connects directly to the research question.¹
- Example
“Adults who practice yoga for 30 minutes daily will have lower mean stress scores than adults who do not practice yoga.”

Here, yoga practice is an independent variable, stress score is the dependent variable, and the expected direction of the relationship is clear.

2.6.2 Why the hypothesis matters

- Frames the sampling, comparison groups, and outcome measures.
- Links the study to existing theory and evidence.
- Reduces bias by defining expectations before data collection.
- Supports ethical research, especially in clinical studies where equipoise is required. ^{1,3,4}

Without this clarity, even well-designed studies struggle to produce meaningful results.

2.6.3 Characteristics of a good hypothesis

A useful research hypothesis shows several qualities:

1. Clarity: Written in direct, unambiguous language.
2. Specificity: Identifies the independent and dependent variables.
3. Testability: Can be confirmed or rejected using scientific methods.
4. Relevance: Addresses the research question directly.
5. Evidence-based: Draws from existing studies rather than speculation. ^{1,5}

2.6.4 Types of research hypotheses

Research hypotheses may take different forms depending on the study design:

- Simple hypothesis: One independent and one dependent variable
Daily soda consumption increases obesity risk.
- Complex hypothesis: Multiple variables
Daily soda consumption increases obesity and cardiovascular risk.
- Directional hypothesis: Specifies the direction of effect
Computer-assisted hip surgery results in improved outcomes.
- Non-directional hypothesis: States a relationship without direction
There is a difference in outcomes between computer-assisted and freehand surgery.
- Null hypothesis (H_0): No relationship or difference
- Alternative hypothesis (H_1): A relationship or difference exists
- Causal hypothesis: Suggests cause–effect
- Statistical hypothesis: Expresses predictions in measurable terms ²

These types help structure the comparison and analysis that follow.

2.6.5 How to formulate a research hypothesis

Developing a hypothesis is a step-by-step process:

- Begin with a straightforward research question.
This question frames the study's aim.
- Review existing literature.
Understanding previous evidence helps justify the expected relationship.
- Draft the working hypothesis.
Connect the independent and dependent variables in a precise statement.
- Refine the wording.
Ensure the hypothesis is measurable, testable, and concise.
- Develop the null and alternative hypotheses.
These operationalize what will be tested statistically. ^{5,6}

Example

- Research hypothesis: Computer-assisted placement improves functional and radiographic outcomes.
- Null hypothesis (H_0): No difference in outcomes.
- Alternative hypothesis (H_1): A difference exists.

2.6.6 Hypothesis testing in brief

Once the hypothesis is set, statistical testing determines whether observed differences are meaningful or due to chance. The process includes clearly stating H_0 and H_1 , collecting appropriate data, applying suitable tests, interpreting P values, and considering the risks of Type I and Type II errors. Only then can the hypothesis be supported or rejected with confidence.

A related decision is whether to use a one-sided (directional) or two-sided (non directional) hypothesis. Most medical studies use two-sided hypotheses unless there is strong justification for predicting a specific direction.^{2,7}

Box 6. Hypothetical example of how students should write the Hypothesis section.

Title of the thesis

Impact of Telemedicine-Supported Follow-Up on Glycaemic Control Among Patients with Type 2 Diabetes

Objectives

General objective

To evaluate whether telemedicine-supported follow-up improves glycaemic control in adults with type 2 diabetes compared with standard clinic-based follow-up.

Specific objectives

1. To compare changes in HbA1c levels between patients receiving telemedicine follow-up and those receiving standard care.
2. To examine medication adherence in both groups over the study period.
3. To compare the incidence of diabetes-related acute events (hypoglycaemia, emergency visits) between the two groups.

Hypotheses

This study aims to determine whether a structured telemedicine follow-up model leads to better clinical outcomes for adults with type 2 diabetes compared with standard clinic-based care. The hypotheses are grounded in existing evidence and formulated for statistical testing.

Primary hypothesis

- Null hypothesis (H_0): There is no significant difference in mean HbA1c reduction between patients receiving telemedicine-supported follow-up and those receiving standard clinic-based care.
- Alternative hypothesis (H_1): Patients receiving telemedicine-supported follow-up will show a significantly greater reduction in mean HbA1c compared with those receiving standard care.

Secondary hypothesis

1. Medication adherence
 - o H_0 : There is no significant difference in medication adherence between patients receiving telemedicine follow-up and those receiving standard care.

- H_0 : There is no significant difference in medication adherence between patients receiving telemedicine follow-up and those receiving standard care.
 - H_1 : Patients receiving telemedicine follow-up will have significantly higher medication adherence compared with those receiving standard care.
2. Diabetes-related acute events
- H_0 : There is no significant difference in the incidence of diabetes-related acute events between the two groups.
 - H_1 : Patients in the telemedicine group will experience fewer diabetes-related acute events compared with the standard-care group.

This example demonstrates how objectives and hypotheses align within a real thesis. It includes a general objective, specific objectives, a primary hypothesis, and secondary hypotheses—each directly linked to measurable outcomes. Students should follow this structure when writing their own thesis.

2.6.7 How objectives lead to hypotheses

The logical order in a thesis is:

Research Question → Objectives → Hypotheses → Materials and Methods → Results

In many analytical quantitative studies, the general objective is linked to the primary hypothesis, while specific objectives may correspond to secondary hypotheses. This alignment helps students choose appropriate statistical tests and ensures examiners can trace each finding back to a clear expectation. ¹

When this chain breaks, the thesis becomes descriptive instead of analytical.

2.6.8 Research questions and hypotheses together.

Both can exist in the same study.

The research question asks what the researcher wants to find out, while the hypothesis predicts the expected answer in measurable terms. The question opens the inquiry; the hypothesis sharpens it. ⁵

2.6.9 Are hypotheses always required?

Not always. Their necessity depends on the study design.

Hypotheses are required in:

- Quantitative studies
- Analytical designs such as cohort studies, case–control studies.

These studies test measurable relationships and therefore need H_0 and H_1 . ³

Hypotheses are not required in:

- Qualitative research
- Descriptive cross-sectional studies.

Here, research questions and objectives are sufficient. ⁵

However, if a study includes a hypothesis, it must be tested, and the results should be presented in relation to that hypothesis. Consequently, the conclusion should be aligned with the findings of the hypothesis testing.

2.6.10 References

1. Hulley SB, Cummings SR, Browner WS, Grady DG, Newman TB. Designing clinical research. 4th ed. Philadelphia: Lippincott Williams & Wilkins; 2013.
2. Kirkwood BR, Sterne JAC. Essential medical statistics. 2nd ed. Oxford: Blackwell Science; 2003.
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7. Friedman LM, Furberg CD, DeMets DL, Reboussin DM, Granger CB. Fundamentals of clinical trials. 5th ed. Cham: Springer; 2015.

2.7 Guiding the Literature Review

2.7.1 What is a literature review?

For supervisors, the first task is to ensure that students understand that a literature review is not simply a list of summaries. Instead, it serves several important scholarly functions in research writing.^{1,2} It has three core functions:

1. Summarising previous research
2. Examining methods and findings
3. Providing a clear overview of the current understanding of the thesis topic

In the thesis, the literature review should:

- Demonstrate the student’s understanding of their topic.
- Show their ability to situate the study within the wider academic and clinical context.
- Provide a clear rationale for the study by:
 - o Highlighting what has already been studied
 - o Explaining the methods and approaches used in previous work
 - o Identifying gaps, inconsistencies, or unresolved questions that the thesis will address.¹

Supervisor’s role:

- Ask: “*After reading this chapter, can a reader see what is known, what is not known, and why your study is needed?*”
- If the answer is no, the literature review needs restructuring and deeper synthesis.

2.7.2 Purposes of the literature review for students

Supervisors should help students understand that the literature review serves multiple interconnected purposes in scientific research.³ The supervisor’s task is to verify that these purposes are clearly reflected in the literature review chapter.

Table 4. Supervisory checklist for evaluating the quality and purpose of a literature review

Aim	Purpose (what you check as a supervisor)
Show a professional grasp	— Has the student identified relevant studies, key ideas, and debates? — Do they understand main theories and how they have been applied?

Aim	Purpose (what you check as a supervisor)
Justify the research	– Have they evaluated previous research rather than just describing it? – Have they avoided unintentional duplication?
Justify the approach	– Are gaps in current knowledge clearly identified? – Is the need for this specific study logically argued? – Is the scope of the study (population, setting, variables) clearly defined?
Synthesise in an academic style	– Has the student compared previous approaches (designs, tools, analyses)? – Is their chosen study design positioned within this context? – Is the choice of method/theoretical framework explicit and defensible? – Is the review structured around themes or questions (not article-by-article summaries)? – Are arguments logical, coherent, and evidence based? – Is referencing accurate and consistent?

Hypothetical example:

Table 5. Example of literature review aims applied to a study on the prevalence and risk factors of COPD

Aim	Purpose
Show a professional grasp	– Identify studies on the prevalence and risk factors of COPD. – Highlight key findings, debates, and research gaps in COPD.

Aim	Purpose
Justify your research	– Review theories and models related to the development of COPD and its risk factors. – Evaluate previous methodologies in cross-sectional studies of COPD.
Justify your approach	– Identify knowledge gaps regarding COPD prevalence and associated risks. – Establish the need for updated or localised data on COPD. – Define the scope of the study, focusing on prevalence and risk factors.
Synthesise in an academic style	– Compare existing relevant studies on COPD. – Place your study in the context of global and regional COPD research. – Explain why a cross-sectional survey is appropriate for this research.
	– Provide a clear, structured summary of existing COPD research. – Align findings with your research objectives and methodology. – Use precise language and maintain accurate referencing.

2.7.3 Teaching students how to search literature

Supervisors should actively teach students how to search the scientific literature systematically. A structured search strategy improves the comprehensiveness and reliability of evidence used in research.¹ Commonly used medical databases:

1. EMBASE – Biomedical and pharmacological research (Elsevier)
2. MEDLINE – Core biomedical literature (via PubMed/Ovid)
3. PsycINFO – Psychology and mental health
4. Cochrane Database of Systematic Reviews (CDSR) – High-quality systematic reviews

5. MedlinePlus – Patient-facing background information (good for context, not primary evidence)

These are frequently accessed via:

- PubMed
- Scopus
- Web of Science
- Google Scholar (as a supplementary tool, not the only source)

Supervisor's role:

- Show students how to:
 - o Select keywords
 - o Search for keywords
 - o Select appropriate databases
 - o Use keywords + Boolean operators (AND, OR, NOT, “ ”)
 - o Apply filters (year, study type, humans, age group)
- Ask students to document their search strategy (databases, time frame, key terms, filters).
- Review their search log to ensure it is systematic, reproducible, and not over-reliant on one database.

2.7.4 Why do we search literature?

Supervisors should help students recognise that literature searching is an integral part of research design, not merely a writing activity.³

Key reasons (supervisor's talking points with students):

1. Identifying research gaps
2. Determining appropriate study design
3. Selecting appropriate methods and measurements
4. Supporting sample size estimation
5. Choosing statistical analysis methods
6. Understanding existing knowledge and standard of care
7. Avoiding unnecessary duplication
8. Refining research questions and hypotheses
9. Identifying theoretical frameworks or models
10. Finding validated tools, instruments, and data sources
11. Learning from ethical issues and errors in previous studies
12. Recognising key authors, groups, and landmark studies
13. Staying updated with recent developments and trials

Supervisor's role:

Ask the student to share a documented search strategy (databases, dates, search

strings). This allows you to verify that their pool of literature is appropriate before they start writing.

2.7.5 Guiding students in conducting and writing the literature review

Supervisors should guide students to follow a structured and transparent approach when conducting and writing the literature review.^{2,5} A well-organized literature review typically follows this sequence:

Introduction → Methods for literature search → Thematic synthesis of evidence → Identification of gaps → Implications for the current study

Each stage plays a specific role in building the scientific rationale for the research.

a. Introduction of the literature review

The literature review should begin with a short introduction that explains the context, scope, and purpose of the review. This introduction is specific to the literature review chapter and should not repeat the general introduction of the thesis.

The introductory paragraph should:

- Introduce the main concept or topic
- Briefly explain its importance in the field
- Indicate the major issues, debates, or inconsistencies in the literature
- State the purpose of the literature review

The final sentence should indicate that the review aims to identify gaps in existing knowledge that justify the current study.

b. Methods used for the literature review

Students should briefly explain how the literature was searched and selected. This section ensures transparency and allows readers to understand how the evidence base was constructed. Supervisors should guide students to describe the following elements.

Search strategy

Students should specify:

- Databases searched
- Time period covered by the search
- Keywords and Boolean operators used
- Whether controlled vocabulary terms (e.g., MeSH) were used

Students should normally search multiple academic databases to ensure comprehensive coverage.

Inclusion and exclusion criteria

Clear criteria should be defined for selecting relevant studies. Typical inclusion criteria may include:

- Peer-reviewed human studies
- Relevant population or setting
- Appropriate study designs (e.g., RCTs, cohort studies, systematic reviews)
- Relevant outcomes related to the research question

Typical exclusion criteria may include:

- Non-peer-reviewed publications
- Animal-only studies
- Studies unrelated to the research question
- Studies with unclear or poor methodology

Supervisors should ensure that the selection criteria align with the objectives of the thesis.

Data extraction

Students should extract key information from each study in a structured format.

Important information often includes:

- Author and publication year
- Study design
- Population and sample size
- Intervention or exposure
- Outcome measures
- Key findings
- Methodological limitations

These details are often summarized in tables to facilitate comparison across studies.

Documentation of the study selection process

Students should maintain a clear record of how studies were identified and selected.

This may include documenting:

- Total records identified
- Duplicates removed
- Number of studies screened
- Full texts assessed for eligibility
- Final studies included

In systematic reviews, this process is often illustrated with a PRISMA flow diagram.⁴

c. Thematic synthesis of the literature

A strong literature review synthesizes evidence rather than summarizing individual articles one by one. Students should organize the literature into themes or conceptual categories based on similarities among studies. For each theme, students should:

- Begin with a clear topic sentence
- Summarize what the literature generally shows
- Compare and contrast findings across studies

- Discuss methodological differences that may explain variations in results

Possible factors explaining differences between studies include:

- population characteristics
- study design
- measurement tools
- intervention dosage or exposure level
- follow-up duration

d. Identifying gaps and limitations in the literature

An important purpose of the literature review is to identify limitations in existing research. Students should explicitly discuss:

- inconsistent findings
- methodological weaknesses
- under-researched populations
- unanswered questions

These gaps provide the scientific justification for the current study.

e. Linking the literature to the current study

The literature review should conclude by explaining how existing evidence informed the design of the current research. Students should demonstrate how the review influenced decisions regarding:

- study design
- study population
- exposure or intervention variables
- outcome measures

A well-written literature review therefore connects previous research with the objectives of the present study.

Box 7. Literature Review for a Hypothetical Study

Title of the study: Vitamin D and Bone Health in Older Adults: A Randomised Clinical Trial

1. Introduction

Vitamin D plays a pivotal role in bone metabolism and musculoskeletal function, particularly in aging populations. It enhances intestinal calcium absorption, regulates bone turnover, and contributes to muscle strength. In older adults, vitamin D insufficiency has been associated with an increased risk of osteoporosis, falls, and fractures. Consequently, vitamin D supplementation has been widely investigated as a potential strategy to improve bone health and reduce fracture risk among the elderly.

Despite the well-established physiological role of vitamin D in skeletal health, clinical evidence regarding its effectiveness remains inconsistent. Some studies have reported beneficial effects on bone mineral density and fracture reduction, while others have found little or no improvement. Differences in dosing regimens, baseline vitamin D status, population characteristics, and outcome measures may explain these inconsistent findings. Therefore, this literature review synthesizes evidence from recent studies examining vitamin D supplementation and bone health in older adults, evaluates methodological patterns in existing research, and identifies knowledge gaps that inform the design of the present randomised clinical trial.

2. Methods of the literature review

Search strategy

A structured literature search was conducted to identify studies evaluating the relationship between vitamin D supplementation and bone health outcomes in older adults. The search was performed in PubMed, Scopus, Embase, the Cochrane Library, and Web of Science for studies published between January 2010 and March 2024. Boolean operators and Medical Subject Headings (MeSH) were used to refine the search strategy. A representative search string applied in PubMed was:

("Vitamin D"[MeSH Terms] OR "vitamin D supplementation" OR cholecalciferol OR ergocalciferol)

AND

("Bone Density"[MeSH Terms] OR osteoporosis OR "bone mineral density" OR fractures OR falls)

AND

("aged" OR "older adults" OR elderly)

AND

("randomised controlled trial" OR RCT OR "clinical trial").

Inclusion criteria

Studies were included if they met the following criteria:

- Peer-reviewed human studies
- Participants aged 60 years or older
- Randomised controlled trials, cohort studies, meta-analyses, or systematic reviews
- Studies reporting outcomes related to bone mineral density, fractures, or fall risk

Exclusion criteria

The following studies were excluded:

- Paediatric or pregnancy-related studies
- Animal experiments
- Editorials, commentaries, or conference abstracts
- Studies lacking clearly defined bone-related outcomes

Study selection and data extraction

The literature search initially identified 100 records across the selected databases. After removing duplicates, 70 studies were screened based on titles and abstracts. Full texts of 30 studies were assessed for eligibility, and 9 studies were ultimately included in the final review. From each included study, information was extracted regarding:

- a. author and publication year
- b. study design
- c. population characteristics and sample size
- d. vitamin D intervention or exposure
- e. outcome measures
- f. key findings
- g. methodological limitations

The characteristics of the included studies are summarized in Table 6.

3. Thematic synthesis of the literature

Bone mineral density

Several randomised clinical trials have demonstrated that vitamin D supplementation may help maintain or modestly improve bone mineral density in older adults. For example, Gallagher et al. reported improvements in bone mineral density among women receiving daily vitamin D doses between 800 and 1600 IU. Similarly, studies combining vitamin D with calcium supplementation, such as the trial conducted by Chapuy et al., reported substantial reductions in hip fracture

incidence among institutionalized elderly women. However, the magnitude of improvement in bone mineral density varies across studies and appears to depend on baseline vitamin D status, adherence to supplementation, and concurrent nutritional factors.

Fracture and fall risk

Evidence regarding the effect of vitamin D on fracture and fall prevention is mixed. A metaanalysis by Bischoff-Ferrari et al. suggested that daily vitamin D doses between 800 and 2000 IU were associated with reduced risk of non-vertebral fractures. In contrast, studies investigating high-dose intermittent supplementation have produced concerning findings. For example, Sanders et al. reported that an annual dose of 500,000 IU increased the risk of falls and fractures among older women. Similarly, the ViDA trial conducted by Scragg et al. found no significant benefit from monthly high-dose vitamin D supplementation. Systematic reviews also indicate that moderate daily doses may produce small reductions in fall risk, although the magnitude of effect is generally modest.

Population differences and moderators

The effectiveness of vitamin D supplementation appears to vary depending on population characteristics. Institutionalized older adults with low baseline vitamin D levels often demonstrate more consistent benefits compared with community-dwelling populations with adequate vitamin D status. Observational evidence from Houston et al. also suggests that higher serum vitamin D levels are associated with better muscle strength and physical performance among elderly individuals. These findings indicate that baseline deficiency, nutritional status, and physical activity may influence the clinical benefits of supplementation.

Methodological variability across studies

A key observation across the literature is the substantial methodological heterogeneity among studies. Differences are evident in dosing regimens, follow-up duration, baseline vitamin D status, and primary outcome measures. For instance, the large VITAL trial reported no significant reduction in fracture risk with 2000 IU daily supplementation, although the study population included many individuals with adequate baseline vitamin D levels. Meta-analyses have also highlighted that many trials did not stratify participants according to baseline vitamin D deficiency. Such heterogeneity complicates direct comparison between studies and may partly explain inconsistent findings. (Table 6)

4. Gaps identified in the literature

The literature review reveals several important limitations in the current body of evidence. First, many trials did not stratify participants according to baseline vitamin D status, potentially masking beneficial effects among deficient

individuals. Second, the optimal dose and dosing frequency remain uncertain, with evidence suggesting that high intermittent doses may be harmful while moderate daily supplementation may be beneficial. Third, relatively few studies have focused specifically on community-dwelling older adults with moderate fracture risk. Finally, considerable variability exists in outcome measures, with some studies focusing on bone mineral density and others on falls or fractures.

5. Implications for the current study

Based on the findings of the literature review, the present randomised clinical trial will address several methodological gaps identified in previous research.

The study will employ daily vitamin D supplementation (800–1600 IU) rather than intermittent high-dose regimens. Participants will include older adults with documented vitamin D insufficiency (serum 25(OH)D <50 nmol/L) to allow evaluation of treatment effects among deficient individuals. The primary outcomes will include changes in bone mineral density at the hip and lumbar spine, while secondary outcomes will assess incidence of falls and fractures during follow-up.

By incorporating baseline stratification, standardized outcome measures, and long-term follow-up, the present trial aims to generate clearer evidence regarding the role of vitamin D supplementation in improving bone health among older adults.

Table 6. Summary of studies included in the literature review

Author and publication year	Study design	Population and sample size	Intervention or exposure	Outcome measures	Key findings	Methodological limitations
Bischoff-Ferrari et al., 2012	Meta-analysis	Older adults ≥ 65 years; $>30,000$ participants	Vitamin D supplementation (800–2000 IU/day)	Non-vertebral fracture risk	Daily vitamin D doses reduced non-vertebral fracture risk	Adherence and baseline vitamin D levels not consistently analysed
Sanders et al., 2010	Randomised controlled trial	Women ≥ 70 years; $n = 2,256$	Vitamin D 500,000 IU annually	Falls and fractures	Annual high-dose vitamin D increased falls and fractures	Effects limited to high bolus dosing
Chapuy et al., 1992	Randomised controlled trial	Institutionalized elderly women; $n = 3,270$	Vitamin D3 plus calcium	Hip fractures, BMD	43% reduction in hip fracture incidence	Limited generalizability to community populations
Scragg et al., 2017	Randomised controlled trial	Adults ≥ 50 years; $n = 5,108$	Vitamin D 100,000 IU monthly	Falls and fracture outcomes	No significant benefit observed	Participants largely vitamin D sufficient
Smith et al., 2017	Systematic review	Adults ≥ 60 years; 81 trials	Vitamin D supplementation	Falls	Small reduction in fall risk with doses >700 IU/day	Short follow-up in many studies
Gallagher et al., 2014	Randomised controlled trial	Women ≥ 65 years; $n = 163$	Vitamin D 800–1600 IU/day	Bone mineral density	BMD improved at moderate doses	Fracture outcomes not assessed
Bolland et al., 2018	Meta-analysis	Adults ≥ 60 years; 81 RCTs	Vitamin D supplementation	Musculoskeletal outcomes	Minimal benefits in general populations	Lack of stratification by deficiency
Houston et al., 2013	Observational study	Older adults ≥ 70 years; $n = 2,638$	Serum vitamin D levels	Physical performance	Higher vitamin D linked to better muscle strength	Observational design limits causality
LeBoff et al., 2022	Randomised controlled trial	Men ≥ 50 , women ≥ 55 ; $n = 25,871$	Vitamin D 2000 IU/day	Fracture incidence	No significant reduction in fractures	Deficient individuals largely excluded

Table 7. Guiding students to identify and gather literature

Step	Description	Actionable tips for students
Use search engines effectively	Guide students to search for academic sources using reliable platforms like PubMed, Google Scholar, Scopus and Cochrane to ensure credible and relevant results.	— Use specific keywords or phrases related to their topic. — Apply filters for publication year, type, and access.
Refine search results	Teach students to refine their search strategies to focus on the most relevant studies, avoiding overwhelming or irrelevant sources.	— Use Boolean operators like AND, OR, and NOT to narrow or expand searches.
Track sources systematically	Show students how to track and organise their sources to prevent duplication and ensure easy access to them.	— Keep a log of downloaded articles and references in a spreadsheet or a citation management tool.
Use citation management tools	Explain how tools like Mendeley, Zotero, or EndNote can help store, organise, and automatically cite sources. Microsoft Word has an inbuilt reference management option, which should also be learned.	— For Mendeley: Teach them how to import PDFs, highlight important sections, and create bibliographies with one click.
Follow citation trails	Encourage students to explore references from important studies to identify more relevant sources.	— Look at the bibliography of key papers to uncover foundational and related works.
Stay organised	Emphasise the importance of organizing literature based on themes, methodologies, or timelines.	— Create folders or tags in citation tools to group studies by topic or research question.
Seek help if needed	Encourage students to ask for guidance if they are struggling to find sources or use citation tools.	— Consult research librarians, advisors, or tutorials offered by their institution on databases and tools.

Table 8. Key steps for supervisors in guiding literature review writing

Step	Description
Argument development	Encourage students to open sections with clear arguments or claims, then support them with literature, instead of listing summaries.
Maintain student's voice	Ensure reviews are written in the student's own words through paraphrasing and synthesis, with minimal direct quotations.
Linking and synthesising sources	Guide students to discuss multiple studies within a paragraph, highlighting patterns, agreements, and contradictions.
Critical analysis	Push students to evaluate strengths, weaknesses, methods, biases, and applicability—not just report results.
Evidence and relevance	Check that all cited sources are relevant to the research question and come from reputable, peer-reviewed journals.
Developing a plan	Require an outline showing main themes and sub-themes before full writing. This prevents a disorganised “data dump”.
Verify proper referencing	Ensure consistent citation style and complete reference list, matching institutional guidelines.
Provide constructive feedback	Offer feedback on logic, flow, and argumentation throughout the drafting process—not only at the end.
Avoid copy-pasting	Remind students that copy-pasting is unacceptable; encourage them to summarise and integrate findings in their own analytical language.
Prepare a table of articles	Ask students to prepare a summary table of key articles (as in the COPD example) to condense descriptive content and support thematic synthesis.

2.7.6 References

1. Booth A, Sutton A, Papaioannou D. Systematic approaches to a successful literature review. 3rd ed. London: SAGE Publications; 2022.
2. Ridley D. The literature review: A step-by-step guide for students. 2nd ed. London: SAGE Publications; 2012.
3. Creswell JW, Creswell JD. Research design: Qualitative, quantitative, and mixed methods approaches. 5th ed. Thousand Oaks (CA): SAGE Publications; 2018.
4. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*. 2021;372:n71. DOI:10.1136/bmj.n71
5. Hart C. Doing a literature review: Releasing the research imagination. 2nd ed. London: SAGE Publications; 2018.

2.8 Materials and Methods

While guiding your students in writing materials and methods section, be sure that the following subheadings are described clearly.

1. Study design, setting and population
2. Study period
3. Study sample, sampling and sample size
4. Eligibility criteria
5. Key variables ascertainment with operational definitions, with special attention to the outcomes
6. Confounding variables (Assessment and descriptions of why these are considered confounders)
7. Data collection methods with special reference of data collection instruments
8. Data quality control measures (Starting from protocol development through data collection up to analysis)
9. Bias control strategies
10. Data management
11. Data analysis
12. Methodological matrix
13. Ethical considerations (Ethical measures taken, approval and participants' data safety)

Box 8. ‘Methodology’ vs. ‘Materials and Methods’: A critical distinction in thesis writing

Many students incorrectly use the term *methodology* when they actually mean *methods* or *materials and methods*. These terms are not interchangeable. They reflect different levels of scientific reasoning and must be used precisely in academic writing.

Methodology refers to the theoretical and philosophical foundation of a study. It explains the logic behind the research approach. In other words, methodology answers questions such as:

- What is the epistemological stance of the study (positivist, interpretivist, pragmatic)?
- Why was a quantitative, qualitative, or mixed-methods design selected?
- What theoretical framework guides the research?
- What assumptions underpin the chosen design?

Methodology justifies *why* a particular research strategy is appropriate for answering the research question. Creswell and Creswell emphasize that

methodology is linked to worldview, research design, and underlying assumptions about knowledge generation¹. Similarly, Polit and Beck describe methodology as the overarching strategy and rationale of the research, distinct from the operational steps².

In contrast, methods (often presented as “Materials and Methods” in biomedical research) describe the practical procedures used to conduct the study. This section explains:

- Study design (e.g., cross-sectional, cohort, randomised controlled trial)
- Study setting
- Participants and sampling technique
- Inclusion and exclusion criteria
- Data collection tools and procedures
- Variables and operational definitions
- Statistical analysis plan
- Ethical considerations

Methods answer the question: *How exactly was the study conducted?* Babbie clearly distinguishes between methodology as the logic of inquiry and methods as the specific techniques used to collect and analyse data³.

In biomedical and clinical research, journals following ICMJE recommendations typically require a structured “Methods” section rather than a “Methodology” section⁴. Therefore, in clinical and public health theses, especially those using quantitative designs, “Methods” or “Materials and Methods” is usually the correct heading.

3 Why this matters for supervisors

Students often write “Methodology” when they are merely describing procedural steps. This reflects conceptual confusion. Supervisors should ensure that:

1. The terminology matches the nature of the study.
2. The study design aligns with the objectives.
3. The section heading follows disciplinary norms.

If a thesis involves philosophical positioning (e.g., grounded theory, phenomenology, constructivism), a “Methodology” subsection may be appropriate. However, for most clinical, epidemiological, and experimental studies, “Methods” is the correct and sufficient term.

Clarity in terminology reflects clarity in thinking. When students understand this distinction, their research writing becomes more precise, rigorous, and academically sound.

2.8.1 Study design, setting and population

i. Quantitative study

Students should present the type of study, study location, and study population within a single descriptive paragraph in their thesis. In the previous model, these elements were presented under separate subheadings in a simplistic and fragmented manner, such as:

Study type: Cross-sectional

Study location: Department of Surgery, BMU

Study population: All patients attending the department.

This approach limits students' writing skills and often results in the omission of crucial details regarding the study design and setting. To address this, the current guideline recommends integrating these elements into a concise yet comprehensive paragraph that clearly conveys the study design, location, and population while maintaining clarity and depth.

Box 9. Guidelines for student write-up

This study was a [*Specify study type*] designed to align with the research objectives and methods. It was conducted at [*Specify study place*], a well-established institution with a strong academic and clinical reputation. The study was [*hospital-based/community-based*], with patient enrolment occurring in the [*outpatient/emergency/inpatient*] department. The institution played a crucial role in medical education and healthcare, with [*mention key details such as patient volume, number of faculty members, or research facilities*], making it an ideal setting for this research.

The study population consisted of [*Specify population*], including [*Participants/respondents*] who met the predefined inclusion criteria. These individuals actively participated in the study through [*Specify methods: clinical examination, surveys, interviews, etc.*], ensuring systematic data collection and research validity.

Box 10. Illustrative example of study design, setting, and study population description

Hypothetical example

This study was a randomised controlled trial designed to compare the efficacy of propranolol and amitriptyline in the management of chronic migraine. It was conducted at the Department of Internal Medicine, Bangladesh Medical University (BMU), a leading academic and clinical institution in Bangladesh. The study was hospital-based, with patient enrolment occurring in the outpatient department (OPD). The Department of Internal Medicine at BMU provided specialised care for a large patient population, catering to approximately 200 patients daily.

The study population consisted of adult patients diagnosed with chronic migraine, who met the eligibility criteria for participation. Participants were randomly assigned to receive either propranolol or amitriptyline and were monitored for clinical response, side effects, and overall treatment efficacy using standardised assessment tools. By conducting this trial in a structured and controlled manner, the study aimed to provide robust evidence on the comparative effectiveness of propranolol and amitriptyline in managing chronic migraine, contributing to improved clinical decision-making in the field of internal medicine.

Box 11. Illustrative example of study design, setting, and study population description-1

Example for reference

This study was conducted at the Department of Surgery, Bangladesh Medical University (BMU), the premier medical university in Bangladesh. The study is [hospital based/community-based], and patient enrolment occurred in [outpatient/emergency/ inpatient] setting.

The Department of Surgery at BMU is one of the busiest surgical units, managing approximately 100 patients daily through its outpatient and emergency services. On average, 20 surgeries are performed each day. The department is staffed by a team of 20 faculty members, ranging from lecturers to professors, who are actively involved in patient care, teaching, and research. This makes it a leading centre for surgical training and clinical excellence in Bangladesh.

Box 12. Ensuring the correct identification and reporting of study design

On proper identification of study design

Supervisors should carefully examine how students describe the type of study they are conducting. Study designs are often presented in vague or technically incorrect terms, such as “*prospective study*,” “*observational prospective study*,” “*observational experimental study*,” or “*observational prospective cross-sectional study*.” These descriptions reflect conceptual confusion.

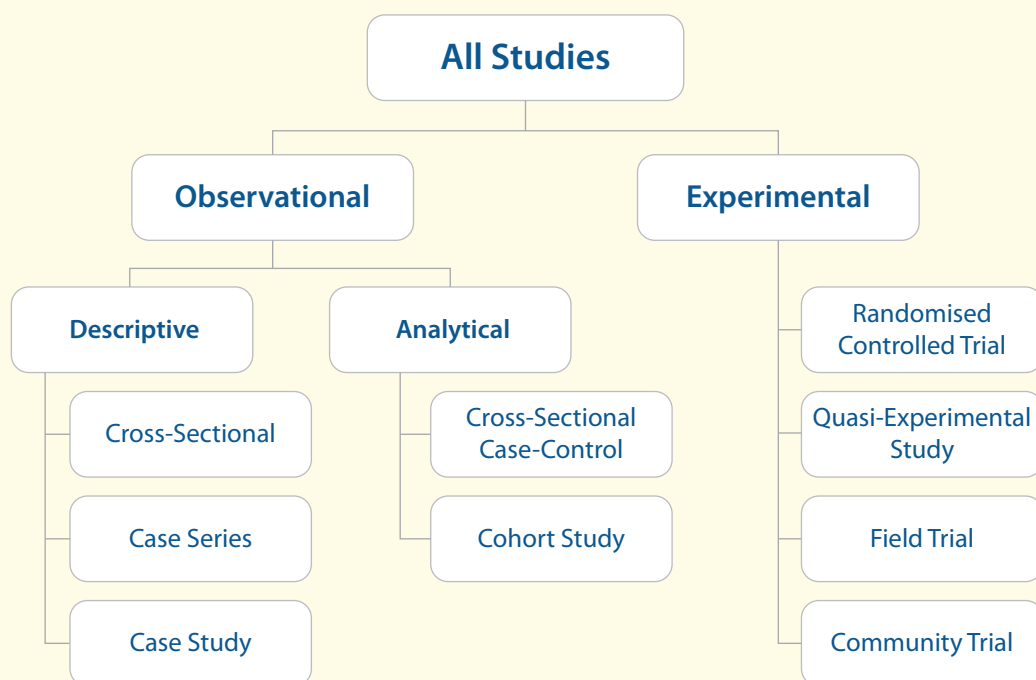


Figure 2. Classification of Epidemiological Study Designs⁵

Epidemiological studies are broadly classified into observational and experimental designs (Figure 2). The selected study design must align with the study objectives, research questions, and methods.

Students frequently label their clinical research as a randomised controlled trial, even when they use purposive or convenience sampling without proper random allocation. In such cases, the study does not meet the criteria of a true randomised controlled trial. This is a critical methodological issue that requires careful review by the supervisor.

Supervisors should clearly explain the distinctions among different types of clinical trials and guide students appropriately. When randomisation is not feasible, the study should be correctly designed and described as a quasi-experimental study rather than misclassified as a randomised controlled trial.

Important note regarding observational study

Observational studies are research methods where participants are observed without any intervention or manipulation. They help identify patterns, associations, and trends.

Types:

1. **Descriptive:** Describe who, what, when, and where of health phenomena (e.g., case reports, case series, cross-sectional). Descriptive studies are mainly hypothesis generating.
2. **Analytical:** Investigate relationships between factors and outcomes (e.g., cross sectional, case-control, cohort, ecological). Cross-sectional studies may be descriptive or analytical depending on the objective.

Key considerations for human studies: Ensure students use "participants" or "respondents" and never "subjects" when referring to humans in research.

Box 13. Difference between research participants and research respondents

Research participants vs. Research respondents ^{2,3,4}

While often used interchangeably, these terms have distinct meanings in research contexts:

- **Research participants:** Individuals who are actively engaged in a study, such as those participating in experiments, interviews, or clinical trials. Common in psychology, medicine, and social sciences.
- **Research respondents:** Individuals who provide answers to surveys or questionnaires, often in market research or opinion polling. Their role is limited to responding to specific questions.

ii. Qualitative study

Qualitative research focuses on understanding human behaviour, experiences, and the reasons behind them. It explores phenomena in-depth using non-numerical data such as words, images, or observations. It is interpretive and often inductive, aiming to generate theories rather than test them. ¹

Types:¹

1. Ethnography (culture-focused)
2. Phenomenology (lived experiences)
3. Grounded theory (theory generation)
4. Case studies (in-depth cases)
5. Narrative research (personal stories)

Data collection:¹

1. Interviews (structured/unstructured/semi-structured): Personal conversations to explore in-depth views.

2. Focus groups: Group discussions to gather diverse perspectives.
3. Observations: Recording behaviours in natural settings.
4. Document/Artifact analysis: Examining existing texts, diaries, videos, and other relevant materials.

Data analysis techniques:¹

1. Thematic analysis: Identifying and analysing patterns or themes in data.
2. Content analysis: The systematic coding and categorization of textual information.
3. Narrative analysis: Examining the structure and content of stories.
4. Discourse analysis: Studying language use in context.
5. Framework analysis: Utilizing structured coding for comparative analysis across cases.

iii. Animal study

Animal studies, also known as preclinical or in vivo studies, involve the use of non human animals to investigate biological processes, understand diseases, and test the safety and efficacy of new treatments before human trials.

They play a critical role in:

1. Biomedical research – uncovering disease mechanisms such as cancer, diabetes, and neurological disorders.
2. Drug development – evaluating pharmacological effects, toxicity, dosage, and therapeutic potential.
3. Behavioural and genetic research – studying memory, learning, anxiety, or gene function using animal models.

Commonly used models include mice and rats, zebrafish, pigs, rabbits, and dogs, as well as non-human primates.

Animal research follows ethical principles like the 3Rs:

- Replacement – using alternatives, when possible,
- Reduction – minimizing the number of animals,
- Refinement – improving care to reduce suffering.

Studies are carefully designed with controls, randomisation, and proper statistical analysis to ensure scientific validity. They serve as a crucial bridge between laboratory discoveries and human clinical research, enhancing public health and medical innovation. ⁶

2.8.2 Study period

When guiding students in describing the study duration, ensure they clearly define the timeline for each phase of the research. A well-structured timeframe should include:

1. Overall study period – The total duration of the study, from initiation to completion (e.g., data collection, analysis, and reporting).

2. Planning period – Idea generation, protocol writing, and obtaining Institutional review board clearance.
3. Participant enrolment period – The specific timeframe during which participants will be recruited.
4. Follow-up duration (if applicable) – If the study involves follow-up visits, mention the length of time participants will be monitored.
5. Statistical analysis and report writing – The time allocated for data processing, analysis, and finalising the report.

Box 14. Example of describing the study duration and timeline

The study was conducted from January 2024 to March 2025. Study planning and IRB clearance were obtained between January and March 2024. Participant enrolment took place over six months (April–September 2024), during which eligible participants were recruited. They were then monitored for three months post-enrolment (October–December 2024). Subsequently, data cleaning, statistical analysis, and interpretation were carried out from January to February 2025, followed by the preparation and submission of the final report in March 2025.

In addition to the activities described above, students should be guided to develop a Gantt chart and present the project timeline clearly.

2.8.3 Study sample, sampling and sample size

Sampling methods

Students should use probability sampling methods whenever feasible, as these methods reduce selection bias and improve generalisability of findings.^{3, 5} However, in some cases, probability sampling may not be feasible, making non-probability sampling a more practical choice.

In hospital settings, it is often challenging to apply probability sampling due to logistical constraints. However, students can consider using systematic sampling or block sampling methods to ensure a structured and representative sample selection process.

By carefully selecting an appropriate sampling method, students can enhance the validity and reliability of their research findings.⁵

Randomisation

As a supervisor, it is essential to ensure that your students clearly describe the randomisation process when conducting a Randomised Controlled Trial (RCT). Many students write, "randomisation into two groups" without clearly describing the randomisation procedure. If they have not performed randomisation, they must be honest and classify their study as a non-randomised comparison, explaining the basis

for treatment allocation. Misrepresenting a non-randomised study as an RCT is unethical and can have serious scientific consequences.^{4,7}

When reviewing your student's work, ensure they include the following:

1. **Sampling frame** – Ask the student to clearly identify their sampling frame. They should specify exactly which population list, register, or source they used (or intended to use) to draw their sample.
2. **Sequence generation** – Ask how they generated the random sequence. Did they use a random number table or a computer programme? Ensure they specify whether they used simple, block, or cluster randomisation.⁷
3. **Allocation concealment** – Confirm that they describe how allocation was concealed to prevent bias. Common methods include sealed opaque envelopes or pharmacy-coded medications. Remind them that allocation concealment is mandatory for all RCTs, even if blinding is not possible.
4. **Blinding** – If blinding was done, ensure they specify whether participants, treating physicians, and outcome assessors were blinded. The most common method involves using a placebo with a similar appearance, taste, and smell. If blinding is not possible, the trial should be declared open label.⁷

Key supervision points:

- Ensure students provide a detailed randomisation process.
- Guide them in properly reporting allocation concealment.
- Emphasize that blinding and allocation concealment are different—allocation concealment is required in all RCTs, while blinding may not always be feasible.
- Supervisors should warn students against falsely claiming randomisation.

By carefully reviewing these aspects, you can help students design scientifically valid RCTs and report them transparently.^{4,7}

Sample size

Supervisors should ensure that their students determine sample size using a statistically sound approach.^{8,9}

Common approaches for sample size calculation in clinical settings

Sample size calculation is a crucial aspect of clinical research, ensuring that studies have sufficient power to detect meaningful differences while avoiding unnecessary resource expenditure. Below are some commonly used methods for sample size determination in clinical settings:

1. Estimating sample size for comparing two means (Continuous Data)

Formula:

$$n = \frac{(Z_{\alpha/2} + Z_{\beta})^2 \times (SD_1^2 + SD_2^2)}{(\mu_1 - \mu_2)^2}$$

Application: Used when comparing two groups based on a continuous outcome, such as blood pressure levels between treatment and control groups.^{8,9}

Key inputs include standard deviation (SD), expected difference (effect size), significance level (α), and power ($1 - \beta$).

2. Estimating sample size for comparing two proportions (Categorical data)

Formula:

$$n = \frac{(Z_{\alpha/2} + Z_{\beta})^2 \times [p_1(1 - p_1) + p_2(1 - p_2)]}{(p_1 - p_2)^2}$$

Application: Used when comparing proportions between two groups, such as the proportion of patients developing complications in treatment vs. placebo groups.^{8,10}

Key Inputs: Expected proportions (p_1 , p_2), significance level (α), and power ($1 - \beta$).

3. Sample size for a single proportion

Formula:

$$n = \frac{Z_{\alpha/2}^2 \times p(1 - p)}{d^2}$$

Application: Used when estimating a prevalence or proportion in a single population, such as the prevalence of diabetes in a given community.^{10, 11}

Key Inputs: Expected prevalence (p), margin of error (d), and significance level (α).

Box 15. Common methods and tools for sample size calculation

Common sample size calculation methods:

- Power analysis (Clinical trials, hypothesis testing).^{8, 12}
- Cochran's formula (Large population surveys).¹¹
- Finite population correction (Small population studies).^{9,11}

Online tools for sample size determination:

- OpenEpi (Epidemiology, medical research).¹³
URL: https://www.openepi.com/Menu/OE_Menu.htm
- G*Power (Hypothesis testing, power analysis).¹⁴
URL: <https://www.psychologie.hhu.de/arbeitsgruppen/allgemeine-psychologie-und-arbeitspsychologie/gpower>
- Epi-Info¹⁵: <https://www.cdc.gov/epiinfo/pc.html>

Several common mistakes are frequently observed in sample size determination:

1. Using an arbitrary sample size without justification – Students often select a sample size, such as 100, without providing a valid scientific explanation. Every sample size must be supported by statistical reasoning.^{8, 9}
2. Using an incorrect formula – Some students use the wrong formula to calculate sample size. Supervisors should encourage students to consult a statistician to ensure they apply the appropriate methodology.^{8, 10}
3. Failing to present and explain the sample size calculation clearly: Even when students use the correct formula, they may struggle to explain their calculations clearly. Proper documentation and interpretation of the formula are essential.^{7,8}
4. Ignoring feasibility and time constraints – Some students determine sample size without considering whether it is practical within the given data collection period. Often, they later claim that time constraints prevented them from reaching the required sample size. Supervisors should guide students in setting a realistic and achievable sample size considering feasibility, time, and resources.
5. Misinterpreting study limitations – Students should remember that study limitations do not validate or justify inaccurate results. In some cases, failing to meet the required sample size may render the study results invalid or unreliable. Supervisors must emphasise that limitations should be acknowledged but should not be used to justify avoidable methodological weaknesses.^{4, 8, 9}
6. Miscalculating sample size for follow-up studies – Students conducting longitudinal or follow-up studies often fail to account for dropout rates over time.^{7,8} In clinical trials with multiple follow-up sessions, patient attrition is common. Additionally, in hospital-based studies, students sometimes include patients discharged from the hospital in follow-up plans, assuming they will return for future data collection. However, in reality, many discharged patients do not return, making follow-up data collection difficult. Some students attempt to gather follow-up data over the phone, which may introduce bias and reliability issues. Given these challenges, students should carefully evaluate whether follow-up data collection is feasible before selecting their study title.
7. Students may sometimes use AI-based tools to estimate sample size. Before accepting those numbers, make sure the student actually used the correct formula for their study design. If there is any ambiguity, the supervisor should consult a statistician to confirm the accuracy.
8. Dropout and missing data: Supervisors should ensure that students present dropout and missing data in a transparent and systematic manner. This will enhance the credibility and robustness of the research findings.^{4,7}

Dropout or non-response rates

It is crucial to thoroughly address dropout or non-response rates, as these issues can significantly impact the validity, reliability, and generalizability of the findings.^{16, 17} Supervisors must guide students in identifying, managing, and reporting dropout and non-response in a clear, structured, and transparent manner.⁷

Table 9. Difference between non-response and dropout in research

Aspect	Non-response	Dropout
Definition	When a participant never responds or participates in the study after being selected.	When a participant initially participates but later withdraws before completing the study.
Stage of occurrence	Happens before data collection begins.	Happens after data collection has started.
Example	A selected individual does not respond to a survey invitation or refuses to participate in a study.	A patient stops attending follow-up visits in a long-term clinical trial.
Impact on sample size	Reduces the initial sample size, requiring oversampling at the recruitment stage.	Reduces the final dataset, affecting statistical power and study validity.
Treating method	Addressed by increasing recruitment efforts or using incentives to response rates.	Addressed by adjusting sample size for expected dropout rates or using statistical methods like intention-to-treat (ITT) analysis. ^{7, 18}

How to account for dropout/non-response in sample size calculation

Participant dropout and non-response are common challenges in clinical and epidemiological studies. If these issues are not considered during the planning stage, the final number of participants completing the study may become insufficient, leading to reduced statistical power and potentially invalid conclusion. Therefore, supervisors should ensure that students anticipate and properly adjust for dropout and non-response during sample size determination.^{19, 20}

Supervisors play a critical role in guiding students to incorporate realistic attrition estimates in their research protocols and to clearly document these assumptions in the materials and methods section.

Approach to adjust for dropout/non-response:

1. Use of an appropriate sample size formula

Students should first calculate the required initial sample size (n) using a formula appropriate for the study design. Examples include formulas for comparing proportions, comparing means, diagnostic accuracy studies, or survival analysis.

Supervisors should verify that the formula used matches the study design and that all parameters (effect size, confidence level, power, prevalence, etc.) are justified.

2. Estimation of expected dropout or non-response rate

Students should estimate the expected dropout or non-response rate (R) based on:

- Published literature
- Similar previous studies
- Pilot studies
- Expert opinion

In clinical research, dropout rates typically range between 5% and 30%, depending on study duration and follow-up complexity.¹⁷

Supervisors should ensure that students provide a clear justification for the selected dropout rate.

3. Adjust the sample size using the dropout formula

Adjusted sample size ($n_{adjusted}$) is calculated as:

$$n_{adjusted} = \frac{n}{1 - R}$$

Where:

- n = Initial required sample size
- R = Dropout (/non-response) rate (expressed as a decimal, e.g., 20% dropout = 0.20)
- $n_{adjusted}$ = Final sample size accounting for dropout

Example

Suppose a study requires 200 participants, as determined by statistical calculations.

If an estimated dropout rate is 20% ($R=0.20$), the adjusted sample size is:

$$n_{adjusted} = \frac{200}{1 - 0.20} = \frac{200}{0.80} = 250$$

So, the study should enrol 250 participants to ensure at least 200 complete the study.

Adjusting for dropout in studies with multiple follow-ups

In longitudinal studies, attrition may accumulate over multiple follow-up visits. Supervisors should ensure that students account for cumulative loss over time, rather than applying the dropout rate only once.²⁰

If:

- n_{final} = required sample size at the final follow-up
- R = dropout rate per follow-up visit
- k = number of follow-up intervals

Then the required baseline sample size is:

$$n_{\text{baseline}} = \frac{n_{\text{final}}}{(1-R)^k}$$

Example: Three follow-up visits

Assume the study requires 200 participants at the final follow-up, and the expected dropout rate is 20% per follow-up visit.

Retention proportion = 0.80

$$\begin{aligned} n_{\text{baseline}} &= \frac{200}{0.8^3} \\ n_{\text{baseline}} &= \frac{200}{0.512} = 391 \end{aligned}$$

Therefore, approximately 391–392 participants should be recruited at baseline. Supervisors should encourage students to present the adjustment clearly, as shown below:

Stage	Participants Required
Final follow-up	200
Before 3rd follow-up	$200 / 0.8 = 250$
Before 2nd follow-up	$250 / 0.8 = 313$
Baseline recruitment	$313 / 0.8 = 392$

Thus, at least 392 participants should be enrolled initially to ensure that 200 participants remain at the final follow-up.

Key advice for supervisors

Supervisors should ensure that students:

- Clearly distinguish between non-response and dropout.
- Justify the assumed attrition rate using literature or previous studies.
- Apply appropriate adjustment formulas when calculating sample size.
- Present the calculation transparently in the materials and methods section.
- Report actual recruitment, follow-up, and attrition using a flow diagram, as recommended by CONSORT guidelines.⁷

Proper guidance at the planning stage will help students design feasible, statistically sound, and transparent research studies.

Approach to adjust for non-response:

Same as described above.

If both are expected, adjust for both nonresponse and dropout separately.

Box 16. Sample, sampling and sample size determination (Hypothetical example)

Title: Effect of Low-Dose Combination Therapy vs Standard-Dose Monotherapy on Blood Pressure Control Among Hypertensive Patients Attending a Tertiary Hospital in Dhaka: A Randomised Controlled Trial

General objective

To compare the proportion of patients achieving controlled blood pressure at 3 months between:

- Group A: low-dose combination therapy
- Group B: standard-dose monotherapy

Sample and sampling

This study was conducted among adult hypertensive patients attending the Hypertension Clinic of XYZ Medical College Hospital. The sampling frame consisted of the clinic's daily outpatient register, which lists all patients diagnosed with hypertension during each clinic session.

Because obtaining a simple random sample from the entire hospital population was not feasible, systematic sampling was used. On average, about 60 eligible hypertensive patients attended the clinic per day, and the study aimed to recruit approximately 10 participants each day. The sampling interval was therefore calculated as:

$$k = \frac{60}{10} = 6$$

A random starting number between 1 and 6 was selected using a computer-generated random number. The selected starting patient and every sixth eligible patient thereafter were recruited until the daily quota was completed. Recruitment continued across consecutive clinic days until the target sample size was achieved.

Randomisation and allocation

Following enrolment and baseline assessment, participants were randomly allocated to either the low-dose combination therapy group or the standard-dose monotherapy group. The random sequence was generated using a computer programme with variable block sizes (4 and 6) to maintain balanced allocation. Allocation concealment was ensured through sequentially numbered, sealed, opaque envelopes prepared by an independent staff member. Because the two treatment regimens differed in appearance and dosing schedule, blinding of participants and clinicians was not feasible; however, the outcome assessor who measured blood pressure during follow-up was blinded to group allocation.

Sample size determination

The required sample size was calculated using the standard formula for comparing two independent proportions:

$$n = \frac{(Z_{\alpha/2}\sqrt{2p(1-p)} + Z_{\beta}\sqrt{p_1(1-p_1) + p_2(1-p_2)})^2}{(p_1 - p_2)^2}$$

Where:

- $p_1 = 0.60$ (expected control rate in the standard-dose group)
- $p_2 = 0.80$ (expected control rate in the combination-therapy group)
- $p = (p_1 + p_2)/2$
- $Z_{\alpha/2} = 1.96$ (5% significance level)
- $Z_{\beta} = 0.84$ (80% power)

Using these assumptions, the minimum required sample size was 82 participants per group. To account for an anticipated 20% dropout rate, the sample size was adjusted using:

$$n_{\text{adjusted}} = \frac{n}{1 - R}$$

Where $R = 0.20$:

$$n_{\text{adjusted}} = \frac{82}{0.80} = 103$$

The final required sample size was therefore 103 participants per group, giving a total of 206 participants.

2.8.4 Eligibility criteria

A clear and structured inclusion and exclusion criteria section is essential for defining the study population.

Inclusion criteria

- Define age range, sex (if applicable), and disease condition criteria.
- Specify the recruitment source (e.g., outpatient department, specific geographic area).

Box 17. Example of Writing Inclusion Criteria

All young adults (20–40 years) presenting to the cardiovascular disease clinic at ABC Hospital with hypertension were eligible. Hypertension was defined as systolic BP ≥ 140 mm Hg and/or diastolic BP ≥ 90 mm Hg on two separate occasions, measured at least 5 minutes apart, or a self-reported history of antihypertensive medication use.

Exclusion criteria

Exclusion criteria should not simply be the opposite of inclusion criteria but should account for bias, ethical concerns, or feasibility issues. These should apply for those covered under the inclusion criteria.

Box 18. Example of writing exclusion criteria

Participants with secondary causes of hypertension (e.g., chronic kidney disease, aortoarteritis), those on hypolipidemic drugs (any duration), or those taking oral contraceptives, corticosteroids, or anticonvulsants for at least one week before enrolment were excluded.

In a clinical setting, students often state that patients with conditions like hypertension, dyslipidaemia, diabetes mellitus, or hyperuricemia were excluded. However, they must ensure that all included patients are free from these conditions through laboratory confirmation rather than assumptions or self-reported history.

Failing to verify this may introduce selection bias, affecting the study's validity and reliability. Supervisors should remind students to include appropriate screening methods to confirm the absence of these conditions before enrolling participants.

Common mistakes

1. Do not list an upper age limit as an exclusion criterion if it is already defined in the inclusion criteria. If the inclusion criteria state "patients aged 18 and above," there is no need to exclude "patients below 18 years separately."
2. Do not include "patients who did not give consent" as an exclusion criterion. Those who refuse to give consent are automatically not part of the study and should not be explicitly listed in the exclusion criteria.

More Examples:

Table 10. Common mistakes in defining inclusion and exclusion criteria and how to avoid them

Mistake	Example	How to Fix It
Too broad or vague criteria	"Adults with diabetes"	Be specific: Adults aged 18-65 with type 2 diabetes diagnosed by a physician. NB: Why up to 65 years, must have clear rationale.
Too strict criteria	Excluding all patients with co-morbidity	Allow minor conditions if they do not affect the study results
Conflicting inclusion and exclusion criteria	Inclusion: "On medication X for 6 months" Exclusion: "Used medication X in the last year"	Ensure consistency between inclusion and exclusion
Ignoring ethical concerns	Excluding women or elderly participants without a reason	Justify exclusions scientifically, not for convenience
Unclear time frames	Exclude patients who have undergone recent surgery	Specify: "Surgery within the last 6 months"
Not considering comorbid conditions	Not addressing if people with controlled hypertension can participate	Clearly list which medical conditions are acceptable
Using unclear words	Participants must be in good health	Use measurable criteria: "BMI between 18.5 and 25"
Unrealistic criteria	Requiring rare medical tests for eligibility	Ensure recruitment is feasible and practical
Ignoring language barriers	Assuming all participants understand the study language	Provide translations or specify language requirements
Not testing criteria in real life	Setting criteria without checking if enough people qualify	Do a pilot study to see if the criteria work

2.8.5 Variables with operational definitions

As a supervisor, it is essential to ensure that students clearly define all variables used in their study. Operational definitions specify how a concept or variable will be measured or categorized in practice, which allows researchers to collect consistent and reproducible data. Without clear operational definitions, variables may be interpreted differently by data collectors or analysts, leading to measurement errors and reduced validity of the study findings.^{1, 8}

Supervisors should carefully review whether students have provided clear, measurable, and justified definitions for each variable included in their research protocol or thesis.

Key points supervisors should verify

Clear description of key variables

All key variables must be clearly described so that readers can easily understand what is being measured and how it relates to the research objectives. Clear definitions improve transparency and facilitate replication of the study by other researchers.⁸

Measurable or classifiable variables

Variables should be defined in a way that allows quantitative measurement or categorical classification. For example, continuous variables may be measured using numerical scales, while categorical variables may be grouped into clearly defined categories. Properly operationalized variables ensure consistent data collection and reliable statistical analysis.²¹

Use of standard definitions whenever possible

If standard definitions exist in the scientific literature or clinical guidelines, students should adopt those definitions to ensure comparability across studies. Standardization improves external validity and allows results to be interpreted within the broader scientific context.¹

Justification when defining new variables

If a standard definition is not available, students should clearly justify their operational definition based on logical reasoning, previous literature, or expert consensus. Supervisors should ensure that such definitions are explicitly stated and supported by references where possible.⁸

Clear operational definitions help maintain measurement validity, reproducibility, and methodological transparency, which are essential components of rigorous scientific research.

Box 19. Examples of operational definitions of study variables

Poorly defined variable	Well-defined variable
Obesity	Obesity is defined as a body mass index of 25 or higher, calculated as weight (kg) divided by height in meter squared (m ²) for Asian people. ²²
High blood pressure	Hypertension is defined as systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg, measured with a standardised sphygmomanometer, or as the use of antihypertensive medication. A participant is considered hypertensive if they meet any one of these criteria or a combination of them. ²³
Smoking habit	Current smoker: A person who has smoked at least one cigarette per day for the past 30 days. Non-smoker: A person who has never smoked or quit smoking more than six months ago. ²⁴

By guiding students to define their variables accurately and measurably, you help them produce research that is scientifically sound, reproducible, and meaningful.

2.8.6 Data collection procedures

The data collection procedure should be comprehensive, precise, and sufficiently detailed so that the study is clearly documented, consistent across participants, and reproducible by another research team. International reporting and protocol guidelines consistently emphasize transparent description of what was measured, how it was measured, when it was measured, and how participant flow and follow-up were handled.^{7, 26, 27, 30}

Specify the type of data collection procedure

Students should explicitly state whether the procedure is diagnostic, observational, or interventional and align the description accordingly.

- Diagnostic procedures involve collection of biological samples (e.g., blood, sputum) and clear reporting of the index test, reference standard, and timing/flow of testing as recommended for diagnostic accuracy studies.²⁶
- Observational procedures gather data through questionnaires, interviews, record review, or structured observation, with emphasis on clearly defined variables and standardized measurement methods.³⁰

Baseline data recording

Baseline data collection should be described as a structured package of clinical history, physical examination (e.g., height, weight, blood pressure), and laboratory investigations (e.g., blood glucose, haemoglobin). For standard population and clinical measurement procedures, using established guidance improves comparability and reduces measurement variation.³¹ If methods are new or modified, the student must describe them in enough detail for replication.^{27, 30}

Equipment, reagents, and calibration

Equipment and reagents should be reported with manufacturer name, model, and calibration/quality control procedures. For blood pressure measurement, standardized technique (rest period, seated posture, arm position, repeated measurements, and averaging rules) is essential for accuracy and should be explicitly stated.²⁹ For laboratory measures, documenting calibration and quality systems is consistent with laboratory quality and competence standards.²⁸ For example, haemoglobin may be measured using an automated analyser (Model XYZ, ABC Corporation, USA), and blood pressure may be measured using a calibrated digital sphygmomanometer (Omron HEM-7200, Omron Healthcare, Japan).

Interventions and comparators

If an intervention is part of the study, the student should describe the intervention and comparator with equal detail: drug name (generic), dose, route, formulation, frequency, duration, timing, adherence checks, and monitoring schedule. Protocol and trial reporting guidance require enough detail to allow replication and appraisal.^{7, 27} For instance, participants in the intervention group may receive 500 mg of Vitamin C daily for 12 weeks, while the control group receives a placebo on the same schedule.

Data collection schedule, monitoring, and quality control

The monitoring plan should specify when assessments occur (e.g., baseline, week 6, week 12), frequency of clinical reviews, timing of lab tests, and prespecified decision rules for any treatment adjustment. Quality control steps such as periodic staff training, inter-observer standardization, and regular instrument calibration should be stated and operationalized.^{29, 31}

Measurements, calculations, and derived variables

Measurements and calculations should be described clearly and in sufficient detail. This includes mentioning the instruments used and whether they were calibrated before use. If any variables are calculated from other measurements, the formula should be provided. For example, Body Mass Index (BMI) is calculated as: $\text{BMI} = \text{weight (kg)} / \text{height (m}^2\text{)}$. The classification standard used for interpretation should also be cited. For BMI risk categories among Asian populations, the WHO recommended thresholds are commonly used.²²

Measurements, calculations, and derived variables

Measurements and calculations should be described clearly and in sufficient detail. This includes mentioning the instruments used and whether they were calibrated before use. If any variables are calculated from other measurements, the formula should be provided. For example, Body Mass Index (BMI) is calculated as: $\text{BMI} = \text{weight (kg)} / \text{height (m}^2\text{)}$. The classification standard used for interpretation should also be cited. For BMI risk categories among Asian populations, the WHO recommended thresholds are commonly used.²²

Similarly, when classifying blood glucose levels (such as normal, prediabetes, and diabetes), researchers should follow recognized diagnostic criteria and cite the appropriate guidelines, such as those from the World Health Organization (WHO), International Diabetes Federation (IDF), or the American Diabetes Association (ADA). The same standard should be applied consistently throughout the study.^{25, 32}

Where appropriate, a flow diagram or schedule diagram should visually summarize enrolment, baseline assessment, follow-ups, and outcome measurement, consistent with established reporting guidance.^{7, 26}

Box 20. Examples of standardised measurement and data collection procedures

Example 1.

Blood pressure was measured using an automated digital sphygmomanometer (Omron HEM-7200, Omron Healthcare, Japan), which was calibrated regularly throughout the study. Measurements were taken at three separate settings during each visit to ensure accuracy and reliability. Prior to each measurement, participants rested for at least five minutes in a seated position with their back supported, feet flat on the floor, and arm positioned at heart level. For each setting, three blood pressure readings were taken at one-minute intervals. The average of the last two readings was recorded as the final blood pressure value. If a significant discrepancy (difference >10 mmHg in systolic or diastolic pressure) was observed between measurements, the process was repeated, and the most consistent values were recorded.

Example 2.

Height and weight were measured using standard techniques to ensure accuracy and consistency. Height was measured using a stadiometer (Model XYZ, Manufacturer Name, City, Country), with the participant standing barefoot on a flat surface, heels together, and back straight against the stadiometer. The participant's head was positioned in the Frankfurt horizontal plane (an imaginary line passing through the lower margin of the orbit and the upper margin of the ear canal), ensuring proper alignment. The measurement was recorded to the nearest 0.1 cm.

Weight was measured using a calibrated digital weighing scale (Model ABC, Manufacturer Name, City, Country). Participants were instructed to wear light clothing and remove footwear before measurement. The weight was recorded to the nearest 0.1 kg. The scale was calibrated before each session to ensure accuracy. Body mass index (BMI) was calculated using the formula:

$$\text{BMI} = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

BMI was classified according to the **World Health Organization (WHO)** standards²²:

- Underweight: BMI < 18.5
- Normal weight: BMI 18.5–22.9
- Overweight (at risk): BMI 23.0–24.9
- Obesity I: BMI 25.0–29.9
- Obesity II: BMI ≥ 30.0

Quality control measures were implemented by calibrating equipment regularly and training staff to follow standardised protocols for height and weight measurement.

Example 3.

Blood glucose levels were measured to assess the glycaemic status of participants. Blood samples were collected following a minimum 8-hour overnight fast for fasting blood sugar (FBS) measurement. The blood was drawn using standard venipuncture techniques and analysed using an automated biochemical analyser (Model XYZ, Manufacturer Name, City, Country).

Blood glucose was categorised based on the South Asian-specific guidelines:³²

- Normal Fasting Blood Glucose (FBG): < 100 mg/dL (5.6 mmol/L)
- Impaired Fasting Glucose (Pre-diabetes): 100–125 mg/dL (5.6–6.9 mmol/L)
- Diabetes Mellitus: ≥ 126 mg/dL (7.0 mmol/L)

In addition to fasting blood glucose, random blood glucose (RBG) and postprandial blood glucose (PPBG) were measured in some cases:

- RBG ≥ 200 mg/dL (11.1 mmol/L) indicates hyperglycaemia or possible diabetes.
- PPBG was measured 2 hours after a standardised meal, with values ≥ 140 mg/dL indicating impaired glucose tolerance.

All measurements were performed under strict quality control conditions. The biochemical analyser was calibrated regularly, and laboratory staff received training to follow standardised procedures. Results were cross-checked for accuracy and consistency.

Quality assurance and experimental protocol documentation

The supervisor must ensure that appropriate quality assurance procedures are followed during data collection and measurement to maintain the reliability and comparability of study results.

Biochemical tests

Supervisors should verify that all biochemical tests are conducted using the same type of analyser or laboratory instrument throughout the study, as different machines may produce slightly different measurements due to variations in calibration, reagents, and measurement techniques. Consistency in laboratory equipment helps ensure comparability of results and reduces measurement bias.^{8, 28}

Blood pressure measurement

Supervisors should confirm that blood pressure measurements are performed using sphygmomanometers from the same manufacturer and model whenever possible, and that the devices are regularly calibrated. Variability in measurement techniques and differences in device calibration can influence blood pressure readings; therefore, standardized measurement procedures and consistent equipment are recommended in clinical research.²⁹

Preparing experimental protocols for animal or mechanical models

When supervising studies involving animal models or experimental systems, it is essential to ensure that students provide a clear and detailed description of all preparatory procedures before initiating the experiment. Transparent documentation allows other researchers to replicate the experiment and evaluate methodological rigor.⁸

In studies involving animal models, students should describe the sedation and anaesthesia protocols, including the type of anaesthetic agent, route of administration, dosage, and monitoring methods used to assess the adequacy of anaesthesia. Proper reporting of these procedures is essential for ethical compliance and reproducibility of experimental research.⁶

All steps related to animal preparation, tissue handling, and experimental setup should be documented carefully so that the procedures can be replicated or critically evaluated by other researchers.

When pharmacological agents are used in experimental studies, supervisors should instruct students to report the generic drug name, manufacturer, concentration, dosage, and infusion rate. Similarly, when medical gases are used, the concentration and flow rate should be clearly specified. Providing such details ensures transparency and allows other investigators to reproduce the intervention accurately.²⁷

For novel experimental techniques or unique models, students should provide a detailed methodological explanation. If the method is highly unconventional, supervisors should encourage separate validation of the technique before it is applied in the main study. This practice strengthens the scientific credibility and methodological robustness of the research.

Digital data collection – Instructions for students

In modern research, ensuring high-quality data collection is fundamental to producing reliable and valid study outcomes. Poor data quality may lead to biased estimates, misinterpretation of findings, and ultimately invalid conclusion. Therefore, adopting advanced data collection systems that minimize human error and improve data integrity is strongly recommended.^{1, 8}

Digital data collection systems, particularly Computer-Assisted Personal Interviewing (CAPI), have become widely used in epidemiological and public health research because they improve efficiency, accuracy, and monitoring of field data collection.³¹

The following section highlights the advantages of digital data collection compared with traditional paper-based methods.

Advantages of digital data collection

The transition from paper-based questionnaires to digital data capture systems offers several advantages:

1. No manual data entry

Data are entered directly into the electronic system during collection, eliminating the additional step of manual transcription and reducing the likelihood of data entry errors.⁸

2. Real-time data transfer

Digital tools allow real-time or near real-time uploading of data to a central server or repository. This ensures that supervisors and research coordinators can monitor data collection progress continuously.³¹

3. Supervisor oversight and monitoring

Supervisors can review submitted data remotely, check completeness, identify inconsistencies, and provide feedback promptly. This improves data quality and allows early correction of errors.¹

4. Geolocation and timestamping

Many digital data collection platforms automatically capture GPS coordinates and timestamps, allowing verification of where and when data were collected. This improves transparency and helps detect fabricated or duplicate entries.³¹

5. Improved data quality

Built-in validation rules, skip patterns, and logical checks reduce missing

values and inconsistent responses, ensuring that the collected data are more reliable and internally consistent.⁸

6. Environmentally friendly approach

Digital data collection reduces the need for printed questionnaires, which helps conserve natural resources and decreases carbon emissions associated with paper production and transportation. This simple change promotes sustainable research practices and contributes to protecting the environment.

Required data collection method

Supervisors should ensure that students collect data using Computer-Assisted Personal Interviewing (CAPI) on portable digital devices such as tablets or smartphones whenever feasible. CAPI systems enable structured questionnaires, automatic validation, and centralized monitoring of field data collection (World Health Organization, 2017).

Students may choose one of the following commonly used digital data capture tools:

1. REDCap (Research Electronic Data Capture) – A secure web-based platform widely used in clinical and academic research for data capture and management.
2. Google Forms – A simple and accessible tool suitable for basic surveys and rapid data collection.
3. SurveyMonkey – A survey platform with customizable questionnaires and advanced analytics options.
4. KoboToolbox – A widely used platform for field surveys, particularly in humanitarian and public health research settings where offline data collection may be necessary.

Instructions from supervisors to students

Supervisors should instruct students to follow these steps during digital data collection:

1. Prepare the device: Ensure that the tablet or smartphone is fully charged and that the required data collection application is installed and configured before beginning fieldwork.
2. Collect data using CAPI: Enter data directly into the digital questionnaire during interviews or observations. Avoid recording responses on paper unless absolutely necessary.
3. Review and submit data: Students should review their entries regularly for completeness and accuracy and upload the data to the central database or server at the end of each working day.
4. Respond to supervisor feedback: Supervisors will periodically review submitted data and may provide feedback if inconsistencies or missing information are detected. Students should address these issues promptly to maintain data quality.

2.8.7 Data collection instruments

As a supervisor, you should carefully guide students in selecting and using appropriate data collection instruments, particularly when studies involve psychological constructs, behavioural variables, or social indicators. The choice of instruments should be aligned with the study objectives and supported by evidence that the tools are valid, reliable, and suitable for the target population.^{1, 8}

Selection of appropriate instruments

Students often need to use standardized instruments such as psychometric scales or socioeconomic assessment tools. Examples include the Depression, Anxiety and Stress Scale (DASS-21) for assessing psychological distress or the Kuppaswamy scale for evaluating socioeconomic status in South Asian populations. When supervising students, ensure that the selected instrument is widely recognized, scientifically validated, and previously used in comparable populations.^{33, 34}

You should encourage students to review the literature carefully to confirm that the chosen instrument demonstrates acceptable validity and reliability. Evidence of reliability (such as Cronbach's alpha) and construct validity should ideally be reported in prior studies involving similar demographic or cultural contexts.⁸

Permission to use copyrighted instruments

Many standardized scales are copyrighted and require permission from the original authors or developers before use. Supervisors must ensure that students obtain the necessary permissions before incorporating such tools into their study.

Students should be guided to:

- Identify whether the instrument is open-access or copyrighted.
- Contact the original developers through formal email communication requesting permission for academic use.
- Clarify any conditions for use, including citation requirements or licensing fees.

All correspondence related to permission should be documented and preserved, as this forms part of the ethical and methodological transparency of the study.

Documentation and record keeping

Supervisors should instruct students to maintain proper records of :

- Permission emails from scale developers
- Validation studies supporting the instrument
- Any translated or adapted versions of the instrument
- Agreements or conditions related to tool usage

Keeping these documents ensures transparency and protects the research team in case of questions regarding intellectual property or methodological rigor.

Pre-testing the questionnaire

Pre-testing, also known as pilot testing, is a critical step before the final implementation of a questionnaire. As a supervisor, you must ensure that students conduct a structured pre-test to evaluate whether the questionnaire is understandable, practical, and capable of collecting reliable data.^{1, 8}

Purpose of pre-testing

Students should understand that the main objectives of pre-testing are:

- To examine whether questions are clear and easily understood by respondents
- To evaluate the logical sequence and flow of questions
- To identify questions that may cause confusion or discomfort
- To assess the time required to complete the questionnaire

Pre-testing also allows students to become familiar with the interview or survey process, which improves their confidence during actual data collection.

Selecting a suitable pre-testing site

Supervisors should advise students to conduct the pre-test outside the main study area whenever possible. This helps prevent contamination of the primary study population.

In clinical research settings where this is not feasible, students may conduct the pre-test in another department or facility with similar characteristics to the study population.

Simulating the actual data collection process

During pre-testing, students should introduce themselves to participants and explain the purpose of the study, simulating the same conditions expected during the real data collection phase. This helps identify logistical challenges in communication, consent procedures, and interview techniques.

Identifying and resolving problems

Students should carefully observe and document any issues encountered during pretesting, such as:

- Questions that are unclear, ambiguous, or difficult to understand
- Items that require excessive time to answer
- Questions that respondents frequently skip or misunderstand
- Difficulties related to sensitive topics, language barriers, or technical terminology

Supervisors should review these observations with students and guide them in revising problematic questions.

Excluding pre-test data from analysis

Students must be clearly instructed that data collected during pre-testing must not be included in the final dataset or statistical analysis. The purpose of the pre-test is solely

to refine the questionnaire and improve the data collection process.

Revising and finalizing the questionnaire

After completing the pre-test, students should revise the questionnaire based on the identified issues. Supervisors should review the revised instrument and confirm that the necessary modifications have been implemented before approving the final version for use in the main study.

Pre-testing significantly improves the clarity, feasibility, and reliability of the questionnaire, thereby reducing measurement errors and ensuring a smoother data collection process. Supervisors should emphasize this step as an essential component of high-quality research methods.³⁵

2.8.8 Bias control strategies

Bias is a systematic error that can occur at various stages of a research study, including the design, data collection, analysis, and interpretation phases. Such errors may lead to incorrect estimates of associations or effects, ultimately affecting the validity and credibility of the study findings. Because bias can arise even in well-designed studies, it is important for students to recognize potential sources of bias and address them appropriately during the research process.^{8, 21}

As a supervisor, you should guide students to understand that acknowledging bias in a thesis is not a weakness. Rather, it demonstrates transparency, critical thinking, and scientific integrity. Completely eliminating bias is often difficult, but identifying potential sources and implementing strategies to minimize them strengthens the reliability of the research.¹

Identifying and acknowledging bias

Supervisors should encourage students to critically examine each stage of their research and identify possible sources of bias. Common forms of bias include:

- Selection bias, which occurs when the participants included in the study are not representative of the target population.
- Information or measurement bias, which arises from errors in data collection methods, instruments, or respondent reporting.
- Response bias, which may occur when participants provide socially desirable or inaccurate responses.
- Observer or interviewer bias, which occurs when researchers unintentionally influence the responses or interpretation of data.
- Confirmation bias, which arises when researchers interpret results in a way that supports their initial expectations.

Students should explicitly mention these potential biases in their methods or discussion sections and explain how they may influence the findings.²¹

Strategies to minimise bias

Supervisors should guide students to adopt appropriate methodological strategies to reduce bias. Examples include:

- **Appropriate sampling techniques:** Using probability-based sampling methods, such as simple random sampling or stratified sampling, can reduce selection bias.
- **Standardised data collection procedures:** Employing validated questionnaires, calibrated instruments, and consistent protocols helps minimise measurement errors.
- **Training data collectors:** Providing adequate training to interviewers or research assistants ensures consistency in data collection and reduces interviewer bias.
- **Blinding where possible:** In clinical or experimental studies, blinding participants or investigators can reduce observer and measurement bias.
- **Pilot testing and pre-testing:** Conducting pilot studies helps identify ambiguous questions or procedural problems before the main data collection begins.

By incorporating these strategies, students can significantly reduce the impact of bias on study outcomes.⁸

Encouraging transparency in reporting bias

Supervisors should emphasise the importance of honest and transparent reporting. Students should clearly explain:

- Potential sources of bias in their study
- The methodological steps taken to minimise these biases
- Any remaining limitations that could not be fully controlled

Transparent discussion of bias strengthens the credibility of the research and demonstrates a mature understanding of research methodology. Scientific guidelines also emphasize the importance of reporting study limitations, including potential biases, as part of responsible research practice.³⁰

Role of supervisors in bias control

Supervisors play a key role in helping students recognize and manage bias. They should review the research design carefully, discuss potential methodological weaknesses with students, and encourage critical reflection throughout the research process. By guiding students to identify and control bias systematically, supervisors help ensure that the final thesis produces reliable, valid, and scientifically credible findings.

Box 21. Examples of bias identification and control in research

Title of the study: Association Between Dietary Patterns and Risk of Type 2 Diabetes: A Case-Control Study with Bias Management Strategies

In this case-control study on the association between dietary patterns and type 2 diabetes risk, several bias management strategies were implemented to ensure reliability and validity of the findings. **Selection bias** was minimised by matching controls to cases based on age, gender, and socioeconomic status, ensuring comparability between groups. **Recall bias** was reduced by using a validated Food Frequency Questionnaire (FFQ) with a six-month recall period and visual aids to improve accuracy in reporting dietary intake. **Interviewer bias** was addressed through interviewer training, the use of standardised protocols, and blinding interviewers to participants' case or control status. To manage **confounding bias**, key variables such as physical activity, family history of diabetes, and body mass index (BMI) were measured and adjusted for in multivariate logistic regression models. Lastly, **misclassification bias** was minimised by applying strict diagnostic criteria for diabetes and conducting regular quality control checks. These strategies helped reduce potential biases, improving the robustness and credibility of the study results.

2.8.9 Writing the clinical trial registry section in the thesis (For clinical trial)

Clinical trial registration is a critical requirement in modern biomedical research. As a supervisor, we should ensure that students conducting clinical trials register their studies in an appropriate public registry before enrolling participants. Trial registration promotes transparency, prevents selective reporting of outcomes, and improves the credibility and ethical accountability of clinical research.^{31,36}

International standards strongly recommend prospective registration of clinical trials. The World Health Organization International Clinical Trials Registry Platform (WHO ICTRP) and the International Committee of Medical Journal Editors (ICMJE) require clinical trials to be registered in a publicly accessible registry as a condition for publication in many reputable journals.^{4,31} Therefore, supervisors should guide students to complete trial registration early in the research process and clearly report the registration information in their thesis.

Registration platforms

Students should register their clinical trial in a recognized registry that is part of the WHO ICTRP network. Commonly used platforms include:

- ClinicalTrials.gov – A widely used international clinical trial registry maintained by the U.S. National Library of Medicine.

- Clinical Trials Registry of India (CTRI) – A WHO-recognized registry widely used in South Asia.
- Other national registries included in the WHO ICTRP system.

Supervisors should ensure that the chosen registry meets international standards and provides a publicly accessible registration record.

Information that must be reported in the thesis

Students should clearly report the following details in the materials and methods section of their thesis:

- Registration platform (e.g., ClinicalTrials.gov or CTRI)
- Trial registration number
- Registration date
- Protocol version and date
- Direct web link to the registered trial

Including these details ensures that readers can verify the study protocol and compare the registered protocol with the reported outcomes.

Avoiding common mistakes

Supervisors should carefully review the thesis to ensure that students avoid common errors related to clinical trial registration, such as:

- Leaving the trial registration number blank or incomplete
- Registering the trial after recruitment of participants has already started
- Reporting registration information in inappropriate sections such as the results or discussion rather than the materials and methods section
- Failing to update the registry if there are major protocol modifications

Proper trial registration should occur before the enrolment of the first participant, which is referred to as prospective registration.³⁶

Linking trial registration with ethical approval

Supervisors should also remind students to link the clinical trial registration section with the Ethical Considerations section of the thesis. Ethical approval from an Institutional Review Board (IRB) or Ethics Committee should be obtained before trial initiation, and trial registration is an additional mechanism to ensure ethical oversight and research transparency.³¹

By ensuring that trial registration is completed and reported correctly, supervisors help students maintain ethical research practices and increase the likelihood that their findings can be published in reputable journals.

Example (Hypothetical):

Clinical trial registration

This clinical trial was registered with ClinicalTrials.gov, ensuring compliance with the

BMU Ethical Guidelines and WHO recommendations. The trial registration aims to promote transparency and prevent selective reporting of results.

Registration details:

Registration platform: ClinicalTrials.gov

Registration number: NCT04567890

Registration date: January 15, 2025

Protocol version: Version 1.1, dated December 20, 2024

Link to trial registration: <https://clinicaltrials.gov/ct2/show/NCT04567890>

2.8.10 Data analysis

The data analysis section is one of the most critical parts of a research protocol and thesis. As a supervisor, our role is to ensure that students clearly describe how the collected data will be analysed, rather than using vague or generic statements. The statistical analysis plan should be detailed enough that another researcher with access to the dataset could reproduce the analysis and verify the results.^{1, 8}

Students should understand that the analysis plan must be developed during the protocol stage, not after the data are collected. The chosen analytical methods must directly correspond to the study objectives, research questions, and study design.

Guiding students to write a clear data analysis plan

1. Encourage study-specific statements: Supervisors should discourage students from writing overly generic statements such as:

Box 22. Example of specific statistical analysis reporting

Poor example

Continuous variables were analysed using t tests and categorical variables were analysed using Chi-square tests.

Instead, guide students to clearly specify what variables are analysed and why.

Better example for students

The mean (SD) systolic and diastolic blood pressure of participants in the intervention and control groups were compared using an independent sample t test. The proportion of hypertensive patients in each group was compared using the Chi-square test or Fisher's exact test where appropriate.

This approach improves clarity and links statistical analysis directly to the research outcomes.

2. Matching statistical analysis to study design: Students should be reminded that not all studies require complex statistical analysis.

Descriptive studies

In purely descriptive studies, results may be summarised using:

- Frequency and percentage

- Mean, median, and standard deviation
- Tables and graphs

Box 23. Example of reporting descriptive data

Example for students

The prevalence of obesity was calculated as a percentage with a 95% confidence interval.

Age was summarised using mean $\pm$ standard deviation.

3. Inferential studies: When studies involve comparison between groups, associations, or prediction, inferential statistics are required. Examples include:⁹

Table 11. Common Inferential Statistical Tests According to Research Objective

Research objective	Example analysis
Compare means between two groups	Independent t test
Compare proportions between groups	Chi-square test
Compare means among three groups	ANOVA
Examine association between variables	Correlation analysis
Identify predictors	Regression

Supervisors should ensure that the selected statistical tests are appropriate for the data type and study design.

Significance level and confidence intervals

Students must define the level of statistical significance during the protocol stage.

Common practice: ⁹

- Significance level: $P < 0.05$
- Confidence interval: 95%

Box 24. Example of reporting P value

A two-sided P value < 0.05 was considered statistically significant. All estimates were reported with 95% confidence intervals.

Students should understand that the P value is calculated after the analysis, but the significance threshold must be predetermined.

Assessing normality of continuous data

Before selecting statistical tests, students should evaluate whether continuous variables follow a normal distribution.

Supervisors should advise students to use: ⁹

Assessing normality of continuous data

Before selecting statistical tests, students should evaluate whether continuous variables follow a normal distribution.

Supervisors should advise students to use: ⁹

- Histograms
- Q–Q plots
- Shapiro–Wilk test

Interpretation of the Shapiro–Wilk test: ⁹

- $P > 0.05 \rightarrow$ data approximately normally distributed
- $P \leq 0.05 \rightarrow$ data not normally distributed

This step determines whether parametric or non-parametric tests should be used.⁹

Table 12. Selection of statistical tests based on data distribution

Data distribution	Normal distribution (parametric)	Non-normal distribution (non-parametric)
Suitable statistical tests	T test, ANOVA	Mann–Whitney U test, Kruskal–Wallis test

Data management and statistical software

Supervisors should guide students to clearly explain how their data will be stored, cleaned, and analysed. A common weakness in protocols and theses is that students simply write the name of a software package without explaining the workflow. The section should briefly describe the steps of data entry, data cleaning, validation, and statistical analysis.

Students must also explicitly mention the statistical software they plan to use, including the software version. This ensures transparency and reproducibility of the analysis.

Another important responsibility of supervisors is to ensure that students use licensed or legitimately free software. If licensed software is used, students should mention the license information or institutional license number where applicable. This maintains academic integrity and prevents the use of unauthorized software. Free and open-source software (such as R or Epi Info) may also be used and should be properly cited.

Box 25. Data management, statistical analysis workflow, and software use (Example text for students)

Example 1 (using licensed software)

Data were entered into Microsoft Excel and analysed using IBM SPSS Statistics (version 27, licensed software; institutional license number XXXX). Prior to analysis, data were checked for completeness, consistency, and entry errors. Data cleaning and validation procedures were performed before conducting descriptive and inferential statistical analyses.

Example 2 (using open-source software)

Data were entered into Microsoft Excel and analysed using R statistical software (version 4.2) and Epi Info (CDC, USA). Data cleaning, coding, and validation were performed before statistical analysis to ensure accuracy and completeness of the dataset.

Example 3 (combined workflow)

Data were entered into Microsoft Excel and exported to R statistical software (version 4.2) for analysis. Data cleaning, variable coding, and validation were completed prior to analysis. Descriptive statistics were calculated first, followed by appropriate inferential statistical tests according to the study objectives.

2.8.11 Missing data and its management

Missing data are common in research and may occur during data collection, follow-up visits, or data entry. For example, participants may skip sensitive questions, miss laboratory appointments, or withdraw from the study before completing all assessments. As a supervisor, you should ensure that students acknowledge the presence of missing data and clearly describe how these data were handled in their thesis. Failure to report missing data may raise questions about the credibility and transparency of the analysis.^{8,37}

Students sometimes worry that reporting missing data will weaken their study. Supervisors should reassure them that transparent reporting of missing data is an ethical and scientifically sound practice. A well-conducted study openly describes the extent of missing data and the strategies used to address it.

Understanding types of missing data

Students should be guided to identify the pattern of missing data because the choice of statistical method depends on it. Missing data are commonly classified into three types:

- Missing Completely at Random (MCAR) – the missing values occur randomly and are unrelated to any observed or unobserved variables.
- Missing at Random (MAR) – the missing values are related to observed variables but not to the missing value itself.

- Missing Not at Random (MNAR) – the missing values are related to unobserved factors or to the missing variable itself.

Understanding these mechanisms helps students choose appropriate methods for handling missing values.³⁷

Example for students

In a study examining the relationship between body mass index (BMI) and glycaemic control, 5% of participants had missing fasting blood glucose values because they did not attend their scheduled laboratory visit. Multiple imputation was applied to estimate the missing values, and sensitivity analysis was performed to assess whether the results changed when the imputed data were included.

Role of supervisors

Supervisors should ensure that students:

- Report the extent and pattern of missing data in the dataset.
- Identify when missing data occurred (baseline, follow-up, or data entry stage).
- Classify missing data as MCAR, MAR, or MNAR.
- Apply and justify appropriate statistical methods for handling missing values.
- Discuss how missing data may influence the validity, reliability, and generalisability of the findings.

Strategies to minimise missing data

Supervisors should encourage students to reduce missing data during study planning and data collection by:

- Designing clear and concise questionnaires.
- Providing adequate training to data collectors.
- Using digital data collection tools with built-in validation checks.
- Minimising unnecessary sensitive questions or offering anonymity when appropriate.

Preventing missing data during the design stage is often more effective than correcting it during analysis.⁸

Methods for handling missing data

The choice of method depends on the amount and pattern of missing data.

Deletion methods (appropriate when missing data are minimal)

- Listwise deletion – removes all records containing missing values.
- Pairwise deletion – uses available data for each analysis without discarding the entire observation.

Imputation methods

- Mean or median substitution – replaces missing values with the mean or median of the variable.
- Regression imputation – predicts missing values using relationships with other variables.

- Multiple imputation (MI) – generates several plausible estimates and combines them to improve accuracy.

Statistical modelling approaches

- Expectation–Maximization (EM) algorithm
- Maximum Likelihood Estimation (MLE)

These methods provide more robust estimates when the pattern of missing data is complex.³⁷

Table 13. Choosing an appropriate approach

Type of missing data	Recommended approach
MCAR	Deletion or simple imputation
MAR	Regression or multiple imputation
MNAR	Advanced modelling or additional data collection

Supervisors should ensure that students clearly justify the chosen method and explain how missing data might affect the interpretation of their results.

2.8.12 Construct a methodological matrix for the thesis

A methodological matrix helps students map their study objectives with the variables, data collection methods, and analysis techniques used in their research. It ensures consistency and clarity in the materials and methods section, making it easier for reviewers and readers to understand how the research was conducted.

Importance of a methodological matrix:

- It provides a clear overview of how each study objective is addressed in the materials and methods section.
- Ensures that the study objectives, variables, and data collection methods are aligned.
- Helps structure the materials and methods section and makes it easier for others to understand and replicate the study.
- Acts as a quick reference for supervisors to assess whether the proposed methodology is coherent and feasible.

Students should include the following columns in the matrix:

- Study objective: What the study aims to achieve.
- Variable(s): The key variables being measured or analysed.
- Operational definition: How each variable is defined and measured in the study.
- Data collection method: The process of collecting data (e.g., interviews, questionnaires, clinical measurements).
- Instrument/Tool: The specific tool or equipment used for data collection.
- Data analysis method: The statistical test or method used to analyse the data.

Table 14. Hypothetical example of a methodological matrix for a cross-sectional study on hypertension
Study Title: Risk factors for hypertension in adults: a cross-sectional study

Study objective	Variable(s)	Operational definition	Data collection method	Instrument/Tool	Data analysis method
1. To determine the prevalence of hypertension in adults	Hypertension (Yes/No)	Systolic BP ≥ 140 mmHg or diastolic BP ≥ 90 mmHg or on medication.	Blood pressure measurement	Calibrated sphygmomanometer	Descriptive statistics (frequency, percentage)
2. To assess the relationship between physical activity and hypertension	Physical activity level	Minutes of moderate to vigorous activity per week	Self-reported questionnaire	Global Physical Activity Questionnaire (GPAQ)	Logistic regression
3. To evaluate the association between BMI and hypertension	BMI	Weight (kg)/Height (m ²), categorised as normal, overweight, obese	Physical measurement	Digital weighing scale, stadiometer	Chi-square test, linear regression
4. To explore the effect of dietary salt intake on blood pressure	Salt intake	Average daily salt intake in grams	24-hour dietary recall	Standardised dietary assessment form	Multivariate analysis
5. To analyse the correlation between stress level and blood pressure	Stress level score	Score from Perceived Stress Scale (PSS)	Structured interview	PSS Questionnaire	Pearson correlation

2.8.13 Ethical considerations

In this section, students should detail the specific ethical challenges they encountered during their study and explain the practical steps taken to address them in real-life data collection. **Instead of presenting ethical issues in a generic or theoretical manner, students must discuss actual challenges faced during their research and how they navigated them in compliance with ethical principles.**

The purpose of this section is to demonstrate that the study was conducted in accordance with recognised ethical principles and institutional requirements.^{38,39}

This section should include:

1. The ethical issue faced – A clear description of the challenge.
2. Why it was an ethical concern – Explanation of how it impacted participants' rights, safety, or well-being.
3. How it was addressed – A detailed account of the real-life steps taken to ensure ethical compliance while conducting the study.
4. Institutional approvals and ethical safeguards – Mention of ethical clearance, consent processes, and compliance with institutional review board (IRB) guidelines.

Parental or guardian consent is required for minors participating in research, and assent should be obtained from children who are capable of understanding the study procedures. The specific age at which assent is required is usually determined by local ethics committees.^{38,39} Informed consent is obtained from adults (≥ 18 years). For children aged 10–17 years, both the child's assent and parental or guardian consent are required, whereas for children under 10 years, consent is obtained only from a parent or legal guardian.

Box 26. Hypothetical example of ethical considerations in a study involving children with ASD

Title of the study: Serum folic acid level in under-five children with Autism Spectrum Disorder (ASD)

This study was conducted to assess serum folic acid status in under-five children with Autism Spectrum Disorder (ASD) at the Department of Paediatrics, BMU. Conducting research involving young children with ASD presented significant ethical challenges, particularly in obtaining blood samples. Children with ASD are considered a vulnerable population due to their limited ability to communicate distress, heightened sensory sensitivities, and potential resistance to medical procedures. Drawing blood from this group required careful ethical considerations to ensure the procedure was conducted safely, with minimal discomfort, and in a manner that respected their needs and rights.

To address these challenges, informed consent was obtained from parents or legal guardians before any procedure was performed. The study team ensured that

parents were fully informed about the study's purpose, the necessity of blood collection, potential risks, and the measures taken to minimise discomfort. They were reassured that participation was voluntary and that they could withdraw their child at any stage without any consequences.

To create a more child-friendly and ASD-sensitive environment, the blood collection was conducted in a quiet, low-stimulation setting to prevent sensory overload. Before the procedure, a familiarization session was provided where children could see and touch non threatening medical tools such as gloves and cotton swabs. This helped reduce anxiety and allowed them to feel more comfortable with the process. The presence of a parent or caregiver during the procedure was encouraged to provide reassurance and emotional support.

Minimizing pain and distress was a priority, so the smallest-gauge needles were used, and topical anaesthetics were applied before the procedure to reduce discomfort. In cases where venous blood collection was difficult, alternative methods such as heel-prick or finger-prick sampling were used whenever possible. The amount of blood drawn for the study was limited to 2-3 millilitres, ensuring that the procedure remained minimally invasive while providing sufficient volume for folic acid level assessment. Distraction techniques, including the use of sensory toys, videos, and soothing verbal communication, were employed to ease the child's anxiety. After the procedure, positive reinforcement, such as verbal praise and small non-monetary rewards, was given to create a more positive association with the experience.

The study protocol was reviewed and approved by the Institutional Review Board (IRB) to ensure ethical compliance, particularly concerning research involving vulnerable populations. Trained paediatric professionals with experience handling neurodivergent children were involved in the blood collection process to ensure that the procedure was conducted with utmost care and sensitivity. Throughout the study, the team monitored participants for signs of distress and maintained an emergency response plan in case of adverse reactions.

2.8.14 References

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2.9 How to Guide Develop Results Section

The **Results** section bridges the Materials and Methods and Discussion sections by presenting the key findings of the study, including both primary and secondary outcomes. The main purpose of this section is to present the study findings in a clear, systematic, and logical manner so that readers can easily interpret the results. A well structured Results section should balance concise narrative descriptions with tables, figures, and graphs to present the data effectively without unnecessary repetition. Findings should be reported objectively without interpretation, which should be reserved for the Discussion section.¹⁻³

2.9.1 General instructions for supervisors

As a supervisor, it is essential to ensure that tables and graphs are used appropriately to present data clearly and meaningfully. The following guidelines should be followed:

1. Limit the number of tables and graphs: The total number of tables or graphs included in the results section should not be more than 8 (in exceptional cases, it may be up to 10) to maintain clarity and avoid redundancy. Ensure that only relevant and necessary tables/graphs are included.
2. One table may be used to present socio-demographic characteristics.
3. Align data presentation with study objectives: Every table and graph should correspond to a specific objective of the study.
4. Ensure clarity and accuracy: Check for correct labelling of tables, columns, and axes.

2.9.2 Guidelines for supervisors: How to present results

Students should be advised to follow these core principles:

- A. **Start with participants:** Students should begin by describing participant recruitment, exclusions, and the final number included in the analysis. Reporting should follow international reporting standards such as CONSORT for randomised trials and STROBE for observational studies.^{4,5}
- B. **Present baseline data:** Supervisors should ensure that students clearly present the demographic characteristics and key variables of participants at the start of the study.
- C. **Report outcomes clearly:** Students should present outcomes in a structured order:
 - Primary outcome first, followed by secondary outcomes.
 - Absolute numbers as well as percentages should be reported.
 - Avoid presenting identical data in both tables and graphs unless necessary for interpretation.

D. **Avoid interpretation:** Supervisors should remind students that the Results section reports findings only. Interpretation, explanation, and comparison with previous studies belong in the Discussion section.³

a. Start with participants

Supervisors should instruct students that reporting participant flow is essential for transparency. It is not sufficient to state the number of participants recruited; students must also report how many participants were excluded, the reasons for exclusion, and the number finally included in the analysis.

This level of transparency is required by international reporting standards such as CONSORT (for randomised controlled trials) and STROBE (for observational studies).^{4,5}

Clinical Trials (CONSORT)

According to the CONSORT (Consolidated Standards of Reporting Trials) guidelines, participant flow should be presented both in the text and in a flow diagram. Supervisors should ensure that students report the following information at each stage of the study:

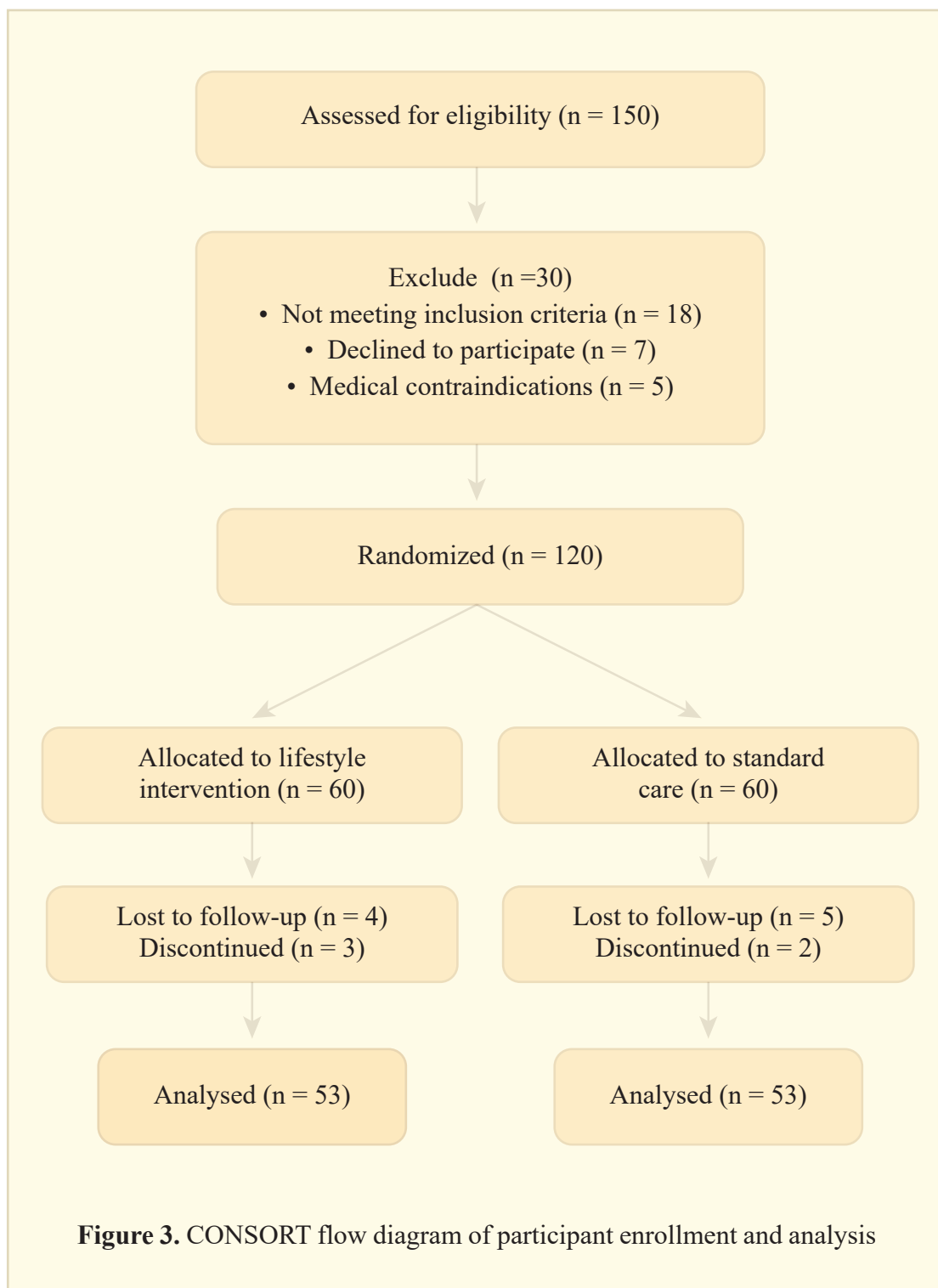
- Number assessed for eligibility
- Number excluded, with reasons (e.g., not meeting inclusion criteria, declining consent)
- Number randomised into study groups
- Number lost to follow-up or who discontinued participation (with reasons)
- Number included in the final analysis (intention-to-treat or per-protocol).⁴

Box 27. Hypothetical intervention study example (CONSORT style)

Title: Effectiveness of a Lifestyle Intervention on Insulin Resistance Among Adults with Metabolic dysfunction–Associated Steatotic Liver Disease

A total of 150 individuals were assessed for eligibility. Of these, 30 were excluded: 18 did not meet the inclusion criteria, 7 declined to participate, and 5 were excluded due to medical contraindications. The remaining 120 participants were randomised in equal numbers to the lifestyle intervention group ($n = 60$) and the standard care group ($n = 60$). During follow-up, 4 participants in the intervention group were lost to follow-up, and 3 discontinued participation, leaving 53 participants included in the final analysis. In the control group, 5 participants were lost and 2 were discontinued, leaving 53 for the final analysis. Thus, the study included 106 participants in the final analysis (53 per group).

A CONSORT flow diagram summarising this process is presented in Figure 3.



Observational studies (STROBE)

For observational studies, supervisors should ensure that students clearly describe how the final analytic sample was derived. According to the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) guidelines, the following

information should be reported:

- Number eligible for inclusion
- Number enrolled at baseline
- Number excluded (with reasons such as missing data or refusal)
- Number lost to follow-up
- Number included in the final analysis.⁵

Box 28. Hypothetical example (STROBE style)

We initially enrolled 100 participants. Of these, 5 were excluded because of incomplete baseline information, and 2 withdrew consent. The remaining 93 were followed up. At 12 months, 6 participants were lost to follow-up, leaving 87 in the final analysis.

Take-home message for supervisors

Supervisors should guide students to ensure that:

- Methods section describes eligibility criteria and sample size calculation.
- Results section begins with a short Participants subsection reporting the actual numbers enrolled, excluded, and analysed.³

b. Present baseline data

After reporting participant flow, students should present the baseline characteristics of the study population.

Supervisors should ensure that this section clearly describes:

- Who the participants were (demographics such as age, sex, education, occupation).
- Clinical characteristics at baseline (e.g., comorbidities, BMI, blood pressure, laboratory values).
- Comparability of groups in randomised trials, where intervention and control groups should appear balanced at baseline.⁴

How to present baseline data

- Use a table for clarity.
- Include text in Results to highlight the main points, but do not repeat every number.
- Report absolute numbers and percentages, and for continuous variables, give *mean (SD)*, or *median (IQR)* if data are skewed.

Box 29. Hypothetical example (MASLD Lifestyle Intervention Trial)

Results

Baseline characteristics:

The baseline characteristics of the study participants are shown in Table 15. The mean age of participants was 52 years (SD 6.2), and 54% were male. Groups were comparable in terms of age, sex, and educational level. Clinical variables, including body mass index (BMI), fasting glucose, and HOMA-IR, were also similar at baseline between the intervention and control groups.

Table 15. Baseline characteristics of participants

Characteristic	Intervention (n = 60)	Control (n = 60)
Age, mean (SD), years	52.1 (6.3)	51.8 (6.1)
Male sex, n (%)	32 (53.3)	33 (55.0)
Education $\geq$ secondary, n (%)	38 (63.3)	36 (60.0)
BMI, mean (SD), kg/m ²	29.5 (3.8)	29.2 (3.9)
Fasting glucose, mean (SD), mg/dL	110.4 (15.2)	109.8 (14.7)
HOMA-IR, mean (SD)	3.1 (0.9)	8.0 (1.0)

c. Report outcomes clearly

After describing participant flow and baseline data, students should present the study outcomes, which form the core of the Results section. Supervisors should ensure that students:

- Present the primary outcome first, followed by secondary outcomes.
- Report both absolute numbers and percentages for categorical data.
- Report mean (SD) for normally distributed continuous variables, or median (IQR) for skewed data.
- Use tables and figures to enhance clarity, while ensuring that the main findings are described in the text.³

Data should not be repeated, and the same information should not be presented in both tables and graphs. Importantly, this section should remain factual and descriptive, without interpretation.

Common methods of presenting results

As a supervisor, your role is to ensure that the student presents research findings in a

clear, structured, and logical manner. The results section should communicate key findings effectively using one or more of the following presentation methods:

1. Textual (Narrative form)

This method describes the data in words, often integrating numbers within explanatory sentences.

Example: The incidence rate of delirium following anaesthesia was 11% in 2016 and increased to 15% in 2017, with no statistically significant difference between the two years.

2. Tabular (Structured data in tables)

Tables are ideal for organising large sets of data and enabling clear comparisons. Always include both numbers and percentages for categorical data and appropriate summary statistics for continuous data.

Box 30. Guidelines for table preparation

1. Table title

- Each table should have a concise and descriptive title placed above the table.
- Tables should be numbered sequentially using Arabic numerals (e.g., Table 1, Table 2) in the order they appear in the text.
- The word “Table” and its number should be bold, while the title should be written in sentence case (capitalize only the first word and proper nouns) and presented in normal font.

Example:

Table 1. Baseline characteristics of participants

2. Table structure

- Use clear column and row labels so that the table can be understood independently of the text.
- Column headings should be short and clear and should not contain detailed explanations.
- Additional explanations should be placed in footnotes, not within the column headings.
- Ensure that numerical values are consistently formatted, including the same number of decimal places across comparable data.

3. Table formatting

- Tables should generally be single-line spaced.
- Avoid unnecessary lines to maintain clarity and readability.
- Tables should follow the three-line rule:
 - o One horizontal line at the top of the table
 - o One line below the column headings
 - o One line at the bottom of the table
- Vertical lines should not be used.
- Additional horizontal lines may be used sparingly to separate major sections, but they should not be placed after every row.
- Numbers should be aligned appropriately, preferably by decimal point for continuous data.

4. Notes and footnotes

- Notes should appear below the table to explain abbreviations, symbols, or data sources.
- Notes should begin with the word “Note.” followed by the explanation.
- Nonstandard abbreviations must be defined in the footnotes.
- Symbols such as *, †, ‡, § may be used to indicate explanatory notes, following the preferred style of the journal or institution.
- Footnotes should be written in normal font, while the superscript symbols indicate the corresponding explanations.

5. General rules

- Each table should be self-explanatory, allowing readers to understand the information without referring back to the text.
- Tables should be mentioned in the text before they appear in the document.
- Tables must be numbered consecutively and cited in the text in the order they appear.
- Statistical measures of variation (e.g., standard deviation, standard error, or confidence intervals) should be clearly identified when presented.

Example layout

Table 16. Baseline characteristics of participants

Variable	Intervention (n=60)	Control (n=60)	P value‡
Age, mean (SD)*	45.2 (6.7)	44.9 (7.1)	0.82
Male, n (%)†	28 (47%)	30 (50%)	0.74
BMI, mean ± SD	26.1 (3.4)	25.8 (3.6)	0.65
Hypertension, n (%)	15 (25%)	18 (30%)	0.56

Note: *SD=standard deviation

† n (%): Frequency (percentage)

‡ Independent t-test or Chi-square test is used as appropriate.

Table 17. Multiple linear regression analysis showing predictors of systolic blood pressure among adults (n = 200)

Predictor variable	B	SE	95% CI	P value
Age (years)	0.4	0.08	0.29 – 0.61	<0.001
Sex (male vs. female)	2.80	1.20	0.45 – 5.15	0.020
Body mass index (kg/m²)	1.25	0.30	0.65 – 1.85	<0.001
Smoking status (smoker vs. non-smoker)	3.10	1.50	0.15 – 6.05	0.040
Constant (intercept)	95.2	5.10	85.0 – 105.4	<0.001

Model summary: R² = 0.38; Adjusted R² = 0.37; F(4,195) = 29.8; P < 0.001.

Note: Dependent variable: systolic blood pressure (mmHg). Predictor variables included age (years), sex (male = 1, female = 0), body mass index (kg/m²), and smoking status (smoker = 1, non-smoker = 0).

The regression coefficient (B) represents the expected change in systolic blood pressure associated with a one-unit increase in the predictor variable, holding other variables constant. SE = standard error; CI = confidence interval.

3. Graphical (Charts and visualisation)

Graphs and charts help highlight trends, patterns, and group comparisons at a glance. Common formats include bar charts (for categorical variables), line graphs (for trends over time), and boxplots (for skewed continuous data). Graphs should complement tables, not duplicate them.

Box 31. Guideline for graphical presentation

Supervisors should ensure that students prepare figures, graphs, and illustrations that are clear, accurate, and consistent throughout the thesis.

1. Format and quality

Supervisors should ensure that all figures and illustrations are clear, sharp, and of high quality. Digital images should be saved in standard formats such as JPEG, TIFF, or PNG, with sufficient resolution to remain legible in both electronic and printed versions of the thesis.

For clinical photographs, radiological images, or microscopic photographs, high resolution is essential to preserve scientific accuracy. Graphs and charts should be generated directly from statistical or spreadsheet software rather than drawn manually.

2. Titles and legends

Every figure must have a number and a title.

- The word “Figure” followed by the number (e.g., Figure 2.) should appear in bold.
- The title should follow in sentence case and normal font.
- The title should be concise and sufficiently descriptive to indicate the content of the figure.

A legend should appear below the figure, aligned to the left. The legend should explain any abbreviations, symbols, arrows, colors, or markers used so that the figure can be understood independently of the main text.

3. Text and labels within figures

Supervisors should advise students to maintain consistency in the formatting of labels and text inside figures.

- Use a clear sans-serif font such as Calibri, Arial or Helvetica.
- Font size should remain legible even after the figure is reduced for printing.
- Decorative fonts should be avoided.
- Bold or italic text within figures should only be used when necessary for emphasis.

Axis labels in graphs must include appropriate measurement units.

4. Design and consistency

Figures and graphs should maintain consistent style, scales, and formatting throughout the thesis.

- Colors, symbols, and graphical styles should be consistent across figures.

- Lines, bars, and markers must be easily distinguishable in both color and black-and-white printing.
- Illustrations should be proportionate, clearly labelled, and visually balanced.

Supervisors should also remind students that figures should be self-explanatory, as they are often reused in presentations or publications.

5. Graphical presentation of data

Graphs are particularly useful for presenting patterns, trends, or comparisons. Common formats include:

- Bar charts for categorical variables
- Line graphs for trends over time
- Boxplots for skewed continuous data

Graphs should complement tables rather than repeat the same data.

For statistical clarity, supervisors should ensure that:

- Categorical variables are presented with numbers and percentages.
- Continuous variables are summarized as mean $\pm$ standard deviation, or median with interquartile range (IQR) if the data are skewed.
- Ordered categorical variables are presented as separate categories rather than treated as continuous variables.

6. Special requirements for scientific images

Certain types of images require additional attention:

- Before-and-after photographs should be taken with identical lighting, orientation, and background.
- Photomicrographs must include a scale bar, and the staining method should be explained in the legend.
- Arrows, symbols, or labels should contrast clearly with the background to guide the reader.

7. Numbering and citation

Figures should be numbered consecutively in the order they appear in the text. Each figure must be cited in the thesis narrative (e.g., “as shown in Figure 5”). Figures that are not referenced in the text should not be included.

8. Permissions and acknowledgement

If a figure, graph, or illustration is reproduced or adapted from another source, the original source must be acknowledged. In many cases, written permission from the copyright holder is required unless the material is in the public domain. Even when using public-domain material, proper citation should be provided.

Structure of the results section

The Results should be written as a continuous, coherent narrative, integrating tables and graphs within the text. Avoid the common mistake of simply placing a description under each table or figure, which can make the section appear long and repetitive. Instead, highlight the most important findings, point the reader to the relevant table or figure, and maintain the flow of an academic article. This structured approach improves readability, clarity, and prevents redundancy.

Box 32. Hypothetical example of writing the results section

Title of the study: Impact of a community-based nutrition programme on childhood malnutrition (hypothetical)

Results

Participants

A total of 520 children were initially assessed for eligibility for participation in the community-based nutrition programme conducted in low-income urban areas. Among them, 20 children did not meet the inclusion criteria, mainly due to age outside the predefined study range or incomplete baseline information. Consequently, 500 children were enrolled in the study at baseline. During the six-month intervention period, 20 children were lost to follow-up because their families relocated from the study area or anthropometric measurements could not be completed at the final visit. Therefore, 480 children were included in the final analysis.

Sociodemographic characteristics

The baseline sociodemographic characteristics of participating children and their households are presented in Table 18. The mean age of the children was 36.4 months (SD 12.1), and slightly more than half were male (52%). Most children belonged to households with five or more members (64%), reflecting the large family structure commonly observed in low-income urban communities. Regarding maternal education, 42% of mothers had primary education, while 22% had no formal education. The majority of households reported monthly incomes between 10,000 and 20,000 BDT (42%), whereas 40% of families earned less than 10,000 BDT per month, indicating a generally low socioeconomic status among participants.

Table 18. Sociodemographic characteristics of participating children and house holds (n = 500)

Characteristic	Frequency	Percentage (%)
Child age group (months)		
6–23	160	32.0
24–47	210	42.0
48–59	130	26.0
Sex of child		
Male	260	52.0
Female	240	48.0
Mother's education		
No formal education	110	22.0
Primary	210	42.0
Secondary or above	180	36.0
Household monthly income		
<10,000 BDT	200	40.0
10,000–20,000 BDT	210	42.0
>20,000 BDT	90	18.0
Household size		
≤4 members	180	36.0
≥5 members	320	64.0

Note: Figures in parentheses indicate percentages. BDT = Bangladesh Taka

Reduction in underweight prevalence

The primary outcome of the study was the change in the prevalence of underweight children following the six-month community-based nutrition intervention.

At baseline, 175 children (35.0%) were classified as underweight, whereas 100 children (20.0%) were underweight after the intervention. This corresponds to a 15 percentage-point reduction in underweight prevalence. The difference between baseline and post-intervention measurements was statistically significant (χ^2 test, $P < 0.001$).

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Reduction in stunting

The prevalence of stunting also decreased during the intervention period. At baseline, 200 children (40.0%) were stunted, compared with 125 children (25.0%) after the intervention, representing a 15 percentage-point reduction. This change was statistically significant (χ^2 test, $P < 0.001$). (Table 19)

Reduction in wasting

The prevalence of wasting, an indicator of acute malnutrition, also declined during the study period. At baseline, 90 children (18.0%) were classified as wasted, whereas 60 children (12.0%) were wasted at the end of the intervention, corresponding to a 6 percentage-point reduction. (Table 19)

Improvement in dietary diversity

Dietary diversity among children improved during the intervention. At baseline, only 38% of children consumed foods from at least four food groups per day, whereas this proportion increased to 62% after the intervention, indicating improved dietary quality. (Table 19)

Improvement in protein intake

The intervention was associated with improvements in dietary intake. The mean daily protein intake increased from 12 g (SD 3.5) at baseline to 18 g (SD 4.1) after the intervention, representing a mean increase of 6 g/day (paired t-test, $p < 0.001$).

Table 19. Changes in nutritional outcomes before and after the community-based nutrition intervention

Outcome	Baseline	Post-intervention	Absolute change	P value
Underweight children, n (%)	175 (35.0)	100 (20.0)	–15%	<0.001

Stunted children, n (%)	200 (40.0)	125 (25.0)	−15%	<0.001
Wasted children, n (%)	90 (18.0)	60 (12.0)	−6%	0.030
Children consuming ≥4 food groups, n (%)	190 (38.0)	310 (62.0)	+24%	<0.001
Mean protein intake (g/day)*	12± 3.5	18± 4.1	+6 g	<0.001

Note: Percentages represent the proportion of children affected among the total participants (n = 500). χ^2 = chi-square test for comparison of proportions.

*Values for protein intake are presented as mean $\pm$ standard deviation and compared using a paired t-test.

Figure 4 shows the change in the prevalence of stunted growth among children participating in the community-based nutrition programme. The prevalence decreased from 40% at baseline to 25% after the six-month intervention.

Stuning prevalence (%)

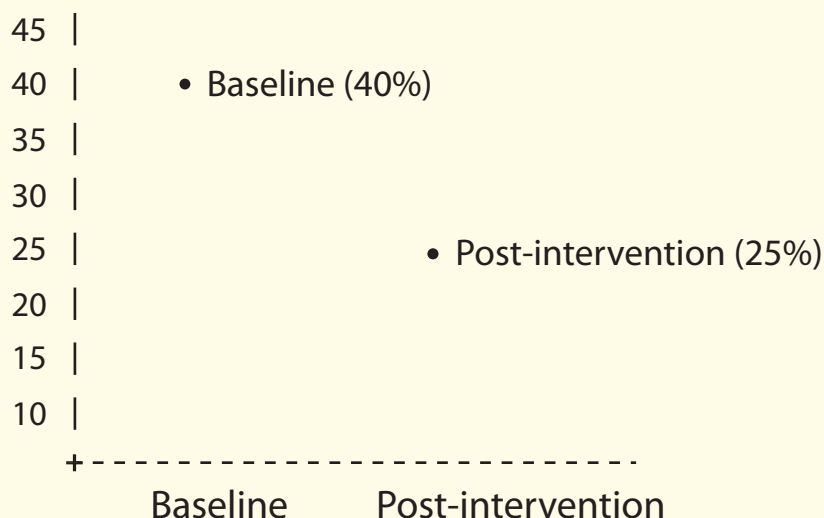


Figure 4. Trend in stunted growth prevalence before and after intervention

Table 20. Utility of different types of graphs and diagrams with example

Type of Graph/Diagram	Utility	Example
Bar chart	Used for comparing different categories or groups.	Comparing the number of cases of different diseases in a hospital.
Line graph	Useful for showing trends over time.	Tracking the progression of a disease outbreak over months.
Pie chart	Best for representing proportions and percentages.	Showing the percentage distribution of different causes of mortality.
Histogram	Displays frequency distribution of numerical data.	Examining the distribution of blood pressure readings in a patient population.
Scatter plot	Shows relationships between two variables.	Analysing the correlation between cholesterol levels and heart disease risk.
Box plot	Summarises distribution, median, quartiles, and outliers.	Comparing haemoglobin levels among patients with anaemia.
Flowchart	Represents processes work-flows visually.	Illustrate the steps in diagnosing and treating a disease.
Tree diagram	Useful for and hierarchical structures and decision making.	Displaying the classification of different types of cancer.
Area chart	Demonstrates quantity changes over time, similar to line graphs but emphasizing volume.	Showing the cumulative number of COVID-19 cases over time.
Radar chart	Displays multivariate data and compares multiple categories.	Comparing different treatment responses in a clinical trial.

Some examples

Histogram

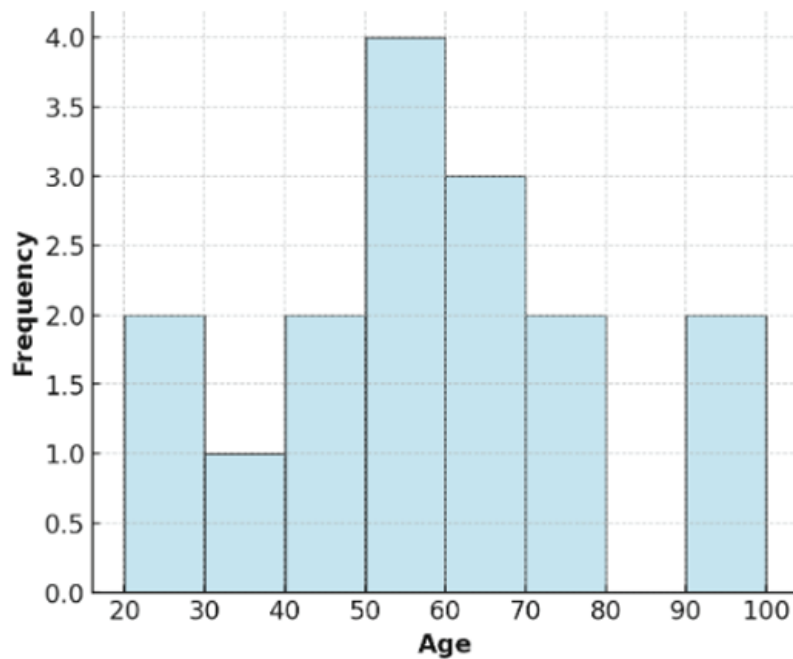


Figure 5. Age distribution

Pie chart

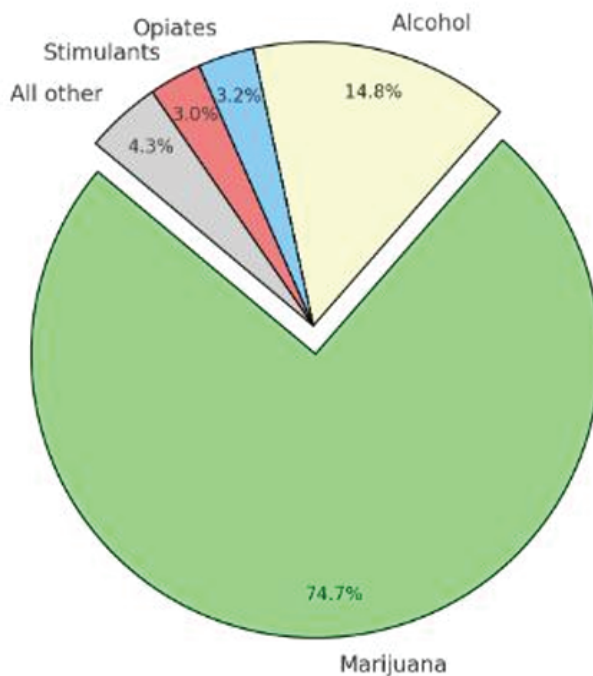


Figure 6. Distribution of adolescents aged 12 to 17 years discharged from substance abuse treatment, 2011

Line graph

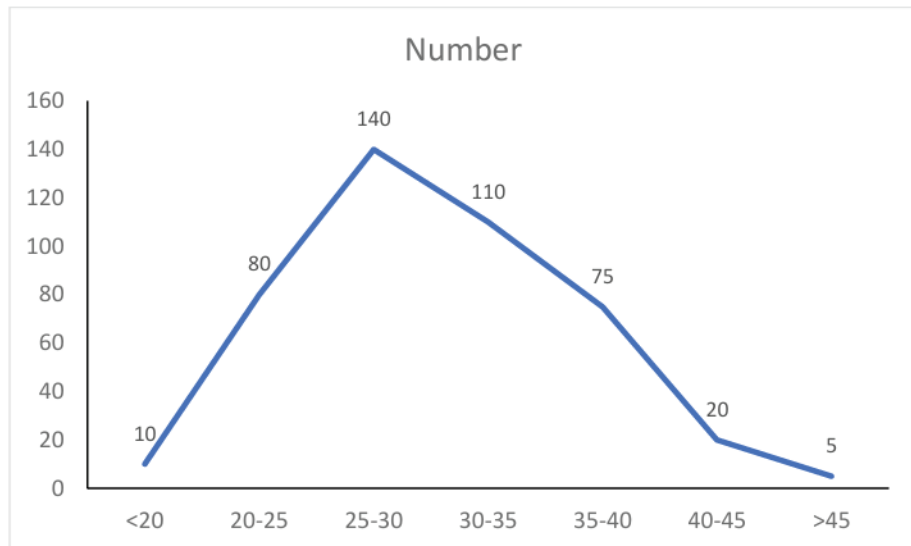


Figure 7. Line graph showing the age distribution of mothers of children with neurodevelopmental disorders

Box and whisker plot

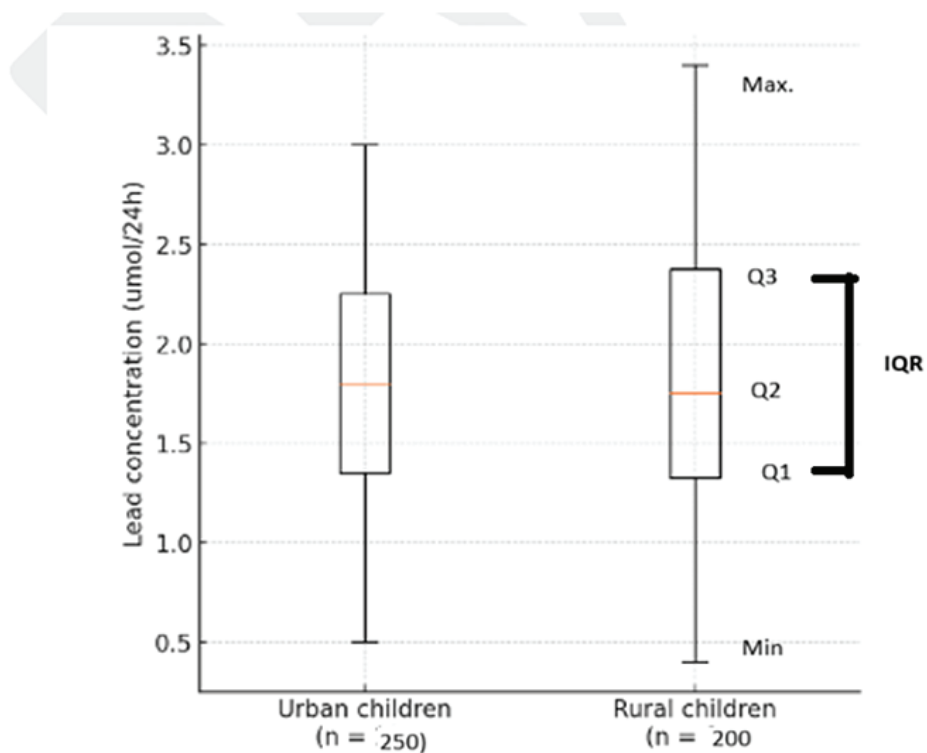


Figure 8. Urinary lead concentration in urban and rural children

Scatter plot

Scatter plot

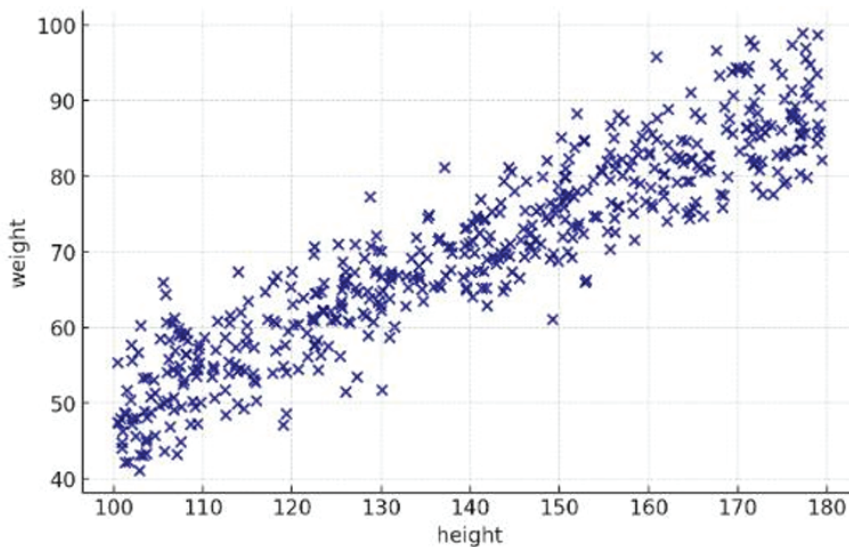


Figure 9. Scatter Plot of Height (cm) vs Weight (kg)

2.9.3 References

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2.10 Writing the Discussion Chapter: Guiding Your Student

The discussion chapter is one of the most intellectually demanding parts of a thesis. After collecting data, analysing results, and presenting findings, this section allows the student to interpret the results and explain their significance within the broader scientific context. Unlike the results section, which presents data objectively, the discussion focuses on understanding what the findings mean and why they matter.^{1,2}

A well-written discussion does not simply repeat results. Instead, it interprets the findings, relates them to existing literature, and explains their implications for theory, practice, or policy.^{2,3} Through this chapter, students demonstrate their ability to critically evaluate their work and place it within the wider body of scientific knowledge.

Supervisors play a crucial role in helping students structure the discussion logically.³ Many students tend to repeat their results or introduce unrelated topics in this section. Supervisors should guide them to develop a coherent narrative that moves from interpretation of the study findings to broader implications for research and practice. In most thesis formats, the discussion chapter contains four core components:

- i. Statement of major findings
- ii. Comparison with existing literature
- iii. Theoretical and practical implications
- iv. Strengths and limitations of the study

Each of these components contributes to helping the reader understand the importance of the study.

i. Statement of major findings

The discussion should begin with a clear and concise statement summarizing the main findings of the study.¹

This opening paragraph should directly address the research question and explain how the results answer it. Students should focus on interpreting the meaning of the findings rather than repeating detailed numerical results.

Supervisors should encourage students to:

- Emphasise the most important findings of the study
- Relate the findings to the research objectives
- Highlight any novel or unexpected observations

Students should avoid repeating detailed results or introducing new data at this stage. This opening paragraph should be clear and confident, allowing the reader to immediately grasp the main message of the study.

Box 33. Example of a strong opening

Our findings indicate that the community-based nutrition intervention substantially improved child nutritional status, as evidenced by significant reductions in underweight and stunting prevalence. These results suggest that targeted community programmes can effectively address childhood malnutrition in low-income urban populations.

Such an opening helps readers quickly understand the key contribution of the study without revisiting the entire results section.

ii. Comparison with existing literature

After presenting the major findings, students should compare their results with those reported in previous studies.² This step helps position the research within the existing body of scientific knowledge.

Supervisors should encourage students to review relevant literature and identify studies that either support or contradict their findings. Through this comparison, students demonstrate how their research contributes to ongoing scientific discussions.

Students should discuss whether their findings:

- Confirm previous research
- Extend existing evidence to new populations or contexts
- Present results that differ from earlier studies

When differences arise, students should analyse possible explanations. Differences between studies may occur due to:

- Variations in study design
- Differences in sample characteristics
- Differences in intervention intensity or duration
- Contextual factors such as socioeconomic or cultural conditions

Students should present these comparisons objectively and avoid criticising previous studies unnecessarily. The goal is to explain differences, not to challenge other researchers.

Box 34. Example of comparing study findings with existing literature in the discussion

The findings of the present study are consistent with earlier research demonstrating that community-based nutrition interventions improve child growth outcomes.⁴ However, the reduction in stunting observed in this study was greater than that reported in previous rural trials. This difference may reflect the higher intensity of the intervention and improved access to health services in the urban programme setting.

By linking their results with previous evidence, students show how their work contributes to the cumulative development of knowledge in the field.

iii. Theoretical and practical implications

Once the findings are compared with previous research, students should explain their theoretical and practical significance.

Theoretical implications

The discussion should explain how the findings relate to existing scientific theories, models, or conceptual frameworks. Doing so helps demonstrate that the results are scientifically plausible and consistent with established knowledge.

For example, improvements in child nutritional status following dietary interventions are consistent with biological theories linking nutrient intake with growth and metabolic development.⁵

Students should be encouraged to explain how their findings support, refine, or expand current theoretical understanding.

Box 35. Example of explaining theoretical implications of study findings

The improvement in child growth indicators observed in this study supports established theories linking adequate nutrient intake with improved metabolic and developmental outcomes during early childhood.

Such explanations strengthen the scientific credibility of the findings.

Practical implications

In addition to theoretical significance, students should discuss how their findings may be applied in real-world settings. Many health and social science studies aim to inform policy decisions, clinical practice, or public health programmes.

Supervisors should encourage students to consider how their findings may contribute to:

- Public health programmes
- Clinical practice guidelines
- Health system planning
- Policy development

For instance, evidence showing that community-based nutrition programmes reduce childhood malnutrition may support the expansion of such programmes in vulnerable communities.

Box 36. Example of discussing practical implications of study findings

The results of this study suggest that integrating community-based nutrition interventions into primary healthcare services may improve child growth outcomes in urban low-income populations. Policymakers may therefore consider scaling up similar programmes as part of national strategies to address childhood undernutrition.

iv. Strengths and limitations

Every study has strengths and limitations, and acknowledging them improves the credibility of the research. Supervisors should encourage students to discuss these aspects honestly and specifically.

Strengths

Strengths are aspects of the study design that enhance confidence in the findings. Examples include:

- Adequate sample size
- Well-defined outcome measures
- Standardized data collection procedures
- Use of validated measurement tools

For example, the use of standardized anthropometric measurements improves the reliability of nutritional assessments.

Box 37. Example of describing study strengths

A key strength of the study is the use of standardized anthropometric measurements conducted by trained field workers, which ensured accurate and reliable assessment of child nutritional status.

Limitations

Students should also identify limitations that may affect the interpretation of their findings. Common limitations include:

- Limited sample size
- Short follow-up
- Reliance on self-reported data
- Possible measurement errors
- Potential confounding variables

Acknowledging limitations demonstrates transparency and critical thinking. Importantly, students should not overemphasize weaknesses but rather explain how they might affect interpretation.³

Students should also suggest how future studies could address these limitations.

Box 38. Example of describing study limitations

One limitation of this study is the reliance on caregiver-reported dietary intake, which may introduce recall bias. In addition, the intervention was implemented in a single urban community, which may limit the generalizability of the findings to rural settings. Future studies conducted in diverse geographical contexts may provide more comprehensive evidence.

Common mistakes students should avoid

Supervisors should ensure that students avoid several common problems when writing the discussion section:

1. Simply repeating the results section
2. Drawing unsupported conclusions
3. Introducing new data that were not presented in the results
4. Selectively reporting findings that support the hypothesis while ignoring others.

Encouraging careful revision and critical reflection helps students develop a balanced and scientifically rigorous discussion.

Table 21. Guidance for supervisors when reviewing the discussion section

Encourage students to	Guide students to avoid
Interpreting the major findings — Emphasise the most significant findings of the study. — Highlight the main research objectives and key outcomes.	— Repeating detailed numerical data that already appear in the results section. — Introducing new findings that were not presented in the results section. — Providing an extensive explanation of the research problem at this stage.
Comparing findings with existing literature — Read full research articles rather than relying only on abstracts. — Focus on key objectives and outcome relevant to their research topic.	— Comparing findings that are unrelated to their research objectives. — Repeating results from other studies without meaningful interpretation.

- Compare findings from multiple studies to understand different perspectives.
- Describe study settings and sample sizes to provide context.
- Critically analyse variations in findings and explore possible explanations.
- Listing results from previous studies without critical evaluation.
- Criticising other authors rather than analysing differences objectively.

Box 39. Hypothetical example of a structured discussion section

Statement of major findings

The present study demonstrates that Drug X significantly reduces blood pressure among patients with hypertension. Over the 8-week treatment period, participants receiving Drug X experienced a 10.7% reduction in blood pressure compared with only a 1.4% reduction observed in the control group. These findings indicate that Drug X has a substantial antihypertensive effect and may be effective in improving blood pressure control among individuals with hypertension. The magnitude of reduction observed in the intervention group suggests that Drug X may contribute to lowering the risk of hypertension-related complications, including cardiovascular and cerebrovascular diseases. Overall, the results indicate that Drug X may serve as a promising therapeutic option for managing elevated blood pressure.

Comparison with existing literature

The findings of this study are consistent with previous research demonstrating the effectiveness of pharmacological agents targeting the renin–angiotensin system in reducing blood pressure. For example, Smith et al. (2021) reported significant reductions in both systolic and diastolic blood pressure among patients treated with drugs acting on the renin-angiotensin pathway. Similar results have also been reported in other clinical trials evaluating antihypertensive medications.

However, the magnitude of blood pressure reduction observed in the present study appears slightly greater than that reported in some previous studies. Several factors may explain this difference, including variations in study population characteristics, baseline blood pressure levels, treatment protocols, or adherence to medication. Additionally, differences in study duration and measurement methods may also contribute to variations in reported outcomes. Despite these differences, the present findings reinforce existing evidence supporting the role of pharmacological interventions in the effective management of hypertension.

Theoretical and practical implications

Theoretical Implications

The results of the present study are biologically plausible and may be explained by the pharmacological mechanism of Drug X. Hypertension is strongly influenced by the activity of the renin–angiotensin system (RAS), which plays a central role in regulating vascular tone and fluid balance. Drug X is believed to inhibit components of this pathway, thereby reducing the production or activity of angiotensin II.

Angiotensin II promotes vasoconstriction and sodium retention, both of which contribute to elevated blood pressure. By inhibiting this pathway, Drug X may reduce vascular resistance and improve cardiovascular function, resulting in lower blood pressure levels. The findings of the present study therefore support existing theoretical frameworks that link inhibition of the renin–angiotensin system with improved blood pressure control.

Practical Implications

The findings of this study have important implications for clinical practice. Effective management of hypertension remains a major public health priority due to its strong association with cardiovascular disease, stroke, and kidney disease. The significant reduction in blood pressure observed among participants receiving Drug X suggests that this medication may represent an effective therapeutic option for individuals with hypertension.

If confirmed in larger clinical trials, Drug X may be incorporated into treatment strategies for patients who do not respond adequately to existing medications. In addition, the potential ability of Drug X to reduce long-term cardiovascular risk highlights its possible role in preventive medicine and chronic disease management.

Strengths and limitations of the study

A major strength of this study is the randomised controlled design, which minimizes selection bias and enhances the internal validity of the findings. The inclusion of a control group allowed for a clear comparison between treatment and standard care, thereby strengthening the reliability of the observed effects of Drug X. Furthermore, the standardized measurement of blood pressure ensured consistency in outcome assessment.

However, several limitations should be considered when interpreting the findings of this study. First, the duration of follow-up was relatively short (8 weeks), which limits the ability to evaluate the long-term effectiveness and safety of Drug X. Second, the study sample may not fully represent the broader population of patients with hypertension, potentially limiting the generalizability of the findings to other settings or populations. Finally, additional clinical factors that may

influence blood pressure outcomes were not explored in this study.

Future studies with longer follow-up periods and larger, more diverse populations are needed to confirm the effectiveness of Drug X and to evaluate its long-term safety profile.

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2.11 Write Effective Conclusion

2.11.1 Background

The conclusion is the final component of the discussion chapter and should summarise the key messages of the study while emphasising their broader significance. At this stage, students should briefly restate the principal findings and explain why these findings are important for research, policy, or practice. Unlike the results section, which presents detailed data, the conclusion should provide a clear and concise synthesis of the overall contribution of the study.^{1,2}

Supervisors should guide students to articulate their conclusion clearly and to explain how the findings may be relevant in real-world contexts. In many health-related studies, this may involve discussing implications for clinical practice, public health programmes, or policy development. However, the conclusion should always remain consistent with the scope of the study and the evidence presented.³

For example, if a study demonstrates that smoking increases the risk of diabetes, the conclusion should highlight how these findings may contribute to diabetes prevention strategies and public health awareness. Students may also suggest directions for future research, such as investigating whether smoking cessation can reduce the risk of diabetes.

Box 40. Example of writing the study conclusion

Our findings highlight the potential role of NSAIDs in colorectal cancer prevention. Further research is needed to confirm these results, explore the underlying biological mechanisms, and assess whether these drugs may prevent adenoma recurrence or promote regression of existing lesions.

Box 41. Writing the conclusion: key guidance for students

Encourage students to:

- Clearly state the main conclusions derived from the study findings.
- Emphasise the clinical and public health relevance of the results, not merely their statistical significance.
- Explain how the findings contribute to existing scientific knowledge.
- Identify contexts or conditions in which the findings may not be applicable.
- Suggest specific and realistic directions for future research.

Guide students to avoid:

- Overstating the importance of their findings.
- Engaging in unnecessary speculation beyond the study's evidence.
- Repeating detailed results that have already been presented.
- Drawing conclusion that are not supported by the study data (for example, making claims about cost-effectiveness or feasibility without appropriate analysis).

2.11.2 Key elements of a strong conclusion

A well-written conclusion should be concise, coherent, and provide a strong final perspective on the research. Supervisors should ensure that students' conclusions include the following elements.^{2,3}

Clear statement of principal findings

- The conclusion should directly reflect the main objectives of the study.
- Key findings should be summarised clearly without repeating detailed numerical data.
- Avoid vague generalisations or claims that are not supported by the student's research.

Significance of the work

- Students should highlight the importance and contribution of their findings.
- Emphasise new insights, methodological contributions, or contextual relevance of the study.
- Ensure that claims about significance are supported by the study results.

Practical applications

- Where appropriate, students may discuss real-world implications for clinical practice, public health programmes, or policy development.
- Supervisors should ensure that these implications remain within the scope of the study findings and avoid broad generalisations.

Future research directions

- Encourage students to identify gaps that remain after their study.
- Suggested research directions should logically follow from the study findings and limitations.
- Recommendations should be realistic and scientifically grounded.

Common mistakes to avoid

Supervisors should ensure that students avoid several common errors when writing the conclusion:

- Overstating the importance of the findings.
- Repeating detailed results instead of summarising the key message.
- Making unsupported claims or speculating beyond the scope of the study.
- Introducing new information that was not discussed earlier in the thesis.

Applying these principles helps students produce conclusions that are clear, balanced, and scientifically credible.¹

2.11.3 References

1. Hess DR. How to write an effective discussion. *Respir Care*. 2004;49(10):1238-41. DOI: 10.4187/respcare.04491238
2. Day RA, Gastel B. How to write and publish a scientific paper. 7th ed. Cambridge: Cambridge University Press; 2012.
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2.12 Writing the Recommendations Section in a Thesis

The recommendations section of a thesis presents practical or research-oriented suggestions that arise directly from the study findings and conclusion. It usually appears after the conclusion and proposes actions, improvements, or areas for further investigation based on the evidence generated by the research.

Unlike the discussion section, which interprets results, the recommendations section focuses on what should be done next. These suggestions must be logically derived from the study findings rather than introduced as unrelated ideas.

Well-written recommendations help translate research findings into practical actions, policy decisions, or future research opportunities.

Box 42. Hypothetical thesis used as an illustrative example

Thesis title

Maternal Nutrition Knowledge and Its Association with Child Undernutrition in Urban Slum Communities

Study objectives

General objective

To assess the relationship between maternal nutrition knowledge and the nutritional status of children under five years of age in urban slum communities.

Specific objectives

1. To determine the level of maternal knowledge regarding infant and young child feeding practices.
2. To assess the prevalence of undernutrition (stunting, wasting, and underweight) among children under five years.
3. To examine the association between maternal nutrition knowledge and child nutritional status.
4. To identify socio-demographic factors associated with childhood undernutrition.

All examples in the recommendations section below are based on this hypothetical study.

Purpose of the recommendations section

The recommendations section serves several important purposes:

1. Provide practical solutions to problems identified in the research.
2. Translate findings into actions that practitioners, policymakers, or organisations can implement.
3. Identify directions for future research where additional investigation is needed.
4. Highlight improvements to existing systems, policies, or practices based on the study findings.

These recommendations should always be supported by the evidence generated in the research and aligned with the research objectives.

Steps for writing the recommendations section

1. Revisit the research objectives

Students should begin by reviewing the original research questions or objectives. Recommendations must directly address the problems or gaps identified in the study.

In the hypothetical study, one objective was to assess maternal knowledge regarding infant feeding practices. If the findings indicate poor maternal knowledge, the recommendations should focus on improving maternal education and awareness programmes.

2. Analyse the study findings

The recommendations should be based on the key findings of the research. Students should identify the most important insights from the results and discussion sections. For example:

If the study finds that children of mothers with low nutrition knowledge have a significantly higher prevalence of stunting, a recommendation may focus on strengthening maternal nutrition education programmes.

Recommendations should therefore directly reflect the evidence generated in the study.

3. Develop practical and actionable suggestions

Effective recommendations should be clear, realistic, and actionable. Instead of making vague statements, students should propose specific actions.

Box 43. Example of weak and strong recommendations

Weak recommendation

Government authorities should improve child nutrition services.

Strong recommendation

Community health workers should provide regular maternal nutrition education sessions during antenatal and postnatal visits to improve knowledge of infant feeding practices in urban slum communities.

Action-oriented recommendations help readers understand what actions should be taken and by whom.

4. Prioritise the most important recommendations

Students often generate many possible suggestions, but not all recommendations are equally important. They should prioritise recommendations based on:

- Importance of the problem
- Feasibility of implementation
- Potential impact of the intervention

This helps ensure that the recommendations remain focused and practical rather than overly broad.

Box 44. Example of hypothetical write-up for study recommendations

Example

Based on the findings of the hypothetical study, priority recommendations may include:

1. Strengthening maternal nutrition counselling in primary healthcare services.
2. Implementing community-based growth monitoring programmes.
3. Improving access to nutrition education for mothers in low-income communities.

5. Provide justification for each recommendation

Each recommendation should include a brief explanation of why it is important and how it relates to the study findings.

For example:

Strengthening maternal nutrition education programmes is recommended because the study found a strong association between poor maternal knowledge of infant feeding practices and child stunting.

This approach ensures that recommendations are evidence-based rather than speculative.

6. Suggest directions for future research

Many studies reveal new questions that were beyond the scope of the original research. Students should identify these areas and propose topics for further investigation.

Example

Future studies may explore:

- The long-term effectiveness of maternal nutrition education programmes.
- The role of paternal involvement in child nutrition practices.
- The impact of community-based nutrition interventions in rural settings.

Such recommendations help advance knowledge in the field and guide future researchers.

Types of recommendations in a thesis

Recommendations may fall into several categories:

1. Policy recommendations: Suggestions for government policies or institutional regulations.

Example

National child nutrition policies should incorporate community-based maternal education programmes to improve infant feeding practices in low-income urban communities.

2. Practice or programmatic recommendations: Actions that organisations or practitioners can implement.

Example

Primary healthcare centres should integrate regular nutrition counselling sessions for mothers during antenatal and child health visits.

3. Research recommendations: Suggestions for future studies.

Example

Further research should examine the effectiveness of digital nutrition education programmes in improving maternal knowledge and child feeding practices.

These categories help ensure that recommendations are structured and targeted to relevant stakeholders.

Box 45. Example of hypothetical write-up of recommendations

Example

Based on the findings of this study, several recommendations can be proposed. First, maternal nutrition education programmes should be strengthened in urban slum communities to improve knowledge of infant feeding practices. Second, primary healthcare services should incorporate routine growth monitoring and nutrition counselling for children under five years of age. Finally, future research should evaluate the long-term effectiveness of community-based nutrition interventions in improving child nutritional outcomes.

Common mistakes students should avoid

Students should avoid several common problems when writing the recommendations section:

- Making recommendations that are not supported by the study findings
- Providing vague or overly general suggestions
- Proposing unrealistic or impractical interventions
- Introducing new information that was not discussed in the research
- Repeating the discussion or conclusion instead of proposing actions.

Effective recommendations should be concise, practical, evidence-based, and logically derived from the research findings.

Key principle

A simple rule for writing recommendations is:

Findings → Conclusion → Recommendations

This ensures that recommendations remain logically connected to the evidence generated by the research.

2.13 Guide the Students on How to Construct Their References Section

Ask the students to use strictly pertinent references.

Students will follow the Vancouver style of referencing in their thesis.¹ Since most journals adopt this referencing style, it allows students to easily convert their thesis into a manuscript for publication without requiring additional effort.

Supervisors should guide students on how to properly format and cite references in Vancouver style, as outlined in the "Uniform Requirements for Manuscripts Submitted to Biomedical Journals" by the International Committee of Medical Journal Editors (ICMJE). This includes using numbered citations in the text in the order of appearance and listing references in a numbered bibliography at the end of the document.

Detailed guidance on Vancouver-style referencing is available from the ICMJE website. <http://www.icmje.org>.

Reference

1. International Committee of Medical Journal Editors. Recommendations for the conduct, reporting, editing, and publication of scholarly work in medical journals. Updated 2026 Jan [cited 2026 Mar 13]. Available from: <https://www.icmje.org/recommendations/>

Section 3. Supervising the Thesis: How to write the Abstract

3.1 Supervising the Thesis: How to Write the Abstract

3.1.1 Background

The abstract is a critical component of the thesis, providing a concise summary of the entire research. It is one of the first sections read by examiners, and a well-written abstract helps in determining the relevance and quality of the study. According to Cooley and Lewkowicz¹, the abstract serves as a summary of the research written after the study is completed. It highlights the purpose, methods, key findings, and significance, acting as an overall signpost for readers.

Even though the abstract is written last, it is typically one of the first parts read, and if poorly written, it may be the only part read. Supervisors must ensure that students produce an abstract that captures the essence of the thesis and encourages further reading.

3.1.2 Purpose of the abstract

- Provides a concise overview of the study.
- Helps readers decide whether to read the full thesis.
- Summarises the research findings and their importance.
- Prepares the thesis for journal submission (if applicable).

3.1.3 Typical structure of an abstract

A thesis abstract should answer the following questions:

1. What was the purpose of the study?
2. Why was the study carried out?
3. How was the study conducted?
4. What were the key findings?
5. What is the main conclusion or implication?

3.1.4 Structured abstract

A structured abstract is recommended for a thesis. It is divided into sections, including Background, Objectives, Methods, Results, and Conclusion. Commonly used in scientific and clinical research.

Box 46. Guidelines for writing a structured abstract

Background (1–2 sentences)

Introduce the research topic and its significance.

Example: Hypertension is a significant public health issue contributing to cardiovascular diseases worldwide. This study investigates the prevalence of hypertension and its associated risk factors in rural Bangladesh.

Objectives (1–2 sentences)

State the main aim of the study.

Example: The objective was to determine the prevalence of hypertension and identify associated lifestyle and demographic factors.

Methods (2–3 sentences)

Briefly describe the study design, population, sampling method, and key procedures.

Example: A cross-sectional study was conducted among 500 adults in rural Bangladesh. Data on blood pressure, physical activity, and dietary intake were collected through interviews and clinical measurements.

Results (3–4 sentences)

Summarise the key findings with relevant statistics.

Example: The prevalence of hypertension was 35%. Factors significantly associated with hypertension included age ($P < 0.01$), high salt intake ($P < 0.05$), and low physical activity ($P < 0.01$).

Conclusion (1–2 sentences)

State the main conclusion and its implications.

Example: Hypertension is highly prevalent in rural Bangladesh, with several modifiable lifestyle factors contributing to the risk. Public health interventions focusing on diet and physical activity are recommended.

Keywords (3–5 words)

Include relevant keywords for indexing.

Example: Hypertension, Risk Factors, Cross-sectional Study, Rural Health.

The careful selection of keywords is essential for maximizing the visibility and accessibility of scientific publications in digital databases. To ensure accurate indexing and improved searchability, it is recommended to select keywords from Medical Subject Headings (MeSH) terms. If an exact match is not available in the MeSH list, additional relevant terms may be included based on professional judgment. This approach enhances the discoverability of research while maintaining standardised terminology.

Box 47. Hypothetical example of a structured abstract

Background: Hypertension is a significant public health issue, contributing to cardiovascular diseases globally. This study aims to assess the prevalence of hypertension and its associated risk factors in rural Bangladesh.

Objectives: The objective was to determine the prevalence of hypertension and identify associated lifestyle and demographic factors.

Methods: A cross-sectional study was conducted among 500 adults in rural Bangladesh. Data on blood pressure, physical activity, and dietary intake were collected through interviews and clinical measurements. Statistical analysis was performed to identify associations between risk factors and hypertension.

Results: The prevalence of hypertension was 35%. Significant risk factors included advanced age ($p < 0.01$), high salt intake ($p < 0.05$), and low physical activity ($p < 0.01$). No significant association was observed with smoking or alcohol consumption.

Conclusion: Hypertension is highly prevalent in rural Bangladesh, with modifiable lifestyle factors contributing to the risk. Public health interventions targeting dietary behaviour and physical activity are recommended to reduce the burden of hypertension.

Keywords: Hypertension, Risk Factors, Rural Population, Cross-sectional Study, Public Health

3.1.5 Common mistakes to avoid

- Writing too much detail, exceeding word limits
- Including information does not present in the main thesis
- Missing key methods
- Missing key findings
- Focusing on the background only
- Using complex jargon or overly technical language.

3.1.6 General instructions for writing an abstract

Word limit: Up to 300 words

Paper size: A4, 1.5-line spacing

Font type: Times New Roman (12 points)

3.1.7 References

1. Cooley L, Lewkowicz J. Dissertation writing in practice: turning ideas into text. Hong Kong: Hong Kong University Press; 2003.

Section 4. Supervising the Thesis: The Essential Elements

4.1 Organizing the Thesis

Guide your students to arrange their thesis in the following essential elements.

A. Front matters

- I. Cover page
- II. Title page
- III. Declaration by the student
- IV. Certificate
- V. Acknowledgments
- VI. Table of contents
- VII. Glossary of abbreviations/acronyms
- VIII. Abstract

B. Main body of the thesis

1. Introduction
2. Research questions/Objectives of research/Hypothesis
3. Review of literature
4. Materials and methods
5. Results
6. Discussion
 - 6.1 Strengths and limitations
7. Conclusion and recommendations
8. References

C. Appendices

- i. Consent form (local language and English)
- ii. Assent form (for children)
- iii. Case record forms, questionnaires, datasheets
- iv. Certificate of approval from the institutional review committee
- v. Presentation of the thesis results to scientific forums and publications in scientific journals, if any

4.2 Typesetting and Formatting

4.2.1 Thesis formatting and structure guidelines

- Language and Text Formatting:
 - The thesis should be written in UK English.
 - Use a 12-point font size with a Times New Roman font.
 - The text should be printed in black ink on both sides of A4 paper, while images and figures should be printed in colour.
 - Maintain 1.5-line spacing with justified alignment on both sides.
- Headings: Use three levels of headings for section organization.
- Margin: Keep a 1.5-inch blank margin on the left and 1-inch margins on all other sides for A4 sized paper.
- Pagination: Use Indo-Arabic numerals (1, 2, 3, ...) placed at the centre bottom of each page, starting from the Introduction section and continuing through to the References.

4.2.2 Section-wise word limit recommendations

Section	Maximum word count
Introduction	800 words
Literature Review	2400 words
Materials and Methods	4400 words
Results	3600 words
Discussion (with limitation)	2400 words
Conclusion and Recommendation	400 words

References: Not more than 40 references

4.2.3 References and citation guidelines

- Use references that are preferably published within the last 10 years, with a focus on those from the last 5 years, depending on the availability of relevant sources.
- Follow the Vancouver citation style for referencing.
- Include DOI for journal articles and URLs for online sources.
- Citations from textbooks are generally discouraged; instead, primary research articles or systematic reviews should be used whenever possible. However, openly accessible online textbooks may be cited when readers can readily access the source.

4.3 Guidelines for Teachers on Educating Students About Plagiarism

4.3.1 Introduction

Plagiarism is a serious academic offense that involves using someone else's work without proper attribution. Teachers play a crucial role in guiding students to understand plagiarism, its consequences, and how to avoid it. This section provides a structured approach for educators to teach students about plagiarism, best practices to prevent it, and the penalties associated with committing plagiarism.

According to the Merriam-Webster Dictionary, plagiarism refers to the theft and use of another person's ideas or words without proper credit and presenting them as one's own work.¹

The World Association of Medical Editors (WAME) defines plagiarism as *"the use of others' published and unpublished ideas or words (or other intellectual property) without attribution or permission and presenting them as new and original"*.² Plagiarism is widely recognized as a violation of academic integrity and research ethics.^{3, 4}

4.3.2 Types of plagiarism

Several forms of plagiarism have been identified in academic and research settings:^{3, 4}

- a. Intentional plagiarism: Deliberate copying or use of another person's work without acknowledgement.
- b. Unintentional plagiarism: Occurs due to lack of awareness of citation rules or improper paraphrasing; however, it still carries the same penalties as intentional plagiarism.
- c. Self-plagiarism: Reusing one's own previously published work without appropriate citation or disclosure.
- d. Patchwork plagiarism: Copying portions of text from multiple sources and combining them without proper attribution.
- e. Ghost writing and commissioned work: Having another person write an assignment or thesis and submitting it as one's own work.

The Committee on Publication Ethics (COPE) describes several examples of major plagiarism, including: ⁴

- i. Unattributed copying of another person's data or findings.
- ii. Verbatim copying of more than 100 words without citation.
- iii. Unattributed use of another author's ideas, hypotheses, or original work.
- iv. Verbatim copying of shorter text (<100 words) without quotation marks.
- v. Close copying of substantial sections from another source, even if cited.

4.3.3 How to guide students about plagiarism

1. Discuss the ethical implications

Teachers should emphasize academic honesty and integrity as core values of scholarly work.⁵ Students should understand that plagiarism damages academic credibility and undermines trust in research.

Teachers should also train students in proper citation and referencing practices, including commonly used styles such as Vancouver or Harvard.

2. Explain paraphrasing, summarizing, and quoting

Students should clearly understand the differences between paraphrasing, summarizing, and quoting.³

Paraphrasing: Students restate an idea in their own words while preserving the original meaning. Proper citation is still required.

Summarizing: Students condense the key ideas of a larger text into a shorter form while retaining the main message. A reference to the original source is necessary.

Quoting: Direct use of the author's exact words enclosed in quotation marks with appropriate citation. Direct quotations should be used sparingly.

3. Use plagiarism detection tools

Teachers should introduce students to plagiarism detection and writing support tools such as Turnitin, Grammarly, and PlagScan, which help identify similarity in text and improve academic writing.⁶

Students should be encouraged to check their assignments before submission to ensure originality and proper citation.

Note: The BMU authority now provides plagiarism detection software through the Central Library, and the University Grants Commission (UGC) has also taken the initiative to make such software available for teachers free of cost.

4. Incorporate practical exercises

Teachers should provide practice opportunities where students:

- Paraphrase or summarize scholarly articles
- Use proper citation in assignments
- Analyse real-world cases of plagiarism and discuss their academic implications

Such exercises help students develop ethical research practices.⁷

5. Promote original thought and research skills

Teachers should encourage students to develop critical thinking, independent analysis, and originality in their academic work. Assignments that require interpretation and reflection reduce the likelihood of plagiarism.⁶

4.3.4 How to avoid plagiarism

Students should follow the following best practices to ensure that their work remains plagiarism-free:^{3, 7}

- a. Write assignments and thesis in their own words.
- b. Always acknowledge the original source of information, ideas, or illustrations.
- c. Use quotation marks when including direct quotes and provide proper citation.
- d. Paraphrase information appropriately and cite the original source.
- e. Summarize key information while maintaining attribution.
- f. Keep track of all sources consulted during research.
- g. Distinguish between common knowledge and information requiring citation.
- h. Use plagiarism detection software before submitting assignments.

4.3.5 Penalties for plagiarism

Academic institutions impose strict consequences for plagiarism to maintain academic integrity and research ethics.^{4, 5} These penalties may include:

- a. Failing grades for assignments or courses.
- b. Suspension or expulsion from academic institutions.
- c. Retraction of previously published research papers or theses.
- d. Blacklisting from academic or research institutions.
- e. Legal action for intellectual property violations.
- f. Damage to professional credibility and future career opportunities.

4.3.6 Plagiarism thresholds for BMU thesis

Thesis with 25% text similarity can be submitted for examination. However, the final version of the thesis should have less than 15% text similarity before acceptance.

4.4 Acknowledgements

In this section, students should express sincere gratitude to individuals and institutions that supported the completion of the thesis. Students should acknowledge their supervisor and co-supervisor for their academic guidance, mentorship, and constructive feedback throughout the research process.

Students may also acknowledge other individuals or organizations who contributed to the study but do not meet the criteria for authorship. This may include advisors, laboratory technicians, data collectors, administrative staff, study participants, or institutions that provided logistical, technical, or financial support. Acknowledgements should be limited to those who made meaningful contributions to the research.

When preparing this section, students should follow the authorship recommendations of the International Committee of Medical Journal Editors (ICMJE).⁵ According to the ICMJE, authorship should be based on all four of the following criteria:

1. Substantial contribution to the conception or design of the work, or to the acquisition, analysis, or interpretation of data.
2. Drafting the manuscript or critically revising it for important intellectual content.
3. Final approval of the version to be submitted or published.
4. Accountability for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Individuals who contributed to the study but do not meet all four criteria should not be listed as authors. Instead, their contributions should be recognized in the Acknowledgements section.

Box 48. Hypothetical example for students to write the acknowledgements section

Acknowledgements

The author expresses sincere gratitude to Professor Dr. A.B.C., Supervisor of this study, for his invaluable guidance, continuous encouragement, and constructive suggestions throughout the planning and completion of this research. The author is also grateful to Dr. X.Y.Z., Co-supervisor, for her helpful advice and support during data analysis and manuscript preparation.

The author would like to thank the Department of Public Health and Informatics, Bangladesh Medical University, for providing institutional support to conduct this study. Special thanks are extended to the data collectors and laboratory staff for their assistance during data collection and processing. Finally, the author expresses heartfelt appreciation to all study participants for their cooperation and willingness to participate in this research.

4.5 Funding source

Students should clearly acknowledge the funding source (if any), including the grant name, memo number, and date.

Box 49. Hypothetical example of a funding source statement for students

Funding source

This study was supported by a research grant from Bangladesh Medical University (BMU) under the *BMU Research Grant Programme 2025–2026*. The grant was awarded through the Office of Research and Development, Bangladesh Medical University, Dhaka, Bangladesh (Memo No.: BMU/RD/Grant/2025/145; Date: 12 January 2025). The funding body provided financial support for data collection and laboratory investigations. The funding authority had no role in the study design, data analysis, interpretation of the findings, or preparation of the thesis.

4.6 Conflict of Interest

Authors must disclose any financial, personal, or professional relationships that could potentially influence the conduct of the research or the interpretation of the findings. Transparent disclosure of conflicts of interest is essential for maintaining integrity, credibility, and trust in academic research. ⁵

In many student theses, no such conflicts usually exist. In such cases, students should clearly state under this heading that they have no conflict of interest.

If a conflict of interest exists but is not disclosed, it is considered a serious breach of academic integrity. Failure to disclose such information may raise concerns about bias, undermine the credibility of the research, and in some cases lead to corrections, withdrawal of the thesis or article, or institutional investigation.

Students should therefore be encouraged to disclose any potential conflicts honestly. Declaring a conflict does not automatically invalidate a study; it simply ensures transparency.

Box 50. Example scenarios for students to write the conflict-of-interest section

Example 1: No conflict of interest

Conflict of Interest:

The author declares that there is no conflict of interest related to this study.

Example 2: Funding support from a company

Conflict of Interest:

The author received partial financial support from ABC Pharmaceuticals Ltd. for laboratory reagents used in this study. The company had no role in the study design, data analysis, interpretation of results, or manuscript preparation.

Example 3: Equipment or materials support

Conflict of Interest:

Medical equipment used in this study was provided by XYZ Medical Technologies. The company had no involvement in the study design, data collection, analysis, or interpretation of findings.

Example 4: Professional affiliation

Conflict of Interest:

One of the authors is a consultant for a health organization that promotes the intervention evaluated in this study. This role had no influence on the study design, analysis, or reporting of results.

Example 5: Personal relationship

Conflict of Interest:

One of the authors has a family member employed by the organization that supplied materials for this study. The organization had no role in the study design, data analysis, or interpretation of findings.

Example 6: Institutional collaboration

Conflict of Interest:

The study was conducted in collaboration with the Department of Community Health, which is involved in implementing the programme evaluated in this research. The authors confirm that the analysis and interpretation of the results were conducted independently.

These examples help students understand that even potential or perceived influences should be disclosed to ensure transparency in academic research.

Key message for students

When in doubt, disclose the relationship. Transparency protects both the researcher and the credibility of the research.

References

1. Merriam-Webster. Plagiarism [Internet]. Springfield (MA): Merriam-Webster; 2023 [cited 2026 Mar 13]. Available from: <https://www.merriam-webster.com/dictionary/plagiarism>
2. World Association of Medical Editors. Publication ethics policies for medical journals [Internet]. WAME; 2021 [cited 2026 Mar 13]. Available from: <https://www.wame.org>
3. Roig M. Avoiding plagiarism, self-plagiarism, and other questionable writing practices: a guide to ethical writing. Washington (DC): Office of Research Integrity; 2015.
4. Committee on Publication Ethics. COPE guidelines on plagiarism and redundant publication [Internet]. London: COPE; 2019 [cited 2026 Mar 13]. Available from: <https://publicationethics.org>
5. International Committee of Medical Journal Editors. Recommendations for the conduct, reporting, editing, and publication of scholarly work in medical journals [Internet]. Updated 2026 Jan [cited 2026 Mar 13]. Available from: <https://www.icmje.org/recommendations/>
6. Eaton SE. Academic integrity in Canada: an enduring and essential challenge. Calgary: University of Calgary Press; 2021.
7. Pecorari D. Teaching to avoid plagiarism: how to promote good source use. Maidenhead: Open University Press; 2013.

Section 5. Appendices

Appendix I. Supervision meeting checklist

Student's name:

Department:

E-registration number:

Session:

Title of the study:

Items	Check 
1. A shared understanding of the current status and progress of research has been established.	
2. Concerns and issues (academic, administrative, personal, if relevant) have been thoroughly discussed.	
3. Agreement on the next steps and direction of the research has been reached.	
4. Tasks and activities to be completed before the next meeting have been clearly allocated with tentative deadlines where appropriate.	
5. The student has submitted a written summary of their activities since the last meeting.	
6. Feedback has been provided—constructive, timely, and specific to the student's current progress.	
7. Progress has been evaluated against the thesis timeline and key milestones.	
8. Discussion has addressed any potential delays or obstacles, with agreed-upon resolutions.	
9. Any changes in supervision frequency, contact method, or responsibilities have been clarified.	
10. The meeting summary has been prepared (by co-supervisor) and a copy submitted to the Department Head/Chairman.	
11. A copy of the meeting summary has been preserved by the supervisor.	
12. Authorship and publication matters, if relevant, have been discussed.	
13. Plans for the next meeting have been discussed and scheduled.	
14. Any required ethical approvals, administrative permissions, or research compliance issues (if relevant at this stage) have been reviewed.	

If any of the issues remain unresolved, please explain why?

(The student may use a separate page, but it must be signed by the supervisor.)

Additional comments (if any): Please explain.

Date:

Signature and name

Student

Co-supervisor

Supervisor

Chairman/Head of the Department

Appendix II. Checklist for guiding the development of a thesis Title

Student's name:

Department:

E-registration number:

Session:

Title of the study:

Items	Check 
1. Is the title clear and descriptive?	
2. Is the title concise and free of unnecessary words?	
3. Does the title avoid overcomplicating the focus?	
4. Does the title summarise the core idea of the thesis?	
5. Does the title align with the student's academic or professional goals?	
6. Is the title neutral and free of declarative statements?	
7. Are abbreviations and acronyms avoided in favour of full forms?	
8. Is the title free of italics and underlining?	

Date:

Signature and name

Student

Co-supervisor

Supervisor

Chairman/Head of the Department

Appendix III. Checklist for reviewing in the thesis introduction

Student's name:	Department:
E-registration number:	Session:
Title of the study:	

Checklist Item	Check 
1. Does the introduction start with a clear and engaging opening that captures attention?	
2. Is the research topic clearly introduced with appropriate scope and focus?	
3. Does the introduction summarize the current state of knowledge on the topic?	
4. Are major knowledge gaps or unresolved issues in the literature clearly identified?	
5. Is the rationale for the study logically developed and convincing?	
6. Are key terms, variables, or concepts appropriately defined or explained?	
7. Is the research problem or question explicitly stated and clearly framed?	
8. Are the study objectives or aims clearly outlined and logically aligned with the research question?	
9. Does the introduction explain how the study adds value or addresses a specific need?	
10. Are the potential contributions to theory, policy, or practice briefly noted?	
11. Is the structure or organization of the thesis briefly described (if applicable)?	
12. Does the introduction follow a logical "funnel structure" moving from general background to the specific research focus?	
13. Does the introduction maintain a logical flow and coherence throughout?	
14. Does the final paragraph clearly lead to the study objective or thesis statement?	
15. Is the introduction appropriately concise (800 words, 1.5-line spacing)?	
16. Are the sources cited current (mostly within the past 10 years) and relevant?	
17. Is the reference list limited to essential and high-quality sources (≤ 20 recommended)?	

If any of the issues remain unresolved, please explain why?

(The student may use a separate page, but it must be signed by the supervisor.)

Additional comments (if any): Please explain.

Date:

Signature and name

Student

Co-supervisor

Supervisor

Chairman/Head of the Department

Appendix IV. Checklist for reviewing in the research question/hypothesis

Student's name:	Department:
E-registration number:	Session:
Title of the study:	

Checklist Item	Check 
1. Has the student reviewed key literature to understand the research area?	
2. Has the student identified knowledge gaps that the research will address?	
3. Is the research question specific, focused, and manageable within available resources?	
4. Is the research question original and contributes new knowledge to the field?	
5. Is the research question clearly phrased, specific, and understandable?	
6. Does the final question align with the research objectives and study goals?	

If any of the issues remain unresolved, please explain why?

(The student may use a separate page, but it must be signed by the supervisor.)

Date:

Signature and name

Student

Co-supervisor

Supervisor

Chairman/Head of the Department

Appendix V. Checklist for supervisors: Guiding the development of research objectives

Student's name:

Department:

E-registration number:

Session:

Title of the study:

Checklist Item	Check 
1. Are the objectives directly related to the research problem?	
2. Are the objectives written clearly and concisely?	
3. Is the language specific and free from vagueness?	
4. Are the objectives achievable within the student's available resources?	
5. Do the objectives follow the SMART principles (Specific, Measurable, Achievable, Relevant, and Time-bound)?	
6. Do the objectives align with the proposed research methods?	
7. Do the objectives avoid implying any unethical approaches?	
8. Are the objectives logically organised in a clear and progressive manner?	
9. Are all objectives relevant and free from redundancy?	
10. Are clear criteria or indicators identified to measure the success of each objective?	
11. Are appropriate action verbs used in each objective to ensure clarity and actionability?	

Appendix VI. Checklist for supervisors: Evaluating the appropriateness of research objectives based on the SMART approach

Students may present their objectives in a way that allows the supervisor to assess whether they fulfill the SMART approach. Supervisors will place a tick against each characteristic of the SMART approach for every objective.

	Specific	Measurable	Achievable	Relevant	Time-bound
Sp. objective 1					
Sp. objective 2					
Sp. objective 3					
Sp. objective 4					

If any of the issues remain unresolved, please explain why?

(The student may use a separate page, but it must be signed by the supervisor.)

Additional comments (if any): Please explain.

Date:

Signature and name

Student

Co-supervisor

Supervisor

Chairman/Head of the Department

Appendix VII. Checklist for supervisors: Literature review

Student's name:	Department:
E-registration number:	Session:
Title of the study:	

Checklist Item	Check 
1. Relevance and Scope	
Are the sources selected relevant to the thesis topic and research objectives?	
Are the sources current and drawn primarily from peer-reviewed academic literature?	
Is the scope of the literature review clearly defined (population, concepts, or variables)?	
2. Search Process	
Were credible databases used (e.g., PubMed, Scopus, Web of Science, Embase)?	
Were appropriate keywords, Boolean operators (AND, OR, NOT), and search filters applied?	
Is the literature search strategy clearly documented (databases, years covered, search terms)?	
3. Critical Analysis and Synthesis	
Does the review critically evaluate previous studies rather than merely summarizing them?	
Are major knowledge gaps, inconsistencies, or unanswered questions clearly identified?	
Are findings from different studies compared and synthesised across themes or concepts?	
4. Structure and Writing Quality	
Is the literature review organised logically (introduction, thematic synthesis, gap identification)?	
Does the writing demonstrate clear academic reasoning and coherence?	
Are references cited accurately and consistently according to the required citation style?	

If any of the issues remain unresolved, please explain why?

(The student may use a separate page, but it must be signed by the supervisor.)

Additional comments (if any): Please explain.

Date:

Signature and name

Student

Co-supervisor

Supervisor

Chairman/Head of the Department

Appendix VIII. Checklist for supervisors: Materials and Methods

Student's name:	Department:
E-registration number:	Session:
Title of the study:	

Checklist Item	Check 
1. Study Design and Setting	
Is the study type clearly defined (observational, analytical, experimental, etc.)?	
Are the study setting and study population described clearly in an integrated paragraph?	
Does the study design appropriately align with the research objectives?	
2. Study Timeline	
Does the study timeline include all key stages such as planning, data collection, analysis, and reporting?	
Is a Gantt chart or structured research calendar provided to illustrate the timeline?	
3. Selection and Sampling	
Are the inclusion and exclusion criteria logical, specific, and clearly defined?	
Is the sample size justified using an appropriate formula, statistical method, or calculation tool?	
Is the sampling method clearly described and appropriate for the study design?	
Has the sample size been adjusted to account for dropout or non-response where necessary?	
4. Variables and Bias	
Are all study variables clearly defined with operational definitions, particularly the outcome variables?	
Have potential confounding variables been identified and explained?	
Are strategies for controlling or minimizing bias clearly described?	
5. Data Collection and Tools	
Are data collection instruments or tools clearly described, including model, calibration, and purpose where applicable?	
Are appropriate digital data collection platforms used (e.g., REDCap, KoboToolbox)?	

Has the questionnaire or data collection instrument been pre-tested and documented?	
Does the methodological matrix clearly align objectives, variables, and data collection tools?	
6. Data Management and Analysis	
Is the data entry and statistical software plan clearly described (e.g., R, SPSS, Stata)?	
Are statistical tests appropriately linked to each study objective?	
Are the significance level and methods for testing data normality clearly specified?	
Is there a clear plan for handling missing data or participant dropout?	
7. Ethics and Registration	
Are ethical approval procedures and participant safety considerations clearly described?	
Are informed consent and assent procedures appropriately outlined?	
Is the trial registered with complete registration details where applicable?	

If any of the issues remain unresolved, please explain why?

(The student may use a separate page, but it must be signed by the supervisor.)

Additional comments (if any): Please explain.

Date:

Signature and name with designation

Student

Co-supervisor

Supervisor

Chairman/Head of the Department

Appendix IX. Checklist for supervisors: Results

Student's name:

Department:

E-registration number:

Session:

Title of the study:

Checklist Item	Check 
Structure of the Results Section	
Do the results logically follow the research objectives?	
Are all tables and figures cited in the text before they appear?	
Does the Results section avoid interpretation or discussion of findings?	
Tables and Figures	
Are tables and figures limited to an appropriate number (maximum 8, or up to 10 if essential)?	
Does at least one table or figure present socio-demographic characteristics of the study population?	
Is each table or figure clearly titled, numbered, and appropriately labelled?	
Do the tables follow standard formatting (e.g., APA style with clean alignment, consistent decimals, and no vertical lines)?	
Are abbreviations and statistical terms explained through footnotes or notes where necessary?	
Data Presentation	
Are categorical variables presented as frequencies and percentages (n, %)?	
Are continuous variables presented as mean $\pm$ standard deviation, or median and interquartile range when data are skewed?	
Are ordered categorical variables correctly presented without being misrepresented as continuous variables?	
Do the summary statistics correspond appropriately to the type of data and study objectives?	
Is decimal precision consistent across all tables and figures?	
Graphs and Visual Aids	
Are appropriate graph types used according to the nature of the data (e.g., bar chart, line graph, pie chart, box plot)?	
Do the graphs effectively enhance understanding of trends, patterns, or comparisons?	

Are graph titles, legends, axes, and measurement units clearly and correctly labelled?	
Alignment with Study Objectives	
Does each table or figure correspond to a specific study objective?	
Are key findings related to both primary and secondary outcomes clearly presented?	

If any of the issues remain unresolved, please explain why?

(The student may use a separate page, but it must be signed by the supervisor.)

Additional comments (if any): Please explain.

Date:

Signature and name with designation

Student

Co-supervisor

Supervisor

Chairman/Head of the Department

Appendix X. Checklist for supervisors: Discussion

Student's name:	Department:
E-registration number:	Session:
Title of the study:	

Checklist Item	Check 
Are the key findings clearly stated with direct reference to the research question or objectives?	
Does the discussion avoid repeating numerical results already presented in the Results section?	
Are the findings interpreted rather than merely restated?	
Are the study findings compared with multiple relevant studies from the literature?	
Are agreements, contradictions, and possible explanations for differences clearly discussed?	
Is the literature review effectively used to support these comparisons?	
Does the discussion explain how the findings support, refine, or challenge existing theories or evidence?	
Are biological plausibility or conceptual explanations provided where appropriate?	
Is the clinical, public health, or policy relevance of the findings discussed?	
Are the strengths of the study clearly highlighted to support the credibility of the findings?	
Are study limitations and potential sources of bias (e.g., recall bias, confounding) clearly acknowledged?	
Are practical suggestions or directions for future research proposed?	
Does the discussion maintain a logical and coherent narrative throughout?	
Does the section avoid introducing new data or selectively presenting only supportive results?	
Is a concise conclusion provided that aligns with the study findings?	

If any of the issues remain unresolved, please explain why?

(The student may use a separate page, but it must be signed by the supervisor.)

Additional comments (if any): Please explain.

Date:

Signature and name

Student

Co-supervisor

Supervisor

Chairman/Head of the Department

Appendix XI. Checklist for supervisors: Conclusion

Student's name:	Department:
E-registration number:	Session:
Title of the study:	

Strengths and Limitations

Checklist Item	Check 
Are the study limitations specific and clearly stated rather than vague or generic?	
Are the limitations relevant to the study methodology, data, or research context?	
Are the strengths of the study briefly acknowledged?	
Is the potential impact of the limitations on the interpretation of findings discussed?	
Are the types of limitations (e.g., methodological, empirical, ethical) clearly identified where appropriate?	
Are the limitations presented together with suggestions for improvement or directions for future research?	

Strengths and Limitations

Checklist Item	Check 
Are the principal findings clearly and concisely stated?	
Are the findings directly linked to the research objectives?	
Are real-world or public health implications (if applicable) clearly highlighted?	
Does the section avoid introducing any new data or findings?	
Do the conclusion avoid overgeneralisation or unsupported speculation?	
Are practical recommendations grounded in the study results?	
Are directions for future research realistic and connected to the identified research gaps?	
Does the conclusion maintain a clear and engaging final tone?	

If any of the issues remain unresolved, please explain why?
(The student may use a separate page, but it must be signed by the supervisor.)

Additional comments (if any): Please explain.

Date:

Signature and name

Student

Co-supervisor

Supervisor

Chairman/Head of the Department

Appendix XII. Checklist for supervisors: Thesis Abstract Writing

Student's name:	Department:
E-registration number:	Session:
Title of the study:	

Checklist Item	Check 
Is the abstract structured into the sections: Background, Objectives, Methods, Results, and Conclusion?	
Is the abstract within the prescribed word limit (≤ 300 words)?	
Is the abstract written clearly, concisely, and free from unnecessary jargon?	
Is the abstract formatted using 1.5-line spacing?	
Does the abstract clearly state the aim of the study?	
Does it briefly describe the study design, population, tools, and procedures used?	
Are the key findings summarized with relevant data or statistics?	
Does the abstract present the main takeaway and its implication?	
Does the abstract avoid introducing any new data or findings not included in the thesis?	
Does the abstract include 3–5 relevant keywords?	

If any of the issues remain unresolved, please explain why?

(The student may use a separate page, but it must be signed by the supervisor.)

Additional comments (if any): Please explain.

Date:

Signature and name with designation

Student

Co-supervisor

Supervisor

Chairman/Head of the Department



Professor Md. Abul Kalam Azad
Pro-Vice Chancellor
(Administration), BMU



Professor M Atiqui Haque
Dean, Faculty of Preventive
and Social Medicine, BMU



Professor Md. Ibrahim Siddique, Dean, Faculty
of Surgery , BMU



Professor Shamin Ahmed
Dean, Faculty of Medicine,
BMU



Professor Dr. Saif Ullah Munshi
Dean, Faculty of Basic Science
and Para Clinical Science, BMU



Dr. Shahawat Hossain
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Professor Dr. Md. Atiar Rahman,
Dean, Faculty of Paediatrics,
BMU



Professor Dr. Md. Manir Hossain Khan, Dean,
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Technology, BMU



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Course Director, Faculty of
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Professor KM Didarul Islam
Course Director, Faculty of
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Professor Nahid Farhana Amin
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and Paraclinical Sciences, BMU



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Professor ATM Atkur Rahman, Course Director,
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