Column: Tips on Research and Publication

AIM, RESEARCH QUESTIONS, OBJECTIVES, AND HYPOTHESES: WHICH ONE AND HOW TO WRITE IN A MANUSCRIPT?

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ABSTRACT
A well-defined research framework is fundamental to conducting effective and impactful studies. This article explores the distinct yet interconnected roles of key research components: the aim, research questions, objectives, and hypotheses. The *aim* outlines the broad purpose of a study, while *research questions* specify the inquiries that guide the investigation. The *objectives* delineate the measurable steps necessary to achieve the aim. A *hypothesis* provides a testable prediction based on an assumption. Clarifying these elements is crucial for designing a coherent and focused research plan. By distinguishing and articulating each component, researchers can improve the clarity, direction, and overall quality of their studies.
Keywords: Aim, Research Question, Objective, Hypothesis

INTRODUCTION

The introduction section in an original research paper explains the rationale for the research and ends with a one-sentence overview. This overview can be framed as an aim, research question(s), objective(s), hypothesis(es), or a combination of these. In a thesis or dissertation, all applicable elements are usually included. However, in a journal article, not all need to be mentioned as doing so may seem overly pedantic. Therefore, it is essential to identify which element to choose. We describe these four components and their differences to help authors understand the nuances and select the most appropriate one (Table 1, Figure 1).

What is a study/ research aim?

The aim of a research study describes what the researcher hopes to achieve by the end of the study. It is usually *broad*, *general*, and *abstract*, outlining the overall intention or ultimate goal of the study. Typically, there is only *one main aim*, and it is conventionally written using an *infinitive verb* (e.g., *to explore*, *to examine*, *to evaluate*). The aim reflects what you want to discover or understand—it is the central purpose of conducting the research. While ambitious, it should remain realistic and achievable. It should not be overly broad without any focus, which may appear unrealistic. In essence, the aim sets the direction for the entire study. Here are three examples:

Study 1: "To explore whether cognitive-behavioural therapy is better than behavioural activation in major depressive disorder."
Study 2: "To evaluate if childhood trauma is related to the development of borderline personality disorder."
Study 3: "To examine the impact of early diagnosis on long-term outcome in schizophrenia."

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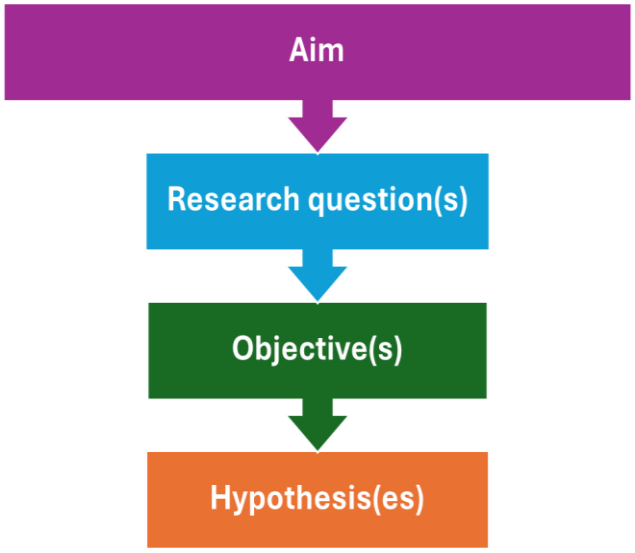
Table 1: Differences between aim, research questions, objective(s), and hypothesis(es)

	Aim	Research question(s)	Objective(s)	Hypothesis(es)
Description	Broad, general statement of what the research intends to achieve	Specific question(s) derived from the aim, guiding the focus of the study	Action-oriented steps designed to answer the research question(s)	Testable predictions formulated based on the objectives
Scope	Broad focus	Narrow focus	Narrow focus, very specific	Narrow focus, very specific
Number	Usually, one overarching aim	One or more, one primary question	One primary, multiple secondary	One primary, sometimes secondary
Format	Single sentence	Question format with PICO elements	Sentences with PICO elements	Sentences with PICO elements

PICO: Population, intervention, comparison, outcome

Figure 1: Relationship between aim, research questions, objective(s), and hypothesis(es)



What is a research question?

A research question is a clear, focused question that a study aims to answer. It guides the research process by helping determine what will be studied, how it will be studied, and what type of data needs to be collected. It is typically framed to address a specific gap in existing knowledge. A good research question should be specific, answerable through research, and relevant to the field. It should not be too broad or vague; instead, it should clearly define the problem the study intends to explore.

Ways to identify the research question have been discussed in this column (Praharaj and Ameen, 2020). Broadly, the question should meet the *FINER criteria* (i.e. Feasible, Interesting, Novel, Ethical, and Relevant) (see Table 2). The elements that should be part of the research question in interventional studies are referred to as *PICOT* (i.e., Population, Intervention, Comparator, Outcome, and Time). In contrast, for observational studies, the relevant framework is *PECO* (i.e., Exposure, not Intervention).

Some examples of research questions are:

Study 1: "In adults with major depressive disorder, is cognitive-behavioural therapy more effective than behavioural activation in reducing depressive symptoms at 8 weeks?"

Study 2: "Is there an association between childhood trauma and borderline personality disorder in adults?"

Study 3: "How does early diagnosis affect long-term clinical and functional outcomes in patients with schizophrenia?"

Table 2: FINER criteria for the research question

	Explanation	Example
Feasible	Can be practically done (with available resources, time, skills, and participants)	TMS for bulimia nervosa (feasible if TMS and patients are available in that setting)
Interesting	Engages researchers (scientific community finds it interesting)	Understanding the mechanistic effects of ECT or TMS
Novel	Adds new knowledge	Biomarkers for depression (new marker that has not been studied)
Ethical	Respects ethical principles of research	Ketamine for depression treatment non-responders (clinical equipoise situation for RCT)
Relevant	Impacts practice or policy (fills the needs gap)	Domiciliary tDCS for treatment of depression (makes tDCS accessible and possibly cost-effective)

TMS: Transcranial Magnetic Stimulation; ECT: Electroconvulsive Therapy; RCT: randomized controlled trial; tDCS: transcranial direct current stimulation

What are research objectives?

Objectives are precise and serve as specific steps to achieve the overall aim of the research. They are written in *clear* and *measurable* terms. There may be multiple objectives, and they often represent *project milestones*. Well-formulated objectives should follow the *SMART criteria*, meaning they are: a) *Specific*: clearly stated and

unambiguous; b) *Measurable*: includes criteria that can be objectively measured; c) *Achievable*: realistic and feasible with available resources and time; d) *Relevant*: related to the aim of the study; and e) *Time-bound*: specific completion time. Objectives are essential for operationalizing the research, that is, translating broad aims into actionable and assessable components. They should be mutually exclusive, with no overlap between them. They are written using *action verbs* (e.g., to estimate, to compare, …).

Study 1: a) To compare reduction in depression symptoms after cognitive-behavioural therapy versus behavioural activation in adults at eight weeks; b) To compare relapse rates in adults treated with cognitive-behavioural therapy versus behavioural activation over a 6-month follow-up period; c) To assess participant satisfaction and adherence in both therapy groups.

Study 2: a) To assess the prevalence of childhood trauma in adults diagnosed with borderline personality disorder; b) To identify which types of childhood trauma are most strongly associated with borderline personality disorder symptoms; c) To explore gender differences in the association between childhood trauma and borderline personality disorder.

Study 3: a) To compare functional outcomes between patients diagnosed early (within one year of onset) and those diagnosed later; b) To evaluate differences in symptom severity between early- and late-diagnosed patients.

Objectives incorporate the study outcomes, both primary and secondary outcomes. There is usually *one primary objective*, which reflects the *main question* the study seeks to answer, and includes the *primary outcome*. This objective typically *guides the estimation of sample size*. In rare cases, a study may have two primary objectives (i.e., co-primary objectives). However, this is generally discouraged, as it complicates sample size calculations and may require both objectives to be considered simultaneously. In contrast, a study may have *multiple secondary objectives*, which explore additional questions beyond the primary aim, and involves all *secondary outcomes*. For study 1, the primary objective is, "To compare reduction in depression symptoms after cognitive-behavioural therapy versus behavioural activation in adults." The other two objectives—assessing relapse rates over a 6-month follow-up and evaluating participant satisfaction and adherence—serve as secondary objectives.

What are research hypotheses?

A hypothesis is a *clear*, *specific*, and *testable* statement that flows directly from the research question. In most studies, there would be multiple hypotheses, each addressing a particular aspect of the research question. A research hypothesis is a *predictive* statement about the expected relationship between two or more variables. It represents a *tentative solution* to the research problem and can be tested through data collection and analysis. It is always generated *a priori*, and not after the research is carried out.

A hypothesis is stated as a null hypothesis for significance testing or as an alternative hypothesis. The *null hypothesis* asserts no difference or relationship between the variables (typically expressed as a negative statement, such as "There will be no difference between..." or "There will be no relationship between..."). In contrast, the *alternative hypothesis* is a positive or directional statement (e.g., "There will be a greater reduction in mean scores..." or "There will be a significant association between..."). The null hypothesis, where the direction of findings is not known, is the reason why two-tailed statistical tests are always preferred (very rarely one-tailed tests are actually carried out). While the *null hypothesis is used in statistical testing*, some researchers consider it overly formal or pedantic in the context of research writing. As a result, many academic papers emphasize writing the alternative hypothesis, which aligns with the study's predictions or expected outcomes (though dissertations may include both null and

alternative hypotheses). An example of study hypothesis is:

> Study 1: The primary hypothesis stated as null hypothesis:
> "At eight weeks, there will be no difference in depression symptoms in adults with depressive disorder receiving cognitive-behavioural therapy as compared to those receiving behavioural activation."
> The alternative hypothesis can be stated as:
> "At eight weeks, adults receiving cognitive-behavioural therapy will show a significantly greater reduction in depression symptoms compared to those receiving behavioural activation."

A study may have more than one stated hypothesis. The additional ones are usually secondary hypotheses, which are mentioned in the research paper only if they are relevant.

Not all studies require a hypothesis. Descriptive studies, for example, aim to observe, record, or describe characteristics of a population or phenomenon and typically do not involve testing a specific hypothesis. In such cases, the study may have a well-defined aim, research question(s), and objective(s), but no formal hypothesis is necessary.

How to plan and write, and what to avoid

1. *Avoid formulating multiple aims*. Typically, a research study should have a single, broad aim that outlines the overall purpose. In rare cases, two distinct aims may be justified; however, this is generally discouraged, as it can reduce the study's focus and clarity.
2. *Avoid unrealistic and overly broad aims that are vague and unachievable.* For example, the aim "To improve the treatment of schizophrenia" is too general and lacks specificity. A more appropriate and focused aim would be: "To evaluate the effectiveness of psychoeducation in patients with first episode psychosis."
3. *Avoid using terms inappropriately.* For example, "efficacy" refers to the effects of an intervention under ideal and controlled conditions, while "effectiveness" refers to its effects in real-world clinical settings. Similarly, the term "impact" is typically used to describe long-term effects, often over several years, and should not be used to refer to short-term outcomes.
4. *Pose a research question*. Some readers may find a "tested-the-hypothesis" statement to be pedantic, artificial, and not reflective of clinical language. Often, it is preferable to present the research purpose as a question, which can feel more natural and engaging.
5. *Mention only the central question*, even if several other questions have been addressed (e.g., "We conducted a cross-sectional study to determine whether condition X is associated with risk factor Y").
6. *The aims and objectives should be aligned*. The specific steps outlined in the objectives must correspond with the overall intention described in the aim. While objectives should not simply restate the aim, they should break it down into SMART components that effectively guide the research process.
7. *The study design should align with the aim and objectives*. For example, associations between variables can be examined using a cross-sectional design, whereas assessing causality typically requires a cohort study. Similarly, to evaluate the effects of an intervention, a randomized controlled trial is generally necessary.
8. *Stating the hypothesis clearly* helps readers understand the study's focus. For example, it is better to say, "We hypothesized that there is a positive association between X and Y," rather than using an awkward phrase like, "This is an attempt to find whether there is an association between X and Y."
9. *It is not always necessary to explicitly state the null hypothesis.* For example, "There is no association between X and Y." Presenting the alternate hypothesis is acceptable when it is grounded in theory.

CONCLUSION

In conclusion, the *aim* of a research study represents its broad goal or overall purpose; *research questions* are specific, answerable inquiries to help achieve that aim; a *hypothesis* is a testable statement based on an assumption; and *objectives* are precise statements that outline the measurable steps needed to achieve the aim. Typically, only one of these is stated in a manuscript—most often as a research question, objective, or hypothesis—and is found in the last paragraph of the introduction section. Understanding the difference between the aim, research questions, hypothesis, and objectives is essential for developing a clear and structured research plan and ensuring that the study remains focused and aligned with its intended purpose. By clearly defining these elements, researchers can enhance the clarity, effectiveness, and overall impact of their work.

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