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## Methods Section

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The purpose of a methods section of a research paper is to provide the information by which a study's validity is judged. It must contain enough information so that (a) the study could be repeated by others to evaluate whether the results are reproducible, and (b) others can judge whether the results and conclusions are valid. Therefore, the methods section should provide a clear and precise description of how a study was done and the rationale for the specific procedures chosen.

Historically, the methods section was referred to as the “materials and methods section” to emphasize the two areas that must be addressed. “Materials” referred to what was studied (e.g., humans, animals, tissue cultures), treatments applied, and instruments used. “Methods” referred to the selection of study subjects, data collection, and data analysis. In some fields of study, because “materials” does not apply, alternative headings such as “subjects and methods,” “patients and methods,” or simply “methods” have been used or recommended.

Below are the items that should be included in a methods section.

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### **Subjects or Participants**

If human or animal subjects were used in the study, who the subjects were and how they were relevant to the research question should be described. Any details that are relevant to the study should be included. For humans, these details include gender, age, ethnicity, socioeconomic status, and so forth, when appropriate. For animals, these details include gender, age, strain, weight, and so forth. The researcher should also describe how many subjects and how they were selected. The selection criteria and rationale for enrolling subjects into the study must be stated explicitly. For example, the researcher should define study and comparison subjects and the inclusion and exclusion criteria of subjects. If the subjects were human, the type of reward or motivation used to encourage them to participate should be stated. When working with human or animal subjects, there must be a declaration that an ethics or institutional review board has determined that the study protocol adheres to ethical principles. In studies involving animals, the preparations made prior to the beginning of the study must be specified (e.g., use of sedation and anesthesia).

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### **Study Design**

The design specifies the sequence of manipulations and measurement procedures that make up the study. Some common designs are experiments (e.g., randomized trials, quasi-experiments), observational studies (e.g., prospective or retrospective cohort, case-control, cross-sectional), qualitative methods (e.g., ethnography, focus groups) and others (e.g.,

secondary data analysis, literature review, meta-analysis, mathematical derivations, and opinion–editorial pieces). Here is a brief description of the designs. Randomized trials involve the random allocation by the investigator of subjects to different interventions (treatments or conditions). Quasi-experiments involve nonrandom allocation. Both cohort (groups based on exposures) and case–control (groups based on outcomes) studies are longitudinal studies in which exposures and outcomes are measured at different times. Cross-sectional studies measure exposures and outcomes at a single time. Ethnography uses fieldwork to provide a descriptive study of human societies. A focus group is a form of qualitative research in which people assembled in a group are asked about their attitude toward a product or concept. An example of secondary data is the abstraction of data from existing administrative databases. A meta-analysis combines the results of several studies that address a set of related research hypotheses.

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### **Data Collection**

The next step in the methods section is a description of the variables that were measured and how these measurements were made. In laboratory and experimental studies, the description of measurement instruments and reagents should include the manufacturer and model, calibration process, and how measurements were made. In epidemiologic and social studies, the development and pretest of questionnaires, training of interviewers, data extraction from databases, and conduct of focus groups should be described where appropriate. In some cases, the survey instrument (questionnaire) may be included as an appendix to the research paper.

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### **Data Analysis**

The last step in the methods section is to describe the way in which the data will be presented in the results section. For quantitative data, this step should specify whether and which statistical tests will be used for making the inference. If statistical tests are used, this part of the methods section must specify the significance level and whether one- or two sided or the type of confidence intervals. For qualitative data a common analysis is observer impression. That is, expert or lay observers examine the data, form an impression, and report their impression in a structured, quantitative form.

The following are some tips for writing the methods section: (a) The writing should be direct and precise. Complex sentence structures and unimportant details should be avoided. (b) The rationale or assumptions on which the methods are based may not always be obvious to the audience and so should be explained clearly. This is particularly true when one is writing for a

general audience, as opposed to a subspecialty group. The writer must always keep in mind who the audience is. (c) The methods section should be written in the past tense. (d) Subheadings, such as participants, design, and so forth, may help readers navigate the paper. (e) If the study design is complex, it may be helpful to include a diagram, table, or flowchart to explain the methods used. (f) Results should not be placed in the methods section. However, the researchers may include preliminary results from a pilot test they used to design the main study they are reporting.

The methods section is important because it provides the information the reader needs to judge the study's validity. It should provide a clear and precise description of how a study was conducted and the rationale for specific study methods and procedures.

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See also

- [Discussion Section](#)
- [Results Section](#)
- [Validity of Research Conclusions](#)

### **Further Readings**

**Branson, R. D.** *Anatomy of a research paper.* (2004).49,1222–1228.

**Hulley, S. B., Newman, T. B., & Cummings, S. R.** (1988). The anatomy and physiology of research. In Edited by: **S. B. Hulley & S. R. Cummings** (Eds.), *Designing clinical research* (pp. 1–11). Baltimore: William & Wilkins.

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**Van Damme, H. , Michel, L. , Ceelen, W. , & Malaise, J.** *Twelve steps to writing an effective “materials and methods” section.* (2007).107,102.