
### Writing Informative Abstracts for Journal Articles

**Abstracts serve 3 important purposes:**
1. They may persuade someone to read the article.
2. They allow busy readers to learn the main results without reading the entire article, and (3) they make it easy to capture the main results in computerized databases, such as MEDLINE, which make the results available worldwide. Given these purposes, it is worth writing an informative abstract.

We suggest a structured abstract format with 8 sections:

1. **Objective(s).** State an objective, not necessarily a hypothesis. Hypothesis testing does not fit the design of many studies and sometimes leads to simplistic thumbs-up or thumbs-down conclusions. One sentence is usually sufficient. We are convinced that the best articles focus on just 1 objective; if you have more than 2, reconsider.

   **Examples:**
   - To estimate the association between dietary intake of kumquats and school performance.
   - To estimate the prevalence of asthma among school children in Iowa.
   - To determine whether drug A, a new antiviral agent, reduced morbidity related to the common cold.

2. **Design.** A few words can usually do the job.

   **Examples:**
   - Case-control study.
   - Randomized controlled trial.
   - Prospective cohort study.

   Not every study can be neatly summarized by a widely understood label; a brief description of what you did may be necessary.

3. **Setting.** This is about place and time; where and when the study participants were selected. Try to be specific without being wordy.

   **Examples:**
   - The Children's Medical Center of the Bosporus, a referral hospital, Istanbul, Turkey, from September 1, 2001, to July 31, 2002.
   - All public schools in Milwaukee, Wis, during the 2001-2002 school year.

   “Three general pediatric practices in Kansas City, Mo, from January 1990 to December 2001.”

4. **Participants.** Who was studied, and how many were studied? Describe important eligibility criteria. The most useful count of subjects may not be obvious. Refusal to participate, dropouts, and missing information are potential sources of bias. We encourage authors to be forthright; give the counts for the target population and the count of the participants in the data actually analyzed.

   **Examples:**
   - All 11,041 children in the eighth grade; adequate information was available for 9411 children (85%), who formed the analytic sample.
   - A random sample of children admitted to the intensive care unit for bronchiolitis (N=201).
   - “Asthma patients 4 to 15 years of age were randomly assigned to the intervention (n=67) or placebo (n=63) groups. Follow-up data on the outcome were available for 55 intervention and 60 control patients.”

If you did not collect the data, state the data source in this section; for example, “a survey done by the National Center for Health Statistics.”

5. **Intervention(s) or Main exposure(s).** This section may include interventions that were controlled by the investigators or exposures that the investigators measured but did not manipulate, such as smoking, use of a bicycle helmet, or residence in a state with a seat belt law. Skip this section if there was no intervention or exposure.

   **Examples:**
   - Oral acyclovir, 15 mg/kg 5 times per day for 5 days.
   - “Drinking alcohol at least weekly.”
   - “Two hours of school instruction regarding seat belt use.”

6. **Main outcome measure(s).** There is room for choice in this section. Imagine your objective was “To estimate the association of new treatment X with death among infants with sepsis.” Given this objective, the main outcome was death prior to hospital discharge. Suppose the
main analysis estimated the adjusted risk ratio for death of those who received the new treatment compared with children who received standard treatment. It would make the results section clearer and shorter if the main outcomes section said, “The main outcome was death in the hospital; adjusted risk ratio for death compared children receiving the new treatment with those given standard treatment.”

Suppose the objective was “To estimate the association between kumquat consumption and school performance,” and there were 5 outcome measures, including grade point average, scores on standardized state tests, and days absent from school. It would save space to say in the outcome section, “Five measures of school performance; estimates of mean difference in each outcome per each additional 4-oz serving of kumquats,” and report the mean differences for each outcome measure in the results.

7. Results. The most common problem that we see in abstracts is a failure to give the main quantitative results. Give the main numerical results with estimates of precision, such as confidence intervals.

Examples: Instead of “Asthma was highly prevalent,” give the proportion of children who had asthma with a confidence interval. Rather than “The intervention arm had better outcomes; P < .01 for all comparisons,” show the proportions in each arm with each outcome and the ratios or differences in these proportions with confidence intervals.

Give the results that are thought to be most free of bias; if there was confounding in the study, give the adjusted estimates of association, not the crude estimates. If some outcomes were considered most important prior to the analysis, just report those. Avoid reporting just those outcomes that were statistically significant. Only report results that pertain to the study objective.

8. Conclusion(s). Conclusions should be related to the results given in the abstract. Suppose a case-control study of life vests and drowning reported in the results, “The risk of drowning was less among children wearing life vests, compared with those without vests (adjusted risk ratio, 0.5; 95% confidence interval, 0.3-0.6).” The conclusion might say, “If the association estimated in our study is causal, some drownings can be prevented if children wear life vests. However, our risk ratio estimate may be biased by confounding due to a lack of information about swimming ability.”

But the conclusion should not say, “Laws should require parents to put their children in life vests.” If the study did not examine the effect of a law on either life vest use or drowning rates, laws should not be mentioned. Don’t use the conclusion section as a soapbox for views that go beyond what you studied.

Avoid clichés such as “more research is needed.” More research is always needed, especially if it funds your next study. Another platitude is, “This study has important implications for pediatricians.” If there are implications, state them.

Don’t make judgments based solely on a P value; consider the estimated associations and confidence intervals. Imagine that you conducted a randomized controlled trial of drug X to prevent wound infection after a ferret bite. You estimated the risk ratio for infection among bite victims given drug X compared with those given placebo. The Table shows hypothetical results from 6 trials of drug X. As an exercise, we ask you to stop reading here and write a 1- or 2-sentence summary conclusion for each of the 6 trial results (pretend each is the first trial of drug X). Then read our suggestions.

Based on the P values, you might write, “Drug X was not associated with a statistically significant change in the risk of infection” for studies A, B, and F. For studies C, D, and E, you could write, “The risk of infection was reduced by drug X.” These summaries would be technically correct, but they ignore the size and precision of the risk ratios.

Assuming that each trial was the only available evidence, a concluding sentence might say:

Study A: “Our results were compatible with a wide range of effects, including substantial decreases or increases in the risk of infection. The clinical utility of drug X remains uncertain.”

Study B: “Our results were compatible with a beneficial effect of drug X on the risk of infection, although the size of the benefit remains uncertain; a harmful effect seems unlikely.”

Study C: Same as for study B. Studies B and C had similar results; the fact that B had an upper confidence interval slightly greater than 1 and C had an upper confidence interval slightly less than 1 does not affect our interpretation.

| Table. Hypothetical Outcomes of 6 Randomized Trials of Drug X Compared With Placebo to Prevent Wound Infection After a Ferret Bite: Risk Ratios for Infection in the Drug X Group Compared With the Placebo Group |
|-----------------|-----------------|-----------------|-----------------|-----------------|
| Drug X          | Placebo         | Risk Ratio      | P Value         |
|                 |                 | (95% Confidence Interval) |              |
| Trial | Total, No. | Infected, No. (%) | Total, No. | Infected, No. (%) |                   |                   |
| A    | 40         | 2 (5.0)           | 40         | 4 (10.0)         | 0.50 (0.10-2.58) | .40              |
| B    | 200        | 10 (5.0)          | 200        | 19 (9.5)         | 0.52 (0.25-1.10) | .08              |
| C    | 240        | 11 (4.6)          | 240        | 23 (9.6)         | 0.48 (0.24-0.96) | .03              |
| D    | 2000       | 100 (5.0)         | 2000       | 199 (10.0)       | 0.50 (0.40-0.63) | <.001            |
| E    | 100,000    | 9,500 (9.5)       | 100,000    | 10,000 (10.0)    | 0.95 (0.92-0.98) | <.001            |
| F    | 2000       | 190 (9.5)         | 2000       | 200 (10.0)       | 0.95 (0.79-1.15) | .60              |
Study D: “Drug X reduced the risk of infection by about half.”

Study E: “Although drug X reduced the risk of infection, the observed risk reduction was only 5%, and the true effect is not likely to be much greater than this.”

Study F: “We found little evidence that drug X influences the risk of infection. A risk reduction of 25% or more is doubtful given our data.”

To make decisions about the clinical use of drug X, one would want to consider not only the size of any effect of X on infection risk but also the consequences of infected ferret bites, how easy it is to treat infected bites, the costs of prophylactic treatment and treatment after infection occurs, and treatment side effects. A clinical trial of drug X cannot cover all of these issues, and therefore the conclusion should not provide advice based on incomplete information. Few studies by themselves yield sufficiently broad and deep evidence to justify sweeping clinical or policy recommendations.10-12

WHAT TO LEAVE OUT

The statistical methods can usually be omitted from the abstract. If you present hazard ratios, rate ratios, or mean differences, it is not necessary to say in the abstract that you used proportional hazards models, Poisson regression, or linear regression. Make the study design and outcome measures clear in the abstract, and describe the statistical tools in the article. For most purposes, confidence intervals are more useful than P values.4

SYSTEMATIC REVIEWS AND META-ANALYSES

The abstract for a review should follow principles similar to those previously outlined, but use 7 section headings: Objective(s), Data sources, Study selection, Intervention(s) or Main exposure(s), Main outcome measure(s), Results, and Conclusion(s).

WRITE THE ABSTRACT LAST

Write early drafts of the article without an abstract. Write the abstract only when near the final draft. With this approach, most of the abstract can be cut and pasted from the manuscript, nothing will appear in the abstract that is not in the text, and the numerical information in the abstract will agree with that in the article. Don’t worry if the abstract sounds repetitious to your ear; it’s supposed to repeat what the article says.

KEEP IT SHORT AND CLEAR

Limit the abstract to 250 words. The goal is to have something so short that everyone will read it. If you use fewer than 250 words, no one will object.

Aim for clarity above all else; if you must choose between our advice and something that would make your abstract clearer, choose clarity and defend your choice.

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REFERENCES