

Science Research Paper Outline

IMRAD Format (Introduction, Methods, Results, And Discussion)

I. Title Page

Paper Title: Clear, concise, descriptive - Should indicate main variables and relationship being studied - Typically 10-15 words

Author(s): Full names and affiliations

Institution/Department:

Corresponding Author Contact Information:

Date:

Running Head: (Abbreviated title, if required)

II. Abstract (150-300 words)

Write this section LAST, after completing the paper

Structured Abstract Format:

Background/Objective: - What problem or question does this study address?
- 1-2 sentences

Methods: - Study design and key procedures - 2-3 sentences

Results: - Main findings with key data - 2-3 sentences (include specific numbers/statistics)

Conclusions: - What the results mean and their significance - 1-2 sentences

Keywords: 4-6 key terms for indexing

III. Introduction

A. Opening/Context (Funnel Approach: Broad to Specific)

General background: - Establish the broader scientific context - Why is this topic important?

Current state of knowledge: - What do we already know about this topic?
- Brief literature review of relevant research

B. Literature Review

Key Study 1: - Authors, year - Main findings - Relevance to your research

Key Study 2: - Authors, year - Main findings - Relevance to your research

Key Study 3: - Authors, year - Main findings - Relevance to your research

(Continue as needed)

C. Knowledge Gap

What is unknown or unclear: - What questions remain unanswered? - What conflicts exist in the literature? - What needs further investigation?

Rationale for current study: - Why is your research needed? - How does it fill the gap?

D. Research Question and Hypothesis

Research Question: - Clear, specific question your study addresses

Hypothesis (if applicable): - Null Hypothesis (H₀): - Alternative Hypothesis (H_a): - Directional or non-directional prediction

E. Study Objectives

Primary Objective:

Secondary Objectives (if applicable):

•

Expected Contribution: - How will this advance the field?

IV. Methods (Materials and Methods)

Note: Write in past tense. Include enough detail for replication.

A. Study Design

Type of study: - Experimental, observational, correlational, case study, etc.

Study period: - When was data collected?

Study location: - Where was the research conducted?

B. Participants/Subjects/Sample

For human subjects: - Population characteristics - Sample size and justification (power analysis) - Inclusion criteria - Exclusion criteria - Recruitment method - Demographics (age, gender, etc.)

For animal subjects: - Species, strain, age, sex - Source of animals - Housing conditions - Ethical approval number

For other samples (plants, materials, etc.): - Detailed description - Source and preparation - Relevant characteristics

C. Materials and Equipment

Materials: - Chemicals, reagents, solutions (with concentrations) - Biological materials - Suppliers and catalog numbers

Equipment: - Instruments and apparatus - Model numbers and manufacturers - Calibration methods

Software: - Programs used for data collection/analysis - Version numbers

D. Procedure

Step-by-step protocol:

Phase 1: [Setup/Preparation] - Detailed description - Duration - Conditions (temperature, light, etc.)

Phase 2: [Main Experimental Procedure] - Detailed description of what was done - Treatment groups/conditions - Control groups - Randomization method - Blinding procedures (if applicable)

Phase 3: [Data Collection] - What was measured - When and how often - Instruments used - Units of measurement

Variables: - Independent variable(s): - Dependent variable(s): - Controlled variables: - Confounding variables addressed:

E. Data Analysis

Statistical methods: - Tests used (t-test, ANOVA, regression, etc.) - Software packages (with versions) - Significance level (typically $\alpha = 0.05$)

Data preparation: - Outlier treatment - Normality testing - Transformations applied

Specific analyses: - Primary analysis: - Secondary analyses: - Post-hoc tests:

F. Ethical Considerations

Ethics approval: - IRB/Ethics committee approval number - Informed consent procedures

Animal welfare: - IACUC approval number - Humane care standards followed

Data privacy: - How confidentiality was maintained

V. Results

Note: Write in past tense. State findings objectively without interpretation.

A. Overview of Findings

Brief summary: - General statement of what was found

B. Descriptive Statistics

Sample characteristics: - Final sample size (with attrition explained) - Demographic details - Baseline measurements

Table 1: [Title: Participant Characteristics] - Key demographic data - Mean $\pm$ SD or median (IQR)

C. Primary Results

Main finding related to primary objective:

Statistical results: - Test statistic value - Degrees of freedom - P-value - Effect size - Confidence intervals

Example format: “Group A showed significantly higher scores ($M = 45.3$, $SD = 8.2$) compared to Group B ($M = 38.7$, $SD = 7.9$), $t(98) = 4.21$, $p < .001$, $d = 0.84$.”

Table 2: [Title: Primary Outcome Measures]

Figure 1: [Title: Visual representation of main results] - Graph type (bar, line, scatter, etc.) - Clear labels, legend, error bars

D. Secondary Results

Finding 1: - Statistical details - Relationship to hypothesis

Finding 2: - Statistical details - Relationship to hypothesis

Table 3 (if needed): [Title]

Figure 2 (if needed): [Title]

E. Additional Analyses

Subgroup analyses:

Correlation analyses:

Supplementary findings:

F. Negative or Null Results

Non-significant findings: - Report all planned analyses, even if not significant
- Still scientifically valuable

VI. Discussion

Note: Write in present tense when discussing general knowledge, past tense for your specific findings.

A. Summary of Key Findings

Restate main results: - Brief recap without repeating all statistics - 2-3 sentences

B. Interpretation of Results

Primary finding interpretation: - What does this mean? - Do results support or reject hypothesis? - Why might you have gotten these results?

Mechanism explanation: - What biological/physical/chemical processes explain the results?

Secondary findings interpretation: - Additional insights gained

C. Comparison with Previous Research

Agreement with literature: - How do your findings align with previous studies? - Which studies support your results?

Disagreement with literature: - Where do your findings differ? - Possible reasons for discrepancies - Methodological differences that might explain variations

Novel contributions: - What new information does your study provide?

D. Implications

Theoretical implications: - How do findings advance scientific understanding? - Do they support or challenge existing theories?

Practical applications: - Real-world applications - Clinical relevance (if applicable) - Policy implications (if applicable)

Future research directions: - What questions arise from your findings? - What should be studied next?

E. Limitations

Methodological limitations: - Sample size issues - Measurement limitations - Design constraints

Generalizability: - To whom/what do results apply? - What populations/conditions were not studied?

Uncontrolled variables: - Confounds that may have influenced results

How limitations affect interpretation: - Be honest but not overly apologetic - Explain why findings are still valuable despite limitations

F. Strengths

What your study did well: - Novel methodology - Large sample size - Strong controls - High ecological validity - Etc.

VII. Conclusion

Brief section (1-2 paragraphs)

Summary

- Concise restatement of main finding
- Answer to research question

Significance

- Why this matters
- Take-home message

Final thought

- Broader context or future direction
 - Do NOT introduce new information
-

VIII. Acknowledgments

Funding sources: - Grant numbers and funding agencies

Contributors: - People who helped but aren't authors - Technical assistance

Conflicts of interest: - Disclosure statement

IX. References

Format according to journal requirements (typically APA, AMA, or Vancouver style)

Organize alphabetically by first author's last name

Example formats:

Journal article: Author, A. A., Author, B. B., & Author, C. C. (Year). Title of article. Journal Name, Volume(Issue), page-page. <https://doi.org/xxx>

Book: Author, A. A. (Year). Title of book. Publisher.

Website: Author or Organization. (Year). Title of page. Website Name. URL

X. Appendices (if needed)

Appendix A: Detailed protocols or supplementary methods

Appendix B: Additional data tables

Appendix C: Survey instruments or questionnaires

Appendix D: Raw data (if required by journal)

Appendix E: Supplementary figures

Tables and Figures Guidelines

Tables

- Number consecutively (Table 1, Table 2, etc.)
- Descriptive title above table
- Clear column headers
- Include units of measurement
- Use footnotes for explanations
- Keep simple and readable

Figures

- Number consecutively (Figure 1, Figure 2, etc.)
 - Descriptive caption below figure
 - High resolution and clear
 - Label all axes with units
 - Include error bars (with type specified: SD, SE, or CI)
 - Use color-blind friendly palettes
 - Keep consistent formatting across all figures
-

IMRAD Writing Tips

Introduction

- **Purpose:** What and why
- Start broad, end specific (funnel approach)
- End with clear hypothesis or research question
- Typical length: 10-15% of paper

Methods

- **Purpose:** How
- Write with enough detail for replication
- Use subheadings for clarity
- Past tense, passive or active voice
- Typical length: 15-20% of paper

Results

- **Purpose:** What you found
- Objective reporting only (no interpretation)
- Present in logical order, not chronological
- Use tables and figures effectively
- Don't repeat table/figure data in text—highlight key points
- Typical length: 20-25% of paper

Discussion

- **Purpose:** What it means
- Start specific (your findings), end broad (implications)
- Reverse funnel from introduction
- Compare with literature
- Address limitations honestly
- Suggest future research
- Typical length: 30-35% of paper

General Tips

- Use past tense for what was done and found
- Use present tense for established knowledge
- Be concise and precise
- Avoid jargon when possible
- Define technical terms
- Use active voice when appropriate
- Check journal-specific requirements before submission
- Have colleagues review before submitting