CONSCIOUS II
Curriculum Development of Human Clinical Trials

Project Identification: 2021-1-CZ01-KA220-HED-000023177

Investor/Program/Project type: European Union - Erasmus+ Key Action 2: Cooperation for innovation and the exchange of good practices; Strategic Partnerships in the field of education, training and youth

Curriculum Development of Human Clinical Trials for the Next Generation of PhD Students and Early Career Researchers in the Medical, Science, Pharmacy and Health Professions

CHAPTER 11

SCIENTIFIC COMMUNICATION

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Date first created: 06/06/2022

Last revision: 28/05/2024

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of the European Union

Content

Time required to complete this chapter

Core content: 4h 00m
Additional/advanced content (yellow boxes):   2h 00m
Activities/practical exercises (blue framed boxes):   30m

Total time: **6h 30m**

1   Introduction

"Science communication is more of an art than science (…)
A good science communicator connects the public with the world around them."

The art of communication is about building bridges across communities, individuals, and fields of knowledge aiming to reach impact. To efficiently do so, scientific communicators need to adapt their message to the form, written or oral, the platform and most of all to the audience, whether they'd be scientific or non-scientific. Another issue is the aim of a given piece of communication. Is the goal to inform, to educate or to run through? Whichever it is, the way the message is delivered needs to be adapted.

We have written the chapter herewith with the above key tenets in mind, but with a special focus on writing scientific articles, in the hope of training future trialists whose communication will be key to the successful dissemination of their work.

2   How to write a standardized scientific article?

2.1   Introduction

When it comes to writing scientific articles, several systems of guidelines and recommendations exist. The chapter here below focuses on the APA guidelines, given that they are the most used within the scientific community. However, it is worth mentioning that other systems exist. Here are some examples.

- The STROBE[1] (STrengthening the Reporting of OBservational studies in Epidemiology) standards have been specifically developed for reporting on observation studies. Click on the link to read more.
- The CONSORT[2] checklist aims at providing guidelines for reporting on randomized trials. Click on the link to read more.
- The PRISMA[3] (Preferred Reporting Items for Systemic Reviews and Meta Analyses) reporting guidelines provide insight into publishing meta-analyses and systemic reviews. Click on the link to learn more.
- The MOOSE[4] (Meta-analyses of observational studies in epidemiology) guidelines focus on meta-analyses in epidemiology. Click on the link to learn more.
- The STARD[5] guidelines provide a checklist for reporting on diagnostic accuracy studies. Click on the link to learn more.
- The guidelines developed by EASE[6] (European Association of Science Editors) provide insights into matters linked to publishing in English, and in general international communication. Click on the link to learn more.

For a complete list of existing guidelines, click on the following link[7] and choose the guidelines that fit your interests and/or the study type you are working with.

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[1] https://www.strobe-statement.org/
[2] https://www.goodreports.org/reporting-checklists/consort/
[3] https://www.prisma-statement.org/
[4] https://legacyfileshare.elsevier.com/promis_misc/ISSM_MOOSE_Checklist.pdf
[5] https://www.equator-network.org/wp-content/uploads/2015/03/STARD-2015-checklist.pdf
[6] https://www.ease.org.uk/wp-content/uploads/2018/11/doi.10.20316.ESE_.2018.44.e1.pdf
[7] https://www.equator-network.org/reporting-guidelines/

2.2 What is APA?

[The American Psychological Association](#) (APA)[8] developed a set of standards that writers in the social sciences follow to create consistency throughout publications. These rules address:

- crediting sources,
- document formatting,
- writing style and organization.

APA's guidelines assist readers in recognizing a writer's ideas and information, rather than having to adjust to inconsistent formatting. In this way, APA allows writers to express themselves clearly and easily to readers. The latest APA guidelines have been published in [The Publication Manual of the American Psychological Association, Seventh Edition](#).[9]

APA Style originated in 1929, when a group of psychologists, anthropologists, and business managers convened and sought to establish a simple set of procedures, or style guidelines, that would codify the many components of scientific writing to increase the ease of reading comprehension. They published their guidelines as [a seven-page article in *Psychological Bulletin*](#)[10] describing a "standard of procedure, to which exceptions would doubtless be necessary, but to which reference might be made in cases of doubt" (Bentley et al., 1929, p. 57).

Since then, the scope and length of the Publication Manual have grown in response to the needs of researchers, students, and educators across the social and behavioural sciences, health care, natural sciences, humanities, and more; however, the spirit of the original authors' intentions remains.[11]

EXERCISE
Fill in the APA style [diagnostic quiz](#)[12] to check your knowledge on the APA style.

The *Publication Manual* is made up of [twelve chapters](#).[13] We invite students to click on the link in case to wish to have a global overview of contents discussed in the manual.

Given the restricted nature of this chapter, it focuses on certain essential elements, such as:
(2.2) Journal Article Reporting Standards (JARS),
(2.3) Paper Elements and Format,
(2.4) Writing Style and Grammar,
(2.5) Tables and Figures,
(2.6) Credits and References,
(2.7) Open Science.

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[8] https://www.apa.org/
[9] https://www.apa.org/pubs/books/publication-manual-7th-edition-spiral
[10] Bentley, M., Peerenboom, C. A., Hodge, F. W., Passano, E. B., Warren, H. C., & Washburn, M. F. (1929). Instructions in regard to preparation of manuscript. *Psychological Bulletin, 26*(2), 57–63. https://doi.org/10.1037/h0071487
[11] Source: https://apastyle.apa.org/about-apa-style
[12] https://rise.articulate.com/share/cRl2J8RUvKRR90pIhCeZZwLUUiv_D53Q#/
[13] https://apastyle.apa.org/products/publication-manual-7th-edition-introduction.pdf

2.3 Journal Article Reporting Standards (JARS)

APA Style Journal Article Reporting Standards (APA Style JARS)[14] are a set of standards designed for journal authors, reviewers, and editors to enhance scientific rigor in peer-reviewed journal articles.

The standards include information on what should be included in all manuscript sections for:
- **Quantitative research,**
- **Qualitative research and**
- **Mixed methods research.**

Additionally, the APA Style Journal Article Reporting Standards for Race, Ethnicity, and Culture (JARS–REC) provide guidance on how to discuss race, ethnicity, and culture in scientific manuscripts. JARS–REC should be applied to all research, whether it is quantitative, qualitative, or mixed methods.
- Race, Ethnicity, and Culture.

Using these standards will make your research clearer and more accurate as well as more transparent for readers. For quantitative research, using the standards will increase the reproducibility of science. For qualitative research, using the standards will increase the methodological integrity of research.

JARS–Quant should be used in research where findings are reported numerically (quantitative research). JARS–Qual should be used in research where findings are reported using nonnumerical descriptive data (qualitative research). JARS–Mixed should be applied to research that includes both quantitative and qualitative research (mixed methods research). JARS–REC should be applied to all research, whether it is quantitative, qualitative, or mixed methods.

This subchapter gives an overview on general principles of quantitative, qualitative, and mixed research publication, with an expansion on clinical trials. A section with optional reading materials is dedicated to more details concerning certain quantitative study designs and the appropriate way to report on them.

2.3.1 JARS-Quant: reporting quantitative research

The following pages describe general thematic / structural requirements concerning quantitative research publication – in other words, what you need to include into your article.

Before reading it in detail, please note that titles in red headline mandatory sections of the article, (Title, Abstract, Introduction, Methods, Results, Discussion), whereas the ones in pink are there to indicate the key issues to touch upon in the text, in (chrono)logical order. Whether you choose to merge these subtopics into one coherent section under the above mentioned six obligatory sections or decide to create subsections with separate headlines depends on you. If you are hesitating, here are some factors to take into account:
- A section that is too long reduces the accessibility / readability of the article in terms of identifying relevant information. If one section is too long/ contains too much information, it's worth dividing it into noticeable subsections.

- Creating subsections can help you to highlight information
  you deem essential / you intend to specifically draw your readers attention to.

READING

Go through the JARS-Quant: Information Recommended for Inclusion in Manuscripts That Report New Data Collections Regardless of Research Design.[15]

Complement: clinical trials

READING

Read the following article concerning JARS recommendations on reporting clinical trials.[16]

2.3.2 Adapting the quantitative data publication to your study design / methodology

Other than following general guidelines on content, it is highly important to adapt your article to the study type / general methodology you have chosen, as they might require from you to elaborate on other points. You'll find links to some important points below – choose the ones that are interesting for your current research.

- Studies with an experimental manipulation[17]
- Randomized studies[18]
- Non-randomized studies[19]
- Non-experimental design[20]
- Longitudinal studies[21]
- Quantitative meta-analysis reporting standards[22]

2.3.3 JARS-Qual: reporting qualitative research

JARS–Qual, developed in 2018, marks the first time APA Style has included qualitative standards. They outline what should be reported in qualitative research manuscripts to make the review process easier.

The seventh edition of the Publication Manual also includes content on qualitative studies, including standards for journal article reporting, considerations for sharing qualitative data, and a description of case studies as a type of qualitative article.

JARS–Qual include guidance for manuscripts that report

- Primary qualitative research,
- Qualitative meta-analyses.

The following pages describe general thematic / structural requirements concerning qualitative research publication – in other words, what you need to include in your article.

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[15] https://apastyle.apa.org/jars/quant-table-1.pdf
[16] https://apastyle.apa.org/jars/quant-table-2c.pdf
[17] https://apastyle.apa.org/jars/quant-table-2.pdf
[18] https://apastyle.apa.org/jars/quant-table-2a.pdf
[19] https://apastyle.apa.org/jars/quant-table-2b.pdf
[20] https://apastyle.apa.org/jars/quant-table-3.pdf
[21] https://apastyle.apa.org/jars/quant-table-4.pdf
[22] https://apastyle.apa.org/jars/quant-table-9.pdf

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Before reading it in detail, please note that titles in deep blue
headline mandatory sections of the article, whereas the ones in lighter blue are there to indicate the key issues to touch upon in the text, in (chrono)logical order. Whether you choose to merge these subtopics into one coherent section under the above mentioned six obligatory sections or decide to create subsections with separate headlines depends on you. If you are hesitating, here are some factors to take into account:

- A section that is too long reduces the accessibility / readability of the article in terms of identifying relevant information. If one section is too long/ contains too much information, it's worth dividing it into noticeable subsections.
- Creating subsections can help you to highlight information you deem essential / you intend to specifically draw your readers attention to.

READING
Read the following article concerning JARS guidelines on primary qualitative research.[23]

In case you are writing a qualitative meta-analysis, click on the following link[24] to learn about what to include in it.

2.3.4   JARS-Mixed: Reporting mixed research data

APA Style JARS for Mixed Methods Research (JARS–Mixed) include both quantitative and qualitative research designs.

JARS–Mixed, developed in 2018, mark the first time APA Style has included mixed methods standards. They outline what should be reported in mixed methods research manuscripts to make the review process easier.

The seventh edition of the *Publication Manual* also includes content on mixed methods studies such as standards for journal article reporting, considerations for presenting the sequence of quantitative and qualitative studies, and recommendations for describing the integration of quantitative and qualitative aspects of the research throughout a paper.[25]

READING
Read the following article concerning JARS guidelines on mixed methods reporting.[26]

2.4   Paper format

2.4.1   The title page
The professional title page includes the paper title, author names (the byline), author affiliation(s), author note, running head, and page number, as shown in the following example.

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[23] https://apastyle.apa.org/jars/qual-table-1.pdf
[24] https://apastyle.apa.org/jars/qual-table-2.pdf
[25] Retrieved from: https://apastyle.apa.org/jars/mixed-methods
[26] https://apastyle.apa.org/jars/mixed-table-1.pdf
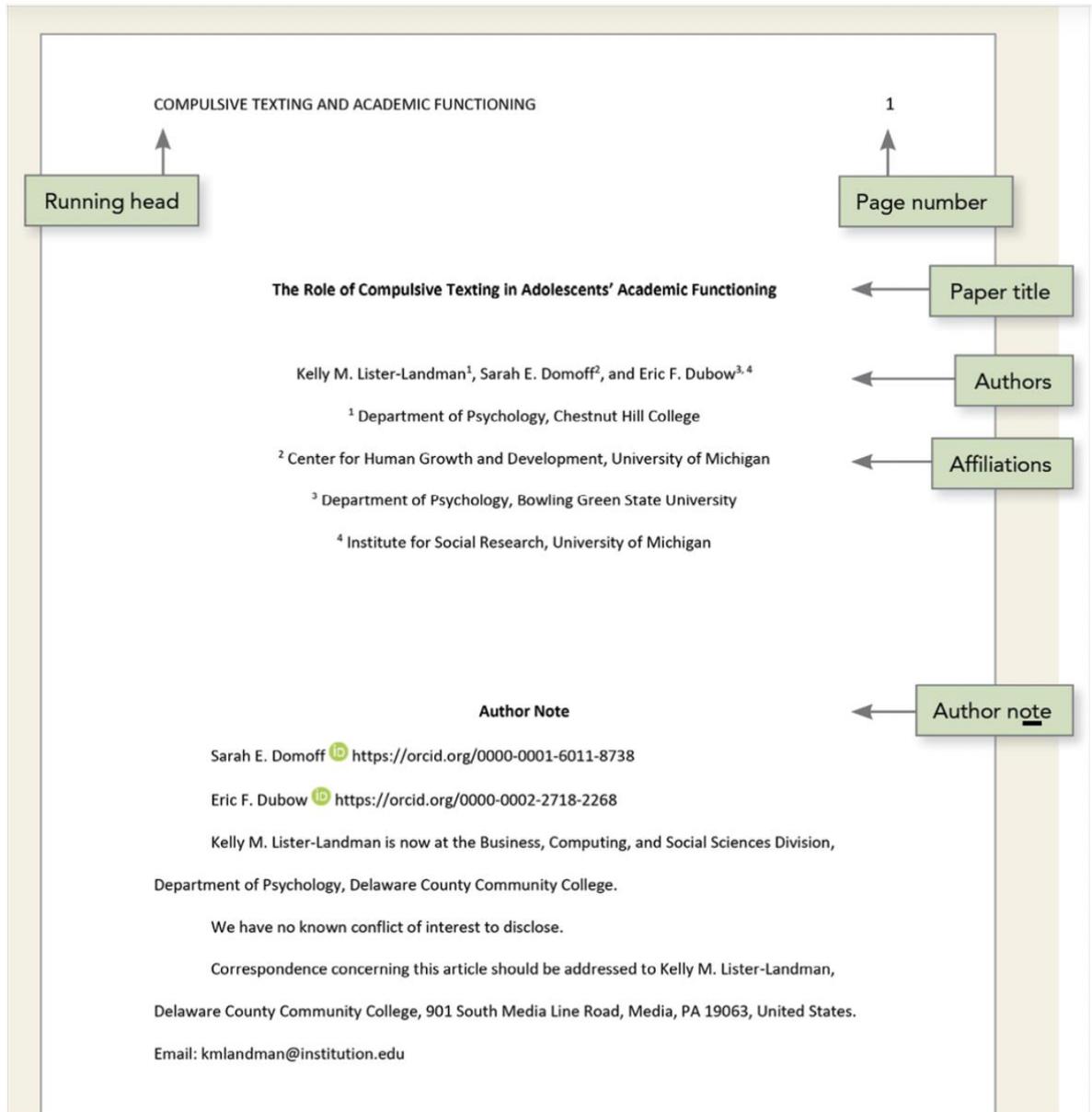
Figure 1: Example for a title page

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8

Here is some advice concerning each section.

Professional title page element	Format	Example
Paper title	Place the title three to four lines down from the top of the title page. Center it and type it in bold font. Capitalize major words of the title. Place the main title and any subtitle on separate double-spaced lines if desired. There is no maximum length for titles; however, keep titles focused and include key terms.	**Predict and Redirect: Prediction Errors Support Children's Word Learning**
Author names	Place one double-spaced blank line between the paper title and the author names. Center author names on their own line. If there are two authors, use the word "and" between authors; if there are three or more authors, place a comma between author names and use the word "and" before the final author name.	Francesca Humboldt
	When different authors have different affiliations, use superscript numerals after author names to connect the names to the appropriate affiliation(s). If all authors have the same affiliation, superscript numerals are not used (see Section 2.3 of the *Publication Manual* for more on how to set up bylines and affiliations).	Tracy Reuter[1], Arielle Borovsky[2], and Casey Lew-Williams[1]
Author affiliation	For a professional paper, the affiliation is the institution at which the research was conducted. Include both the name of any department and the name of the college, university, or other institution, separated by a comma. Center the affiliation on the next double-spaced line after the author names; when there are multiple affiliations, center each affiliation on its own line.	Department of Nursing, Morrigan University
	When different authors have different affiliations, use superscript numerals before affiliations to connect the affiliations to the appropriate author(s). Do not use superscript numerals if all authors share the same affiliations (see Section 2.3 of the *Publication Manual* for more).	[1] Department of Psychology, Princeton University [2] Department of Speech, Language, and Hearing Sciences, Purdue University
Author note	Place the author note in the bottom half of the title page. Center and bold the label "Author Note." Align the paragraphs of the author note to the left. For further information on the contents of the author note, see Section 2.7 of the *Publication Manual*.	n/a
Running head	The running head appears in all-capital letters in the page header of all pages, including the title page. Align the running head to the left margin. Do not use the label "Running head:" before the running head.	PREDICTION ERRORS SUPPORT CHILDREN'S WORD LEARNING
Page number	Use the page number 1 on the title page. Use the automatic page-numbering function of your word processing program to insert page numbers in the top right corner of the page header.	1

Figure 2: Tips for creating the title page

2.4.2 Font

A variety of fonts are permitted in APA Style papers. Font options include the following:

- **sans serif fonts** such as 11-point Calibri, 11-point Arial, or 10-point Lucida Sans Unicode,
- **serif fonts** such as 12-point Times New Roman, 11-point Georgia, or normal (10-point) Computer Modern (the default font for LaTeX).

We recommend these fonts because they are legible and widely available and because they include special characters such as math symbols and Greek letters. Historically, sans serif fonts have been preferred for online works and serif fonts for print works; however, modern screen resolutions can typically accommodate either type of font, and people who use assistive technologies can adjust font settings to their preferences. For more on how font relates to accessibility, visit the page on the accessibility of APA Style.[27]

Use the same font throughout your paper, with the following exceptions:

- **figures:** Within figure images, use a sans serif font with a type size between 8 and 14 points.
- **computer code:** To present computer code, use a monospace font such as 10-point Lucida Console or 10-point Courier New.
- **footnotes:** When inserting footnotes with the footnotes function of your word-processing program, use the default font settings. The footnote font might be smaller than the text font (and have different line spacing), and it is not necessary to change it.

Instructors and publishers vary in how they specify length requirements. Different fonts take up different amounts of space on the page; thus, we recommend using word count rather than page count to gauge paper length if possible.

2.4.3 Line Spacing

In general, double-space all parts of an APA Style paper, including the abstract; text; block quotations; table and figure numbers, titles, and notes; and reference list (including between and within entries). Do not add extra space before or after paragraphs.

Exceptions to double line spacing are as follows:

- **title page:** Insert a double-spaced blank line between the title and the byline on the title page.[28] For professional papers, also include at least one double-spaced blank line above the author note (student papers do not include author notes). Double-space the rest of the title page.
- **tables:** The table body (cells)[29] may be single-spaced, one-and-a-half-spaced, or double-spaced, depending on which is the most effective layout for the information. Double-space the table number, title, and notes.
- **figures:** Words within the image part of a figure[30] may be single-spaced, one-and-a-half-spaced, or double-spaced, depending on which is the most effective layout for the information. Double-space the figure number, title, and notes.

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[27] https://apastyle.apa.org/style-grammar-guidelines/paper-format/accessibility
[28] https://apastyle.apa.org/style-grammar-guidelines/paper-format/title-page
[29] https://apastyle.apa.org/style-grammar-guidelines/tables-figures/tables
[30] https://apastyle.apa.org/style-grammar-guidelines/tables-figures/figures

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- **footnotes:** When inserting footnotes with the footnotes function of your word-processing program, use the default font settings (usually single-spaced and a slightly smaller font than the text).
- **displayed equations:** It is permissible to apply triple- or quadruple-spacing in special circumstances, such as before and after a displayed equation.

These guidelines apply to APA Style student papers and to manuscripts being submitted for publication. If you are using APA Style in another context (e.g., on a website or in a formal publication), different line spacing and other formatting specifications may be appropriate.

2.4.4   Paragraph alignment and indentation

Alignment

Align the text of an APA Style paper to the left margin. Leave the right margin uneven, or "ragged." Do not use full justification for student papers or manuscripts being submitted for publication.

Do not insert hyphens (manual breaks) in words at the end of line. However, it is acceptable if your word-processing program automatically inserts breaks in long hyperlinks (such as in a DOI or URL in a reference list entry).[31]

Indentation

Indent the first line of each paragraph of text 0.5 in. (1,27 cm) from the left margin. Use the tab key or the automatic paragraph-formatting function of your word-processing program to achieve the indentation (the default setting is likely already 0.5 in.). Do not use the space bar to create indentation.

Exceptions to these paragraph-formatting requirements are as follows:
- **title page:** For professional papers, the title (in bold), byline, and affiliations should be centered on the title page.[32] For student papers, the title (in bold), byline, affiliations, course number and name, instructor, and assignment due date should be centered on the title page.
- **section labels:** Section labels (e.g., "Abstract," "References") should be centered (and bold).
- **abstract:** The first line of the abstract should be flush left (not indented).
- **block quotations:** Indent a whole block quotation[33] 0.5 in. from the left margin. If the block quotation spans more than one paragraph, the first line of the second and any subsequent paragraphs of the block quotation should be indented another 0.5 in., such that those first lines are indented a total of 1 in.
- **headings:** Level 1 headings[34] should be centered (and in bold), and Level 2 and 3 headings should be left-aligned (and in bold or bold italic, respectively). Level 4 and 5 headings are indented like regular paragraphs.

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[31] https://apastyle.apa.org/style-grammar-guidelines/references
[32] https://apastyle.apa.org/style-grammar-guidelines/paper-format/title-page
[33] https://apastyle.apa.org/style-grammar-guidelines/citations/quotations
[34] https://apastyle.apa.org/style-grammar-guidelines/paper-format/headings

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- **tables and figures:** Table[35] and figure[36] numbers (in bold), titles (in italics), and notes should be flush left.
- **reference list:** Reference list entries should have a hanging indent of 0.5 in.
- **appendices:** Appendix labels and titles should be centered (and bold).

2.4.5 Headings

General advice

Headings identify the content within sections of a paper. Make your headings descriptive and concise. Headings that are well formatted and clearly worded aid both visual and nonvisual readers of all abilities.

Levels of heading

There are five levels of heading in APA Style. Level 1 is the highest or main level of heading, Level 2 is a subheading of Level 1, Level 3 is a subheading of Level 2, and so on through Levels 4 and 5.

The number of headings to use in a paper depends on the length and complexity of the work.
- If only one level of heading is needed, use Level 1.
- If two levels of heading are needed, use Levels 1 and 2.
- If three levels of heading are needed, use Levels 1, 2, and 3 (and so on).

Use only the number of headings necessary to differentiate distinct sections in your paper; short student papers may not require any headings.

Furthermore, avoid these common errors related to headings:
- Avoid having only one subsection heading within a section, just like in an outline.
- Do not label headings with numbers or letters.
- Double-space headings; do not switch to single spacing within headings.
- Do not add blank lines above or below headings, even if a heading falls at the end of a page.

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[35] https://apastyle.apa.org/style-grammar-guidelines/tables-figures/tables
[36] https://apastyle.apa.org/style-grammar-guidelines/tables-figures/figures

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Here are some visual examples of how to format each level of heading.

Level	Format
1	**Centered, Bold, Title Case Heading** Text begins as a new paragraph.
2	**Flush Left, Bold, Title Case Heading** Text begins as a new paragraph.
3	***Flush Left, Bold Italic, Title Case Heading*** Text begins as a new paragraph.
4	**Indented, Bold, Title Case Heading, Ending With a Period.** Text begins on the same line and continues as a regular paragraph.
5	***Indented, Bold Italic, Title Case Heading, Ending With a Period.*** Text begins on the same line and continues as a regular paragraph.

Figure 3: Formats for headings according to the level of heading[37]

Are you interested in an annotated sample paper? Click on the following link.[38]

2.5 Writing style and grammar

2.5.1 Style

Style refers to guidelines for ensuring clear, consistent communication and presentation in written works. When you follow style guidelines, you avoid inconsistencies among and within academic papers, journal articles, and book chapters.

Existing practices may disagree (e.g., American vs. Canadian, or British English spelling), and the practices you follow depend on where you live and who you are writing for (e.g., the international audience of an academic journal or the classroom). As for the choice between American, Canadian, or British spelling/lexicon: consider where your publisher is from and who your audience are and adapt to that. It is also essential to make sure that you consistently use one or the other all the way through your text.

However, style guidelines often overlap with general good writing practices. Style manuals agree more often than they disagree; when they disagree, follow the guidelines in

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[37] Retrieved from: https://apastyle.apa.org/style-grammar-guidelines/paper-format/headings
[38] https://apastyle.apa.org/style-grammar-guidelines/paper-format/professional-annotated.pdf

the *Publication Manual* for APA Style papers or publications as well as recommendation or guidelines from your instructor or publisher.

For more detailed tips on style, click on the following link.[39]

2.5.2 Grammar

Proper grammar and usage are important to all writing, including papers written in APA Style. Incorrect grammar and careless construction of sentences distract readers, introduce ambiguity, and impede clear communication.

The grammar and usage guidelines in the *Publication Manual* represent only the most common areas of concern for writers—verbs, pronouns, and sentence construction.

If you have questions regarding grammar and usage that are not covered on the APA Style website or in the *Publication Manual*, consult a trusted grammar reference work or website. If you are student, also consider visiting your university writing centre to receive individualized help with your work.

For more detailed tips on grammar in scientific writing, click on the following link.[40]

2.6 Tables and Figures

Tables and figures enable writers to present a large amount of information efficiently and to make their data more comprehensible.

A *table* usually shows numerical values (e.g., means and standard deviations) and/or textual information (e.g., lists of stimulus words, responses from participants) arranged in columns and rows. A *figure* may be a chart, graph, photograph, drawing, plot, infographic, or any other illustration that is not a table.

The goal of any table or figure is to help readers understand your work. The best tables and figures are also attractive and accessible to all users. The APA Style guidelines for tables and figures help ensure your visual displays are formatted clearly and consistently, thus contributing to the goal of effective communication.

2.6.1 Tables

Tables are visual displays composed of columns and rows in which numbers, text, or a combination of numbers and text are presented. There are many common kinds of tables, including demographic characteristics tables, correlation tables, factor analysis tables, analysis of variance tables, and regression tables.

This page addresses the basics of table setup, including table components, principles of table construction (including the use of borders and how to handle long or wide tables), and placement of tables in the paper. Note that tables and figures have the same overall setup.

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[39] https://apastyle.apa.org/style-grammar-guidelines/mechanics-style
[40] https://apastyle.apa.org/style-grammar-guidelines/grammar

View the sample tables[41] to see these guidelines in action.

APA Style tables have the following basic components:

- **number:** The table number (e.g., Table 1) appears above the table title and body in bold font. Number tables in the order in which they are mentioned in your paper.
- **title:** The table title appears one double-spaced line below the table number. Give each table a brief but descriptive title, and capitalize the table title in italic title case.[42]
- **headings:** Tables may include a variety of headings depending on the nature and arrangement of the data. All tables should include column headings, including a *stub heading* (heading for the leftmost, or stub, column). The heading "Variable" is often used for the stub column if no other heading is suitable. Some tables also include column spanners, decked heads, and table spanners; these are described in the *Publication Manual*. Center column headings and capitalize them in sentence case.[43]
- **body:** The table body includes all the rows and columns of a table (including the headings row). A cell is the point of intersection between a row and a column.
- The table body may be single-spaced, one-and-a-half-spaced, or double-spaced.
  - Left-align the information in the leftmost column or stub column of the table body (but center the heading).
- In general, center information in all other cells of the table. However, left-align the information if doing so would improve readability, particularly when cells contain lots of text.
- **note:** Three types of notes (general, specific, and probability) appear below the table as needed to describe contents of the table that cannot be understood from the table title or body alone (e.g., definitions of abbreviations, copyright attribution, explanations of asterisks used to indicate p values). Include table notes only as needed.

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[41] https://apastyle.apa.org/style-grammar-guidelines/tables-figures/sample-tables
[42] https://apastyle.apa.org/style-grammar-guidelines/capitalization/title-case
[43] https://apastyle.apa.org/style-grammar-guidelines/capitalization/sentence-case

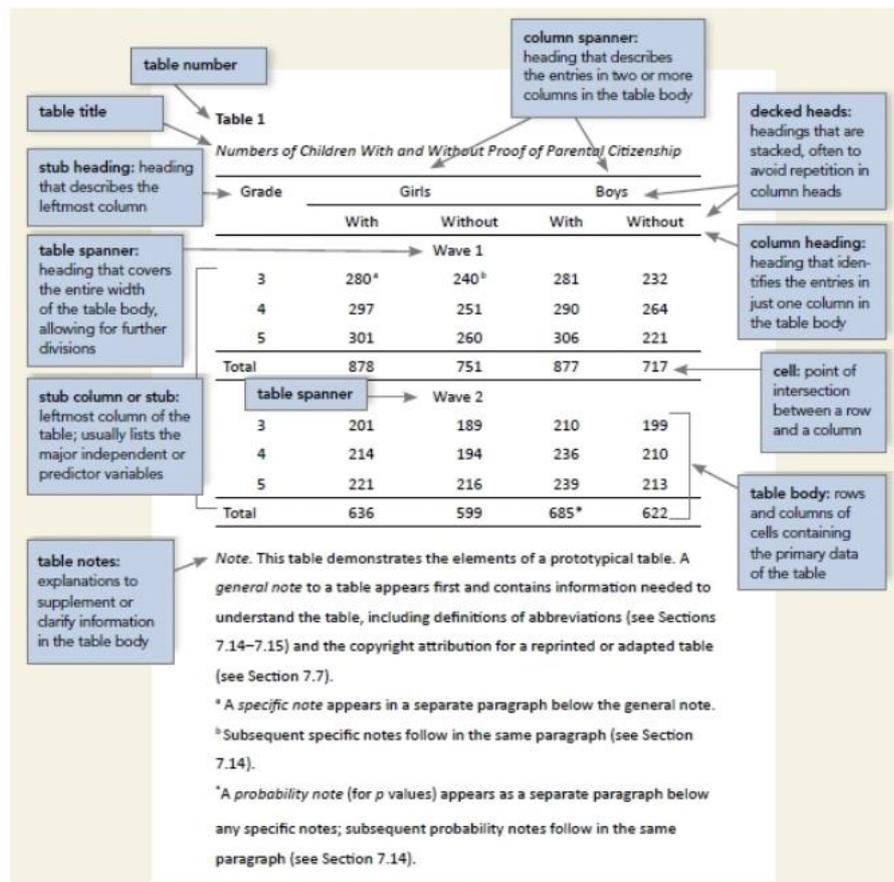The following figure illustrates the components of a table.

Figure 4: Elements of a table[44]

Principles of table construction

The most important principle to follow when creating a table is to present information in a way that is easy for readers to understand. Provide sufficient information in the table itself so that readers do not need to read the text to understand it.

When creating a table, place entries that are to be compared next to each other. In general, place different indices (e.g., means and standard deviations) in different columns rather than in the same column. Use the same font in tables[45] as in the rest of your paper.

Use the tables feature of your word-processing program to create tables in APA Style papers. Do not use the tab key or space bar to manually create the look of a table.

Table borders

Limit the use of borders or lines in a table to those needed for clarity. In general, use a border at the top and bottom of the table, beneath column headings (including decked heads), and above column spanners. You may also use a border to separate a row containing totals or other summary information from other rows in the table.

[44] Retrieved from: https://apastyle.apa.org/style-grammar-guidelines/tables-figures/tables
[45] https://apastyle.apa.org/style-grammar-guidelines/paper-format/font

Do not use vertical borders to separate data, and do not use borders
around every cell in a table. Use spacing between columns and rows and strict alignment to
clarify relations among the elements in a table.

Long or wide tables
If a table is longer than one page, use the tables feature of your word-processing program to
make the headings row repeat on the second and any subsequent pages. No other
adjustments are necessary. If a table is too wide to fit on one page, use landscape orientation
on the page with the wide table. It does not matter if the page header also moves when
switching to landscape orientation.

Placement of tables in a paper
There are two options for the placement of tables (and figures) in a paper. The first is to embed
tables in the text after each is first mentioned (or "called out"); the second is to place each table
on a separate page after the reference list.

An embedded table may take up an entire page; if the table is short, however, text may appear
on the same page as the table. In that case, place the table at either the top or bottom of the
page rather than in the middle. Also add one blank double-spaced line between the table and
any text to improve the visual presentation.

View the sample tables[46] for more information on tables.

2.6.2 Figures

Figure Setup
All types of visual displays other than tables are considered figures[47] in APA Style. Common
types of figures include line graphs, bar graphs, charts (e.g., flowcharts, pie charts), drawings,
maps, plots (e.g., scatterplots), photographs, infographics, and other illustrations.

This page addresses the basics of figure setup, including figure components, principles of
figure construction, and placement of figures in a paper. Note that tables and figures have the
same overall setup.

View the sample figures[48] to see these guidelines in action. Information is also available on
how to use color to create accessible figures.[49]

Figure components
APA Style figures have these basic components:
- **number:** The figure number (e.g., Figure 1) appears above the figure title and image
  in bold font. Number figures in the order in which they are mentioned in your paper.
- **title:** The figure title appears one double-spaced line below the figure number. Give
  each figure a brief but descriptive title, and capitalize the figure title in italic title case.[50]

[46] https://apastyle.apa.org/style-grammar-guidelines/tables-figures/sample-tables
[47] https://apastyle.apa.org/style-grammar-guidelines/tables-figures/tables
[48] https://apastyle.apa.org/style-grammar-guidelines/tables-figures/sample-figures
[49] https://apastyle.apa.org/style-grammar-guidelines/tables-figures/colors
[50] https://apastyle.apa.org/style-grammar-guidelines/capitalization/title-case

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- **image:** The image portion of the figure is the graph, chart, photograph, drawing, or other illustration itself. If text appears in the image of the figure (e.g., axis labels), use a sans serif font between 8 and 14 points.[51]
- **legend:** A figure legend, or key, if present, should be positioned within the borders of the figure and explains any symbols used in the figure image. Capitalize words in the figure legend in title case.[52]
- **note:** Three types of notes (general, specific, and probability) can appear below the figure to describe contents of the figure that cannot be understood from the figure title, image, and/or legend alone (e.g., definitions of abbreviations, copyright attribution, explanations of asterisks use to indicate p values). Include figure notes only as needed.
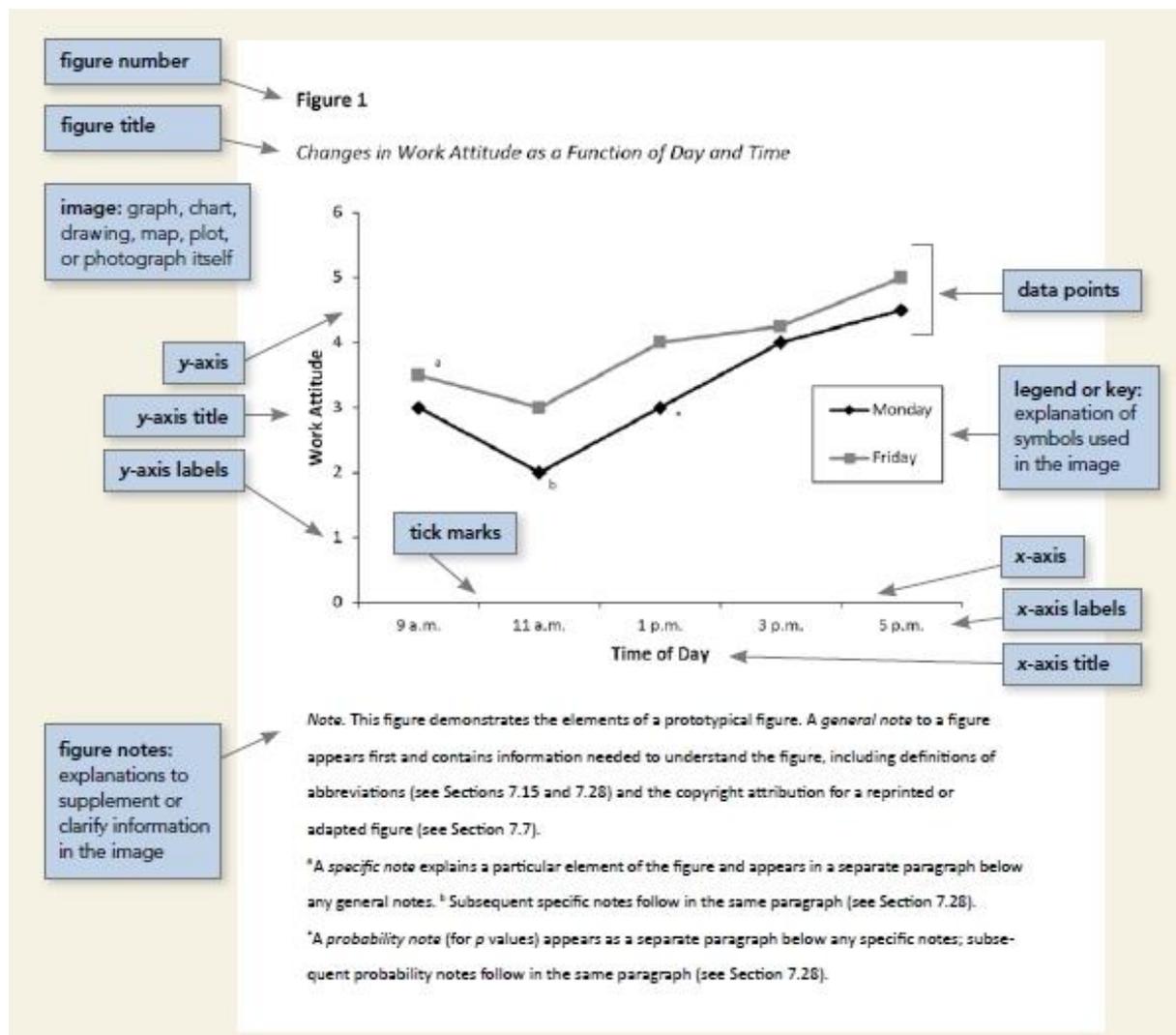
This diagram illustrates the basic figure components.

Figure 5: Figure components[53]

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[51] https://apastyle.apa.org/style-grammar-guidelines/paper-format/font
[52] https://apastyle.apa.org/style-grammar-guidelines/capitalization/title-case
[53] Retrieved from: https://apastyle.apa.org/style-grammar-guidelines/tables-figures/figures

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Principles of figure creation

The most important principle to follow when creating a figure is to present information in a way that is easy for readers to understand. Provide sufficient information in the figure itself so that readers do not need to read the text to understand it.

When creating a figure, ensure you meet the following standards:
- images are clear,
- lines are smooth and sharp,
- font is legible and simple,[54]
- units of measurement are provided,
- axes are clearly labelled,
- elements within the figure are clearly labeled or explained.

Use graphics software to create figures in APA Style papers. For example, use the built-in graphics features of your word-processing program (e.g., Microsoft Word or Excel) or dedicated programs such as Photoshop or Inkscape.

Placement of figures in a paper

There are two options for the placement of figures (and tables) in a paper. The first is to embed figures in the text after each is first mentioned (or "called out"); the second is to place each figure on a separate page after the reference list.

An embedded figure may take up an entire page; if the figure is short, however, text may appear on the same page as the figure. In that case, place the figure at either the top or bottom of the page rather than in the middle. Also add one blank double-spaced line between the figure and any text to improve the visual presentation.

2.7 Credits and references

References provide the information necessary for readers to identify and retrieve each work cited in the text.[55]

Check each reference carefully against the original publication to ensure information is accurate and complete. Accurately prepared references help establish your credibility as a careful researcher and writer.

Consistency in reference formatting allows readers to focus on the content of your reference list, discerning both the types of works you consulted and the important reference elements (who, when, what, and where) with ease. When you present each reference in a consistent fashion, readers do not need to spend time determining how you organized the information. And when searching the literature yourself, you also save time and effort when reading reference lists in the works of others that are written in APA Style.

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[54] https://apastyle.apa.org/style-grammar-guidelines/paper-format/font
[55] https://apastyle.apa.org/style-grammar-guidelines/citations

2.7.1 Basic principles

A reference list entry generally has four elements: the author, date, title, and source. Each element answers a question:

- **author:** Who is responsible for this work?
- **date:** When was this work published?
- **title:** What is this work called?
- **source:** Where can I retrieve this work?

Answering these four questions will help you create a reference entry for any type of work, even if you do not see a specific example in the Publication Manual that matches it. Consistency in reference formatting allows readers to understand the types of works you consulted and the important reference elements with ease.

To learn more about content and format of the author, date, title, and source, visit the page on reference elements.[56]

Correspondence between source and reference list entry

This figure shows the first page of a journal article. The locations of the reference elements are highlighted with different colours and callouts, and the same colours are used in the reference list entry to show how the entry corresponds to the source.

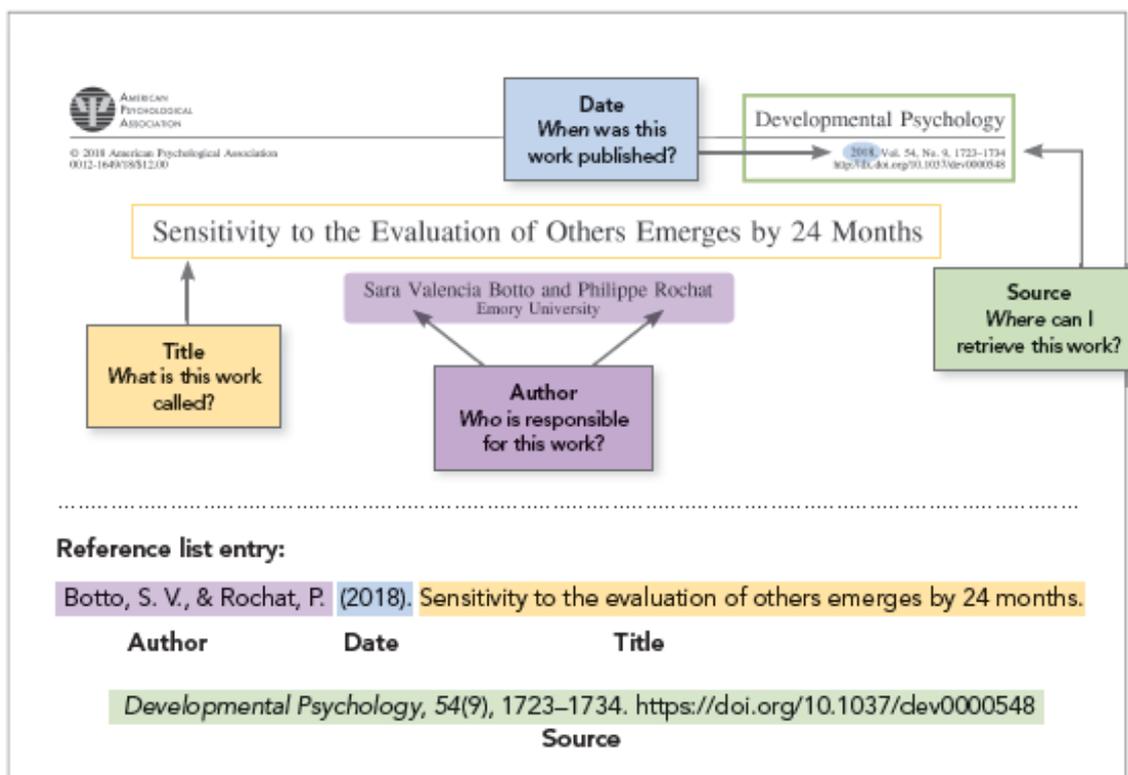Figure 9.1 Example of Where to Find Reference Information for a Journal Article

Figure 6: Reference information for a journal article[57]

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Additionally, the in-text citation for a work corresponds to the reference list entry.[58] For example, the in-text citation for the work in the example is Botto and Rochat (2018) or (Botto & Rochat, 2018).

View the reference examples[59] to see the basic principles of references in action.

Punctuation in reference list entries

Use punctuation marks in reference list entries to group information.

- Ensure that a period appears after each reference element—that is, after the author, date, title, and source. However, do not put a period after a DOI or URL[60] because it may interfere with link functionality. And if a title ends with a question mark, the question mark replaces the period.
- Use punctuation marks (usually commas or parentheses) between parts of the same reference element. For example, in a reference for a journal article, use a comma between each author's last name and initials and between different authors' names, between the journal name and the volume number, and between the journal issue number and the page numbers.
- Do not use a comma between the journal volume and issue numbers. Place the issue number in parentheses directly after the volume number instead.
- Italicize punctuation marks that appear within an italic reference element (e.g., a comma or colon within a book title). Do not italicize punctuation between reference elements (e.g., the period after an italic book title or the comma after an italic journal title).

Suggested citations

Some works contain suggested citations. These citations often contain the information necessary to write an APA Style reference but need editing for style. For example, you may need to change the capitalization of the title or the punctuation between elements. You may also need to put elements in the proper order of author, date, title, and source.

> If you want to make your life easier, you can use a reference manager software that will help you insert your citations and references in a seamless manner. Discover the one developed by Elsevier for Microsoft Word by clicking on the following link.[61]

2.7.2 Elements of reference lists

Reference list entries include the four elements of the author, date, title, and source.

This page describes each element in detail:

- the author element,[62] including the format of individual author names and of group author names,
- the date element,[63] including the format of the date and how to include retrieval dates,

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[58] https://apastyle.apa.org/style-grammar-guidelines/citations/basic-principles/author-date
[59] https://apastyle.apa.org/style-grammar-guidelines/references/examples
[60] https://apastyle.apa.org/style-grammar-guidelines/references/dois-urls
[61] https://appsource.microsoft.com/en-us/product/office/wa104382081?tab=overview
[62] https://apastyle.apa.org/style-grammar-guidelines/references/elements-list-entry#author
[63] https://apastyle.apa.org/style-grammar-guidelines/references/elements-list-entry#date

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- the title element,[64] including the format of the title and how to include bracketed descriptions,
- the source element,[65] including the format of the source and how to include database information.

View the reference examples[66] to see the elements of reference list entries in action.

A summary of this guidance is presented on the page about the basic principles of reference list entries.[67] Additional information and examples are available in Chapters 9 and 10 of the *Publication Manual*.

If a work does not have an author, date, title, or source, visit the page on how to adjust reference list entries when reference information is missing.[68]

Author
The author refers broadly to the person(s) or group(s) responsible for a work. An author may be
- an individual,
- multiple people,
- a group (institution, government agency, organization, etc.), or
- a combination of people and groups.

This element includes not only authors of articles, books, reports, and other works but also others who played primary roles in the creation of a work, such as editors of books, directors of films, principal investigators of grants, podcast hosts, and so on.

When you cannot determine who the author is, treat the work as having no author.[69]

Format of individual author names
Follow these guidelines to format the author element. Additional guidelines for less common cases are provided in the *Publication Manual*.
- Invert all individual authors' names, providing the surname first, followed by a comma and the author's initials.
  Author, A. A.

- Use a comma to separate an author's initials from additional author names, even when there are only two authors. Use an ampersand (&) before the final author's name.
  Author, A. A., & Author, B. B.

- Provide surnames and initials for up to and including 20 authors. When there are two to 20 authors, use an ampersand before the final author's name.
  Author, A. A., Author, B. B., & Author, C. C.

- When there are 21 or more authors, include the first 19 authors' names, insert an ellipsis (but no ampersand), and then add the final author's name.

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[64] https://apastyle.apa.org/style-grammar-guidelines/references/elements-list-entry#title
[65] https://apastyle.apa.org/style-grammar-guidelines/references/elements-list-entry#source
[66] https://apastyle.apa.org/style-grammar-guidelines/references/examples
[67] https://apastyle.apa.org/style-grammar-guidelines/references/basic-principles
[68] https://apastyle.apa.org/style-grammar-guidelines/references/missing-information
[69] https://apastyle.apa.org/style-grammar-guidelines/references/missing-information

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> Author, A. A., Author, B. B., Author, C. C., Author, D. D., Author, E. E., Author, F. F., Author, G. G., Author, H. H., Author, I. I., Author, J. J., Author, K. K., Author, L. L., Author, M. M., Author, N. N., Author, O. O., Author, P. P., Author, Q. Q., Author, R. R., Author, S. S., . . . Author, Z. Z.

- Use one space between initials.
> Author, A. A.

- Write the author's name exactly as it appears on the published work, including hyphenated surnames and two-part surnames.
> Santos-García, S., & Velasco Rodríguez, M. L.

- Retain the author's preferred capitalization.
> hooks, b.
> van der Waal, P. N.

Format of group author names

Group authors are often government agencies, nonprofit organizations, and task forces. Follow these guidelines to format the names of group authors in the reference list.

- Look at the title page or cover of the work to determine whether it has a group author or individual authors.
  - If the names of individuals are presented on the title page or cover, treat the work as having individual authors.
  - If only the name of the group is presented on the title page or cover, treat the work as having a group author, even if individuals are credited elsewhere in the work (e.g., in an acknowledgments section).
- Spell out the full name of a group author in the reference list entry, followed by a period.
> National Institute of Mental Health.

- On a page from an organizational or government agency website, the organization or government agency itself is considered the author, unless otherwise specified. The author of a webpage or website may also be located on an "about us" or acknowledgments page.
- An <u>abbreviation for the group author</u> can be used in the text (e.g., NIMH for National Institute of Mental Health); however, do not include an abbreviation for a group author in a reference list entry.
> **Correct:** National Institute of Mental Health.
> **Incorrect:** National Institute of Mental Health (NIMH).
> **Incorrect:** NIMH.

- When numerous layers of government agencies are listed as the author of a work, use the most specific agency as the author in the reference (e.g., use "National Institute of Nursing Research" rather than "U.S. Department of Health and Human Services, National Institutes of Health, National Institute of Nursing Research"). The names of parent agencies not present in the group author name appear in the source element as the publisher.
> National Institute of Nursing Research. (2015). A family's perspective: Pediatric palliative care stories (NIH Publication No. 15-NR-8018). U.S. Department of Health and Human Services, National Institutes of

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> Health. https://www.ninr.nih.gov/sites/files/docs/NINR_508c_FamilyStories_0.pdf

Date

The date refers to the date of publication of the work. The date will take one of the following forms:

- year only;
- year, month, and day (i.e., an exact date);
- year and month;
- year and season; or
- range of dates (e.g., range of years, range of exact dates).

When you cannot determine the date of publication, treat the work as having no date.[70]

Format of the date

Follow the date format for the reference type as shown in the *Publication Manual*. Most references use only the year. Additional guidelines for less common cases are provided in the *Publication Manual*.

- Enclose the date of publication in parentheses, followed by a period
  (2020).

- For works from a reference category that includes the month, day, and/or season along with the year, put the year first, followed by a comma, and then the month and date or season.
  (2020, August 26).
  (2018, July).
  (2019, Winter).

- For unpublished, informally published, or in-progress works, provide the year the work was produced. Do not use "in progress" or "submitted for publication" in the date element of a reference.
- If a work has been accepted for publication but is not yet published, use the term "in press" instead of a year.
  (in press).

- If a work is an advance online publication, use the year of the advance online publication in the reference.
- When the date of original publication is approximate, use the abbreviation "ca." (which stands for "circa").
  (ca. 1999).

If a date of last update is available (such as for a webpage), use it in the reference. Do not include a date of last review in a reference because content that has been reviewed has not necessarily been changed.

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[70] https://apastyle.apa.org/style-grammar-guidelines/references/missing-information

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24

Retrieval dates

Include a retrieval date only if the work is unarchived and designed to change over time. Most references do not include retrieval dates. Examples of some that do are in Chapter 10 of the *Publication Manual* and on the <u>reference examples</u> page.[71]

When a retrieval date is needed, use the following format for it.

Retrieved September 30, 2020, from https://xxxxx

Title

The *title* refers to the title of the work being cited. Titles fall into two broad categories:

- works that stand alone (e.g., whole books, reports, gray literature, dissertations and theses, informally published works, data sets, videos, films, TV series, albums, podcasts, social media, and works on websites) and
- works that are part of a greater whole (e.g., periodical articles, edited book chapters, TV and podcast episodes, and songs).

When a work stands alone (e.g., a report), the title of that work appears in the title element of the reference. When a work is part of a greater whole (e.g., a journal article or edited book chapter), the title of the article or chapter appears in the title element of the reference and the title of the greater whole (the journal or edited book) appears in the source element.

When the title of the work cannot be determined, <u>treat the work as having no title</u>.[72]

Format of the title

Follow these guidelines to format the title element. Additional guidelines for less common cases are provided in the *Publication Manual*.

- For works that are part of a greater whole (e.g., journal articles, edited book chapters), capitalize the title using <u>sentence case</u>.[73] Do not italicize the title or use quotation marks around it.

  Happy fish in little ponds: Testing a reference group model of achievement and emotion.

- For works that stand alone (e.g., books, reports, webpages), italicize the title, and capitalize it using sentence case.

  Becoming brilliant: What science tells us about raising successful children.

- For book and report references, enclose edition information, report numbers, and volume numbers in parentheses after the title. Do not add a period between the title and the parenthetical information. Do not italicize the parenthetical information. If both edition and volume information are included, separate these elements with a comma, placing the edition number first.

  The psychology of music (3rd ed.).
  Nursing: A concept-based approach to learning (2nd ed., Vol. 1).

- If a numbered volume has its own title, the volume number and title are included as part of the main title, rather than in parentheses.

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[71] https://apastyle.apa.org/style-grammar-guidelines/references/examples
[72] https://apastyle.apa.org/style-grammar-guidelines/references/missing-information
[73] https://apastyle.apa.org/style-grammar-guidelines/capitalization/sentence-case

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> APA handbook of industrial and organizational psychology:
> Vol. 1. Building and developing the organization.

- Finish the title element with a period. However, if the title ends with a question mark or exclamation point, that punctuation mark replaces the period.

> Late-onset unexplained epilepsy: What are we missing?

Bracketed descriptions

To help identify works outside the peer-reviewed academic literature (i.e., works other than articles, books, reports, etc.), provide a description of the work in square brackets after the title and before the period. Capitalize the first letter of the description, but do not italicize the description.

> Comprehensive meta-analysis (Version 3.3.070) [Computer software].

Examples of works that include bracketed descriptions are some audiobooks, gray literature (e.g., press releases), audiovisual works (e.g., films, YouTube videos,[74] photographs), software and mobile apps, data sets, manuscripts in preparation, and dissertations and theses. Bracketed descriptions are also used in social media references to indicate attached links or images.

The examples in the *Publication Manual* and on the reference examples page[75] include bracketed descriptions where they are needed. When in doubt, include a description. Consistency of wording is helpful, but you may alter the wording shown in the examples to best convey the information readers need to understand the nature of the work.

Source

The *source* indicates where readers can retrieve the cited work. As with titles, sources fall into two broad categories: works that are part of a greater whole and works that stand alone.

- The source for a work that is part of a greater whole (e.g., journal article, edited book chapter) is that greater whole (i.e., the journal or edited book), plus any applicable DOI or URL.
- The source for a work that stands alone (e.g., whole book, report, dissertation, thesis, film, TV series, podcast, data set, informally published work, social media, webpage) is the publisher of the work, database or archive, social media site, or website, plus any applicable DOI or URL.
- A location is not required in the source element for most works (e.g., do not include the publisher location for book references).
- Works associated with a specific location (e.g., artwork in a museum, conference presentations) include location information in the source and, depending on the work, may also include a DOI or URL.

If a work is not recoverable, treat it as having no source.[76]

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[74] https://apastyle.apa.org/style-grammar-guidelines/references/examples/youtube-references
[75] https://apastyle.apa.org/style-grammar-guidelines/references/examples
[76] https://apastyle.apa.org/style-grammar-guidelines/references/missing-information

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Format of the source

The format of the source varies depending on the reference type. The most common cases are presented next. Additional guidelines for less common cases are provided in the *Publication Manual*.

Table 1. Reference formats according to the source

Reference type	Components of the source	Example source element
Journal article	Periodical title, volume, issue, page range, and DOI or URL	*Couple and Family Psychology: Research and Practice, 8*(3), 137–151. https://doi.org/10.1037/cfp0000121
Journal article with article number	Periodical title, volume, issue, article number, and DOI or URL	*PLoS ONE, 14*(9), Article e0222224. https://doi.org/10.1371/journal.pone.0222224
Authored book or whole edited book	Publisher name and DOI or URL	Springer. https://doi.org/10.1007/978-3-030-25513-8
Edited book chapter	Information about the whole book (including editor name, book title, edition and/or volume number, page range, and publisher name) and DOI or URL	In G. R. Samanez-Larkin (Ed*.), The aging brain: Functional adaptation across adulthood* (pp. 9–43). American Psychological Association. https://doi.org/10.1037/0000143-002
Webpage on a website (when authors are different from the site name)	Website name and URL	Mayo Clinic. https://www.mayoclinic.org/drugs-supplements-acidophilus/art-20361967
Webpage on a website (when authors are the same as the site name)	URL	https://www.cdc.gov/cancer/kinds.htm

Database information in the source

Database and archive information is seldom needed in reference list entries. For example, if you retrieved a work from an academic research database, the reference very rarely includes the name of the database or the URL of the work on the database.

Visit the page on database information in references[77] to learn when and how to include database information in references.

Visit the page on DOIs or URLs[78] to learn how to include DOIs and URLs in references.

2.8 Open Science

APA supports publishing open, rigorous, and transparent research. The APA Ethics Code prohibits authors from withholding data from qualified requesters for verification through reanalysis in most circumstances (see Standard 8.14, Sharing Research Data for Verification),[79] as long as the confidentiality of the participants is protected. Section 1.14 of the *Publication Manual* (7th ed.) addresses many issues about data retention and data sharing—both during review and after

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[77] https://apastyle.apa.org/style-grammar-guidelines/references/database-information
[78] https://apastyle.apa.org/style-grammar-guidelines/references/dois-urls
[79] https://www.apa.org/ethics/code/manual-updates

publication. Section 1.15 provides guidelines and additional considerations specific to qualitative research, including presentation of raw data in research reports, confidentiality limitations, consent limitations, and researchers' perspective limitations.

APA Style Journal Article Reporting Standards (APA Style JARS)[80] include guidance on how to report on quantitative, qualitative, and mixed method studies. Transparency is a central issue[81] across APA Style JARS. These guidelines provide a degree of comprehensiveness in the information that is routinely included in reports of empirical investigations, be they quantitative, qualitative, or mixed methods in nature. Thus, transparency in reporting permits readers to better comprehend the way methods were carried out, to replicate methods in varied contexts, and to locate findings within the published article.

We also support the Transparency and Openness Promotion (TOP) Guidelines[82] developed by a community working group in conjunction with the Centre for Open Science. Additional information about research transparency standards, replication studies, open science badges, preprints, preregistration, and more can be found on the APA Journals Open Science at APA page.[83]

2.9 Submitting your article: writing a cover letter

A good cover letter can help to "sell" your manuscript to the journal editor. As well as introducing your work to the editor you can also take this opportunity to explain why the manuscript will be of interest to a journal's readers, something which is always as the forefront editors' mind. As such it is worth spending time writing a coherent and persuasive cover letter.[84]

To read basic tips on how to write a successful cover letter, click on the following link.[85]

2.10 Writing a letter to the editor

In most journals, there are letters or answers sections. Letters to the editor are usually a type of short communication that can be written on any topic that attracts the attention of the readers. Although articles are stringently vetted before publication in a journal, some issues can still go unnoticed. In this situation, readers can offer their interpretations by writing a letter to the editor. Thus, letters are also a control mechanism that facilitates progress after an article has been published. One of the most important aspects of a letter to the editor is that it must be short. It is known that a letter is more easily accessible to readers when the message is short and brief. The letter to the editor or author must make reference to objectives or discussions on medical, scientific or general topics that may attract attention. A letter must have a purpose, and it should convey its message in a short and definitive fashion.[86]

To learn more about how to write a letter to the editor, read the following article.[87]

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[80] https://apastyle.apa.org/jars
[81] https://apastyle.apa.org/jars/transparency
[82] https://www.apa.org/pubs/journals/resources/transparency-openness-promotion
[83] https://www.apa.org/pubs/journals/resources/open-science
[84] Retrieved from: https://www.springer.com/kr/authors-editors/authorandreviewertutorials/submitting-to-a-journal-and-peer-review/cover-letters/10285574
[85] https://www.springer.com/kr/authors-editors/authorandreviewertutorials/submitting-to-a-journal-and-peer-review/cover-letters/10285574
[86] Retrieved from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4548563/
[87] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4548563/

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3 How to communicate science to the general public?

While communicating with the scientific community may seem to be the most essential task for a researcher when aiming for impact, it is worth retaining that in the era of citizen science and crowdsourcing, reaching out to the non-scientific public has become just as important and can be a cornerstone of success. Therefore, we recommend reading the following optional chapter.

3.1 Written science communication

Communicating with the general public comes with special requirements in terms of format, length, style and language use.

3.1.1 Popularizing science with articles
One traditional format is writing popular science articles in non-specialized journals and publications. Click on the following link[88] to start your journey.

3.1.2 Science communication on social media
It might seem superfluous, but social media, such as Facebook, LinkedIn or X can contribute to boosting the impact of your research. Here is an article[89] by the European Research Agency on how to do it.

3.1.3 Creating a science blog
Another way to publicize and raise awareness about your research is keeping an online blog. Here are some tips[90] to start.

3.2 Oral science communication

Whether you're creating a vlog, a podcast, preparing for a TEDx speech, a pitch to a potential sponsor or a TV interview, what you need to master is the art of storytelling. To do so, we recommend you watch the following video series ("How to tell a science story | 'Talking Science' Course #5")[91] on the art of scientific storytelling.

3.2.1 How to create a science pitch
A pitch is a short speech, lasting from 1 minute (elevator pitch) to 5 minutes that's been created with the aim of persuading the listener. In the case of a science pitch, you might be aiming for funding by a sponsor or simply for making your science more visible.

Watch the following masterclass ("Tips for a Memorable 5 mintue Research Pitch")[92] to understand how to create a 5-minute science pitch and listen in to a pitch-winner's 3-key tips ("3 tips for creating a fabulous science pitch").[93]

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[88] https://science.thewire.in/the-sciences/a-beginners-guide-to-writing-a-popular-science-article-by-a-teacher/
[89] https://rea.ec.europa.eu/news/science-communication-how-social-media-can-effectively-boost-your-research-project-2023-08-11_en
[90] https://www.gregforcey.com/how-to-write-a-science-blog/
[91] https://www.youtube.com/watch?v=99Ar5_Iwi24
[92] https://www.youtube.com/watch?v=PUrDcYZsZEg
[93] https://www.youtube.com/watch?v=pnzbdOI9Bw0

3.2.2 How to create a science podcast

Podcasts are pre-recorded programs that can be downloaded from or listen to on the internet. They are handy tools in popularizing science. Read the following website to learn more about the first steps in creating a podcast.[94]

3.2.3 How to make an impactful TED talk

TED talks are impactful under-18-minute speeches that seek to demonstrate an idea in a playful manner. Click on the following link,[95] if you want to know more about what a TED talk is, and watch the following video[96] by TED curator, Chris Anderson, for more tips on how to make a successful TED talk.

3.2.4 How to give a brilliant TV interview about your science?

In the internet era, TV interviews remain an impactful tool for promoting science. You might not be there just yet – but the time might come when you'll have to communicate about your research on the small screen. Here is an interesting video about how to do so ("How to give a brilliant media interview about your science | 'Talking Science' Course #9").[97]

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[94] https://dictionary.cambridge.org/dictionary/english/podcast
[95] https://www.ted.com/participate/organize-a-local-tedx-event/tedx-organizer-guide/speakers-program/what-is-a-tedx-talk
[96] https://www.ted.com/talks/chris_anderson_ted_s_secret_to_great_public_speaking?language=en
[97] https://www.youtube.com/watch?v=epPE8CWM3RQ

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of the European Union   30