Writing a strong scientific paper in medicine and the biomedical sciences: a checklist and recommendations for early career researchers

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Abstract

Scientific writing is an important skill in both academia and clinical practice. The skills for writing a strong scientific paper are necessary for researchers (comprising academic staff and health-care professionals). The process of a scientific research will be completed by reporting the obtained results in the form of a strong scholarly publication. Therefore, an insufficiency in scientific writing skills may lead to consequential rejections. This feature results in undesirable impact for their academic careers, promotions and credits. Although there are different types of papers, the original article is normally the outcome of experimental/epidemiological research. On the one hand, scientific writing is part of the curricula for many medical programs. On the other hand, not every physician may have adequate knowledge on formulating research results for publication adequately. Hence, the present review aimed to introduce the details of creating a strong original article for publication (especially for novice or early career researchers).

Keywords Scientific research · Publications · Medical publications · Clinical medicine · Peer review · Academic training · Abstracting and indexing

Introduction

The writing and editing of scientific papers should be done in parallel with the collection and analysis of epidemiological data or during the performance of laboratory experiments, as it is an integral step of practical research. Indeed, a scholar paper is the figurative product of scientific investigations (Behzadi and Behzadi 2011; Singh and Mayer 2014). Moreover, the publication of scholarly papers is important from the standpoint of providing relevant information—both locally and internationally—that may influence clinical practice, while in academia, national and international academic metrics (in which the number and quality of papers determine the score and rank of the scientists) are relevant to fulfill employment criteria and to apply for scientific grants (Grech and Cuschieri 2018; Singer and Hollander 2009). Thus, scientific writing and the publication of quality peer-reviewed papers in prestigious academic journals are an important challenge for medical professionals and biomedical scientists (Ahlstrom 2017). Writing a strong scholarly paper is a multi-procedure task, which may be achieved in a right manner by using a balanced and well-designed framework or blueprint (Gemayel 2016; Tóth et al. 2020). All in all, time needs to be spent of writing a well-designed and thoughtful scientific proposal to support the research, which will subsequently end in the publication of a paper in a prestigious, peer-reviewed, indexed and scholarly journal with an impact factor (IF). A well-designed scientific project encompasses well-supported and strong hypotheses and up-to-date methodology, which may lead to the collection of remarkable (and reproducible!) data. When a study is based on a strong hypothesis, suitable methodology and our studies result in usable data, the next step is the analysis and interpretation of the said data to present a valuable

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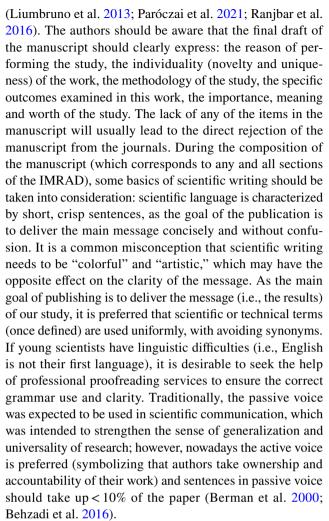
conclusion at the end of our studies. These criteria give you an influent confidence to prepare a robust and prestigious scholarly paper (Ahlstrom 2017; Behzadi 2021; Kallet 2004; Stenson et al. 2019). The aim of this review is to highlight all the necessary details for publication of a strong scientific writing of original article, which may especially be useful for novice or early career researchers.

Approaches for writing and formatting manuscripts before submission

In the presence of effective and appropriate items for writing a strong scientific paper, the author must know the key points and the main core of the study. Thus, preparing a blueprint for the paper will be much easier. The blueprint enables you to draft your work in a logical order (Gemayel 2016). In this regard, employment of a mass of charge, free or pay-per-use online and offline software tools can be particularly useful (Gemayel 2016; Behzadi and Gajdács 2020; Behzadi et al. 2021; Ebrahim 2018; Issakhanian and Behzadi 2019; O'Connor and Holmquist 2009; Petkau et al. 2012; Singh and Mayer 2014; Tomasello et al. 2020). Today, there are a wide range of diverse software tools which can be used for design and organization of different parts of your manuscript in the correct form and order. Although traditionally, many scientist do not use these softwares to help formulate their paper and deliver their message in the manuscript, they can indeed facilitate some stages of the manuscript preparation process. Some of these online and offline software facilities are shown in Table 1.

The first step of writing any scientific manuscript is the writing of the first draft. When writing the first draft, the authors do not need to push themselves to write it in it's determined order (Behzadi and Gajdács 2020; Gemayel 2016); however, the finalized manuscript should be organized and structured, according to the publisher's expectations (Berman et al. 2000; Behzadi et al. 2016). Based on the contents of the manuscripts, there are different types of papers including original articles, review articles, systematic reviews, short communications, case reports, comments and letters to the editor (Behzadi and Gajdács 2020; Gemayel 2016), but the present paper will only focus on the original articles structured in the IMRAD (Introduction, Methods, Results and Discussion) structure. Materials and methods, results, discussion or introduction sections are all suitable target sections to begin writing the primary draft of the manuscript, although in most cases, the methods section is the one written first, as authors already have a clear sense and grasp on the methodologies utilized during their studies (Ebrahim 2018). The final sections of IMRAD papers which should be completed are the abstract (which is basically the mini-version of the paper) and conclusion

(Liumbruno et al. 2013; Paróczai et al. 2021; Ranjbar et al. 2016). The authors should be aware that the final draft of the manuscript should clearly express: the reason of performing the study, the individuality (novelty and uniqueness) of the work, the methodology of the study, the specific outcomes examined in this work, the importance, meaning and worth of the study. The lack of any of the items in the manuscript will usually lead to the direct rejection of the manuscript from the journals. During the composition of the manuscript (which corresponds to any and all sections of the IMRAD), some basics of scientific writing should be taken into consideration: scientific language is characterized by short, crisp sentences, as the goal of the publication is to deliver the main message concisely and without confusion. It is a common misconception that scientific writing needs to be "colorful" and "artistic," which may have the opposite effect on the clarity of the message. As the main goal of publishing is to deliver the message (i.e., the results) of our study, it is preferred that scientific or technical terms (once defined) are used uniformly, with avoiding synonyms. If young scientists have linguistic difficulties (i.e., English is not their first language), it is desirable to seek the help of professional proofreading services to ensure the correct grammar use and clarity. Traditionally, the passive voice was expected to be used in scientific communication, which was intended to strengthen the sense of generalization and universality of research; however, nowadays the active voice is preferred (symbolizing that authors take ownership and accountability of their work) and sentences in passive voice should take up < 10% of the paper (Berman et al. 2000; Behzadi et al. 2016).

Every scientist should be able to present and discuss their results in their own words, without copy–pasting sentences from other scientists or without referring to the work of others, if it was used in our paper. If an author copies or represents another authors' intellectual property or words as their own (accidentally or more commonly on purpose) is called plagiarism. Scientific journals use plagiarism checker softwares to cross-check the level of similarity between the submitted works and scientific papers or other materials already published; over a certain threshold of similarity, journals take action to address this issue. Plagiarism is highly unethical and frowned upon in the scientific community, and it is strictly forbidden by all relevant scientific publishers, and if one is caught with plagiarism, the scientific paper is usually rejected immediately (if this occurs during the submission process) or is retracted. There are some freely available online software tools (e.g., iThenticate® (http://www.ithenticate.com/) and SMALL SEO TOOLS (https://smallseotoolz.net/plagiarism-checker) for authors to screen their works for similarities with other sources; nevertheless, it is also unethical to use these tools to determine the "acceptable" level of similarity (i.e., cheating) before submitting a paper.

Table 1 List of the available free and pay-per-use software tools to facilitate the preparation and formatting of a complete manuscript (Gemayel 2016; Behzadi and Gajdács 2020; Behzadi et al. 2021; Ebrahim 2018; Issakhanian and Behzadi 2019; O'Connor and Holmquist 2009; Petkau et al. 2012; Singh and Mayer 2014; Tomasello et al. 2020)

Software tool	Software Web site	Software function	Operating system/browser
3D Protein Imaging	https://3dproteinimaging.com/	Protein imaging and visualizing	Various browsers
A plasmid Editor (ApE)	https://jorgensen.biology.utah.edu/wayned/ape/	Graphic editor	Mac OS and Windows
Academic Phrasebank	http://www.phrasebank.manchester.ac.uk/	Academic rephrasing, drafting and edition	Various browsers and operating systems
Academic Plagiarism	https://academicplagiarism.com/	Plagiarism checker	Various browsers
ACD/ChemSketch	https://www.acdlabs.com/products/draw_nom/draw/chemsketch/	Multifunctional software tools including: molecular drawing, modeling, analyzer and structural predictor	Various browsers and operating systems
AI Writer	http://ai-writer.com/	Generating and rewriting a paper and article	Various browsers
Authorea	https://www.authorea.com/	Publishing platform for writing a complete article	Various operating systems
Babel Generator	http://babel-generator.herokuapp.com/	Generating a paper and article	Various browsers
Best Free Spinner	http://bestfreespinner.com/index.php	Spinning text and article (rephrasing)	Various browsers
BibDesk	https://bibdesk.sourceforge.io/	Reference manager	Mac OS X
Biblioscape	http://www.biblioscape.com/	Reference manager	Windows
BIBTEX (Bebop)	https://www.ctan.org/pkg/bibtex	Reference manager	Various browsers
Bing Spell Check (Microsoft Azure)	https://azure.microsoft.com/en-us/services/cognitive-services/spell-check/?cdn=disable	English spelling, punctuation and capitalization checker	Various browsers and operating systems
BioRender	https://biorender.com/	Scientific figures drawing	Various operating systems
Bookends	https://www.sonnysoftware.com/	Reference manager	Mac OS
Canva	https://www.canva.com/graphs/graphic-organizers/	Graphic organizer	Various browsers
Cell Illustrator	http://www.cellillustrator.com/	Drawing, visualizing and modeling of biological processes and systems	Linux, Mac OS and Windows
CellDesigner	http://www.celldesigner.org/index.html	Drawing gene regulatory and biochemical networks	Linux, Mac OS and Windows
Center for Plain Language	http://centerforplainlanguage.org/plain-language-checklist/	Rephrasing, drafting and edition of a text	Various browsers and operating systems
ChemAxon	https://chemaxon.com/products/	Multifunctional software tools including: bio-molecule drawing, designing and visualizing, chemical data extraction, analysis and edition, etc.	Various browsers and operating systems
Cite this for me	http://www.citethisforme.com/	Reference manager	Google Apps, Various browsers and operating systems
Citation Machine	http://www.citationmachine.net/	Reference manager, grammar, punctuation, sentence and plagiarism checker	Google Apps, Various browsers and operating systems
Citation Style Language (CSL) Editor	https://editor.citationstyles.org/about/	Finding, editing and using the related style	Various browsers
Citavi	https://www.citavi.com/en	Reference manager	Windows
CmapTools	https://cmap.ihmc.us	Graphic designer, flow-chart drawer and manuscript organizer	Linux, Mac OSX and Windows

Table 1 (continued)

Software tool	Software Web site	Software function	Operating system/browser
COPYLEAKS	https://copyleaks.com/	Plagiarism checker (multi-lingual tool)	Various browsers and operating systems (e.g., Microsoft Office)
Dark room	http://jjafuller.com/dark-room/	Manuscript drafter	Various browsers; Net Framework, Windows
Docoloc	https://www.docoloc.de/	Plagiarism checker	Various browsers
DOI Citation Formatter	https://citation.crosscite.org/	Reference manager	Various browsers
Dragon	https://www.nuance.com/dragon.html	Voice texter	Windows
Draw.io	https://www.draw.io/	Graphic designer, diagram and flow-chart drawer	Mac OS and Windows
Dropbox	https://www.dropbox.com/	Multi-player or individual manuscript editor and writer	Various browsers
DrugBank	https://www.drugbank.ca/interax/multi_search	Drug–drug interaction checker for academic purposes	Various browsers and operating systems
Dupli Checker	https://www.duplichecker.com/	Grammar and plagiarism checker	Various browsers
EasyBib	http://www.easybib.com/	Reference manager, grammar and plagiarism checker	Various browsers and operating systems
Education Oasis	http://www.educationoasis.com/printables/graphic-organizers/	Graphic organizer	Various browsers
Education Place	http://www.eduplace.com/graphicorganizer/	Graphic organizer	Various browsers
EndNote	https://www.endnote.com/	Reference manager	Mac OS and Windows
EssayBot	https://www.essaybot.com/	Generating a paper and article	Various browsers
Etherpad	https://etherpad.org/	Multi-player manuscript editor and writer	Various browsers; Linux, Mac and Windows
Evernote	https://evernote.com/	Multifunctional and multi-lingual manuscript provider	Various browsers and operating systems
F1000Workspace	https://f1000workspace.com/?lg	Reference manager	Various browsers and operating systems
FocusWriter	https://gottcode.org/focuswriter	Multi-lingual manuscript drafter	Linux, Mac OS X and Windows
Focus booster	https://www.focusboosterapp.com/	Manuscript drafter and editor (by time limitation)	Linux, Mac OS X and Windows
FreeMind	http://www.graphic.org/mind-mapping-software/freemind-review.html	Graphic organizer	Various browsers
Freeology	https://freeology.com/graphicorgs/	Graphic organizer	Various browsers
Freeplane	https://sourceforge.net/projects/freeplane	Graphic, diagram and manuscript organizer	Linux, Mac and Windows
Ginger	https://www.gingersoftware.com/	English grammar, spelling and punctuation checker	Mac and Windows; Google Chrome and Safari
Google	https://www.google.com/	Plagiarism checker	Various browsers
Google Drive	https://www.google.com/drive/	Multi-player manuscript editor and writer	Various browsers; Mac and Windows, Android, iOS
GradeProof	https://gradeproof.com/	English grammar and spelling checker; plagiarism checker	Various browsers and operating systems

Table 1 (continued)

Software tool	Software Web site	Software function	Operating system/browser
Grammarly	https://www.grammarly.com/	English grammar, spelling, punctuation and plagiarism checker	Mac OS and Windows
Graphic organizer	https://bubbl.us/	Graphic organizer	Various browsers
GView Server	https://server.gview.ca/	Comparative microbial genomes visualizer	Various browsers
Holt Interactive	http://my.hrw.com/nsmedia/intgos/html/igo.htm	Graphic organizer	Various browsers
iMindMap	http://www.graphic.org/mind-mapping-software/imindmap-review.html	Graphic organizer	Various browsers and operating systems
iCite	https://icite.od.nih.gov/analysis	Evaluation of references	Various browsers
InDesign	https://www.adobe.com/products/indesign.html	Page layout program	Various operating systems
Infogram	https://infogram.com/	Graphic organizer	Various browsers and operating systems
iThenticate	http://www.ithenticate.com/	Plagiarism checker	Various browsers and operating systems
JabRef	http://www.jabref.org/	Reference manager	Linux, Mac OS X and Windows
JSTOR	https://www.jstor.org/analyze/analyzer	Reference manager	Various browsers
LanguageTool	https://languagetool.org/	English grammar, spelling and style checker	Mac and Windows; Google chrome and Firefox
LaTeX	https://www.latex-project.org/	Typesetting system and page layout software	Linux, Mac OS and Windows; LaTeX Online Services
LibreOffice	https://www.libreoffice.org/	Typesetting system (multifunctional system)	Various browsers and operating systems
Linguix	https://linguix.com/	English grammar, spelling and punctuation checker	Various browsers and operating systems
Mathgen	http://thatsmathematics.com/mathgen/	Generating a paper and article	Various browsers
Mendeley	https://www.mendeley.com/newsfeed	Reference manager	Various browsers and operating systems
Microsoft Publisher	https://products.office.com/en-us/publisher	Page layout software	Chrome, Firefox, Safari;Mac OS, Windows
Microsoft Word	https://products.office.com/en-us/home	Typesetting system and reference manager	Various browsers and operating systems
Mind42	https://mind42.com/	Manuscript editor and graphic organizer	Various browsers
Mindjet's MindManager	http://www.graphic.org/mind-mapping-software/mindjet-mindmanager-review.html	Graphic organizer	Various browsers and operating systems
MindMeister	https://www.mindmeister.com/	Mind mapper, visualizer, graphic organizer	ChromeBook; Linux, Mac and Windows
MindtheGRAPH	https://mindthegraph.com/	Scientific figures drawing	Various browsers and operating systems
Molecular Graphics Software	https://www.rcsb.org/pages/thirdparty/molecular_graphics	Multifunctional software tools for visualizing, modeling, docking, etc.	Various browsers and operating systems
Nucleobytes	https://nucleobytes.com/	Manuscript editor, reference management, DNA sequence editor, sequence editor and viewer	iOS and Mac
Ommwriter	https://ommwriter.com/	Multi-lingual manuscript drafter	Mac OS and Windows
OneNote	https://products.office.com/en/onenote/digital-note-taking-app	Multi-functional manuscript provider and graphic organizer	Various browsers and operating systems
OnlineCorrection	https://www.onlinecorrection.com/	English grammar, spelling and style checker	Various browsers
OpenOffice	https://www.openoffice.org/	Typesetting system	Various browsers and operating systems

Table 1 (continued)

Software tool	Software Web site	Software function	Operating system/browser
Overleaf	https://www.overleaf.com/	Manuscript editing with LaTex platform	Various browsers
Paperpile	https://paperpile.com/	Reference manager	Chrome and Google Apps
PaperRater	https://www.paperrater.com/	Manuscript editor and plagiarism checker	Various browsers
PathVisio	https://www.pathvisio.org/	Biological pathways analyzing, drawing, editor and visualizing	Various operating systems
pDRAW32	http://www.acaclone.com/	DNA analysis software	Linux, Mac and Windows
PerfectIt	https://intelligentediting.com/	Manuscript editor	Mac OS, Windows
Plagiarism Detect	http://ww7.plagiarismdetect.com/	Plagiarism checker	Various browsers
Plagiarisma	http://plagiarisma.net/	English grammar and spelling checker; correcting sentences; plagiarism checker	Various browsers
Plagium	http://www.plagium.com/	Plagiarism checker	Various browsers
PlagScan	https://www.plagscan.com/en/	Plagiarism checker	Various browsers
Protein Data Bank	https://www.rcsb.org/	Visualizing (3D shapes of proteins and nucleic acids), analyzing sequences	Various browsers
Pybliographer	https://pybliographer.org/	Reference manager	Various browsers; Linux
QuillBot	https://www.quillbot.com/	English language editor	Various browsers and operating systems
Qiqqa	http://www.qiqqa.com/	Reference manager	Android, Microsoft, Windows
Readability Test Tool	https://www.webfx.com/tools/read-able/	Manuscript readability evaluator	Various browsers
ReadCube	https://www.readcube.com/home	Reference manager	Various browsers; Android, iOS, Mac, Windows
Ref-N-Write	https://www.ref-n-write.com/trial/	Academic rephrasing, drafting and edition	Various browsers and operating systems
refbase	http://www.refbase.net/index.php/Web_Reference_Database	Reference manager	Various browsers and operating systems
RefWorks	https://www.refworks.com/refworks2/default.aspx?r=authentication::init	Reference manager	Various browsers and operating systems
SCIgen	https://pdos.csail.mit.edu/archive/scigen/	Generating a paper and article	Various browsers
Scinote	https://scinote.net/	Manuscript draft	Various operating systems
SciRef	https://sci-progs.com/	Reference manager	Various browsers; Microsoft Word, Windows
Scribus	https://www.scribus.net/	Page layout program	Debian GNU/Hurd, FreeBSD, Haiku, Linux, Mac OS X, NetBSD, OpenBSD, OpenIndiana, PC-BSD, OS/2 Warp 4, eComStation, Solaris, and Windows
Scrivener	https://www.literatureandlatte.com/scrivener/overview	Manuscript draft and compositor	Windows and Mac OS
Search Engine Reports	https://searchenginereports.net/plagiarism-checker	Grammar and plagiarism chercker	Various browsers
SEOMagnifier	https://seomagnifier.com/online-plagiarism-checker	Plagiarism checker	Various browsers

Table 1 (continued)

Software tool	Software Web site	Software function	Operating system/browser
SEO Tools Centre	https://seotoolscentre.com/plagiarism-check er-tool	Plagiarism checker	Various browsers
Serif	https://www.serif.com/en-us/	Photo editor and graphic designer	Mac OS, Windows, iPad
Similarity Check	https://www.crossref.org/services/similarity-check/	Plagiarism checker	Various browsers
Small SEO Tools	https://smallseotools.com/plagiarism-checker/	Plagiarism checker	Various browsers
SOURCEFORGE	https://sourceforge.net/projects/antiplagiarismc/	Plagiarism checker	Linux, Mac and Windows
Speech Texter	https://www.speechtexter.com/	Typing manuscript by the voice (multi-lingual tool)	Chrome browser
SpellChecker	https://www.spellchecker.net/	English grammar, spelling, and punctuation checker	Various browsers
Spinbot	https://spinbot.com/	Spinning and rewriting a text and article (rephrasing)	Various browsers
Stylewriter	http://www.stylewriter-usa.com/	Manuscript editor	Windows
Swan	https://cs.joensuu.fi/swan/	English grammar and spelling checker; manu-script draft	Linux, Mac and Windows
Sylvan paper	https://www.sylvanpaper.sylvanlearning.com/	Writing manager	Various browsers and operating systems
Tex Maker	https://www.xm1math.net/texmaker/	Manuscript editor	Linux, Mac OSX and Windows
TeXstudio	https://www.texstudio.org/	Manuscript editor	The most operating systems
Text Fixer	https://www.textfixer.com/tools/	Multifunctional manuscript editor and creator	Various browsers
The Brain	https://www.thebrain.com/	Network visualizer, graphic designer, manuscript editor	Linux, Mac OS and Windows
TheBestSpinner	https://thebestspinner.com/v4/	Spinning text and article (Rephrasing); audio/mp3 file creator	Various browsers and operating systems
The Plagiarism Checker	http://www.dustball.com/cs/plagiarism.checker/	Plagiarism checker	Various browsers
The Writer's Diet	http://writersdiet.com/test.php	Spinning text and article (Rephrasing)	Various browsers
Turnitin	https://www.turnitin.com/	Plagiarism checker	Various browsers
Typeset	https://typeset.io/	Typesetting system	Linux, Mac OS, Windows and Chrome OS; Vari-ous browsers
Viper	https://www.scanmyessay.com/	Plagiarism checker	Various browsers; Windows
WhiteSmoke	http://www.whitesmoke.com/	English grammar, spelling, punctuation and style checker	Various browsers and operating systems
Wikindx	https://wikindx.sourceforge.io/	Reference manager	Various browsers and operating systems
Wisemapping	http://www.wisemapping.com/	Graphic organizer	Various browsers and operating systems
Write or Die	https://writeordie.com/	Manuscript drafter and editor (by time limita-tion)	Linux, Mac OS X and Windows
WriteCheck	https://en.writecheck.com/	Grammar and plagiarism checker	Various browsers

Table 1 (continued)

Software tool	Software Web site	Software function	Operating system/browser
Writer's Workbench	http://www.writersworkbench.com/	Manuscript analyzer	Various browsers; Mac, Windows, ChromeBooks and iPads
Workflowy	https://workflowy.com/	Manuscript organizer	Various browsers and operating systems
Zenwriter	https://beenokle.com/zenwriter.html	Manuscript editor	Mac OSX and Windows
Zotero	https://www.zotero.org/	Reference manager	Various Browsers; Linux, Mac OS, Unix and Windows

The structure of an IMRAD article includes the title, author's(s') name(s), author's(s') affiliation(s), author's(s') ORCID iD(s) (https://orcid.org/), abstract, keywords, introduction, methods (or materials and methods), results, discussion, conclusion, acknowledgements, conflict of interest and references (Behzadi and Behzadi 2011; Singh and Mayer 2014). The acronym of ORCID (with a hard pronunciation of C (https://orcid.org/blog/2013/01/07/how-should-orcid-be-pronounced)) (abbreviation of Open Researcher & Contributor ID) is considered as unique international identifier for researchers (Haak et al. 2012; Hoogenboom and Manske 2012). The ORCID iD is composed of 16 digits and introduced in the format of https URI (https://support.orcid.org/hc/en-us/articles/360006897674). It is recommended for the authors to register their ORCID iD. The ORCID is important for manuscript submissions, manuscript citations, looking at the works of other researchers among other things (Haak et al. 2012; Hoogenboom and Manske 2012).

The contents of the IMRAD-structured manuscripts

Although the IMRAD format seems to be a cul-de-sac structure, it can be a suitable mold for both beginners and professional writers and authors. Each manuscript should contain a title page which includes the main and running (shortened) titles, authors' names, authors' affiliations (such as research place, e-mail, and academic degree), authors' ORCID iDs, fund and financial supports (if any), conflicts of interest, corresponding author's(s') information, manuscript's word count and number of figures, tables and graphs (Behzadi and Gajdács 2020).

Title

As the title is the first section of your paper which is seen by the readers, it is important for the authors to take time on appropriately formulating it. The nature of title may attract or dismiss the readers (Tullu and Karande 2017). In this regard, a title should be the mirror of the paper's content; hence, a proper title should be attractive, tempting, specific, relevant, simple, readable, clear, brief, concise and comprehensive. Avoid jargons, acronyms, opinions and the introduction of bias. Short and single-sentenced titles have a "magic power" on the readers. Additionally, the use of important and influent keywords could affect the readers and could be easy searchable by the search engines (Cuschieri et al. 2019). This can help to increase the citation of a paper. Due to this fact, it is recommended to consider a number of titles for your manuscript and finally select the most appropriate one, which reflects the contents of the paper the best.

The number of titles' and running titles' characters is limited in a wide range of journals (Cuschieri et al. 2019).

Abstract

The abstract is the vitrine of a manuscript, which should be sequential, arranged, structured and summarized with great effort and special care. This section is the second most important part of a manuscript after title (Behzadi and Gajdács 2020). The abstract should be written very carefully, deliberately and comprehensively in perfect English, because a well-written abstract invites the readers (the editors, reviewers, and readers who may cite the paper in the future) to read the paper entirely from A to Z and a rough one discourages readers (the editors and reviewers) from even handling the manuscript (Cuschieri et al. 2019). Whether we like it or not, the abstract is the only part of the manuscript that will be read for the most part; thus, the authors should make an effort to show the impressiveness and quality of the paper in this section.

The abstract as an independent structured section of a manuscript stands alone and is the appetizer of your work (Jirge 2017). So as mentioned, this part of paper should be written accurately, briefly, clearly, and to be facile and informative. For this section, the word count is often limited (150 to 250/300 words) and includes a format of introduction/background/, aim/goal/objective, methods, results and conclusions. The introduction or background refers to primary observations and the importance of the work, goal/aim/objective should represent the hypothesis of the study (i.e., why did you do what you did?), the methods should cover the experimental procedures (how did you do what you did?), the results should consider the significant and original findings, and finally, the clear message should be reported as the conclusion. It is recommended to use verbs in third person (unless specified by the Journal's instructions). Moreover, the verbs depicting the facts which already have been recognized should be used in present tense while those verbs describing the outcomes gained by the current work should be used in past tense. For beginners in scientific publishing, it is a common mistake to start the writing of the manuscript with the abstract (which—in fact—should be the finalizing step, after the full text of the paper has already been finished and revised). In fact, abstract ideally is the copy-pasted version of the main messages of the manuscript, until the word limit (defined by the journal) has been reached. Another common mistake by inexperienced authors is forgetting to include/integrate changes in the abstract to reflect the amendments made in the bulk text of the paper. All in all, even a paper with very good contents and significant results may could be rejected because of a poor and weak abstract (Behzadi and Gajdács 2020).

Keywords

Keywords are the key point words and terms of the manuscript which come right after abstract section. The keywords are used for searching papers in the related fields by internet search engines. It is recommended to employ 3 to 10 keywords in this section. The keywords should be selected from the MeSH (Medical Subject Headings) service, NCBI (https://www.ncbi.nlm.nih.gov/mesh/). An appropriate title should involve the most number of keywords (Behzadi and Gajdács 2020; Jirge 2017).

Introduction

Introduction section should be framed up to four paragraphs (up to 15% of the paper's content). This section should be progressed gradually from general to specific information and gaps (in a funnel-formed fashion). In another words, the current condition of the problem and the previous studies should be briefly presented in the first paragraph. More explanation should be brought in discussion section, where the results of the paper should be discussed in light of the other findings in the literature (Ahlstrom 2017; Behzadi 2021). In this regard, the original articles and some key references should be cited to have a clarified description. The second paragraph should clarify the lack of knowledge regarding the problem at present, the current status of the scientific issue and explain shortly the necessity and the importance of the present investigation. Subsequently, the relevance of this work should be described to fill the current gaps relating to the problem. The questions (hypothesis/purpose) of the study comprising "Why did you do?/What did you do?/So What?" should be clarified as the main goal in the last paragraph (Ahlstrom 2017; Behzadi 2021; Burian et al. 2010; Lilleyman 1995; Tahaei et al. 2021). A concise and focused introduction lets the readers to have an influent understanding and evaluation for the performance of the study. The importance of the work presented should never be exaggerated, if the readers feel that they have been misled in some form that may damage the credibility of the authors' reputation. It is recommended to use standard abbreviations in this section by writing the complete word, expression or phrase for the first time and mentioning the related abbreviation within parenthesis in this section. Obviously, the abbreviations will be used in the following sentences throughout the manuscript. The authors should also adhere to international conventions related to writing certain concepts, e.g., taxonomic names or chemical formulas. In brief, the introduction section contains four key points including: previous studies, importance of the subject, the presence of serious gap(s) in current knowledge regarding the subject, the hypothesis of the work (Ahlstrom 2017; Behzadi 2021; Lilleyman 1995; Tahaei et al. 2021). Previously, it
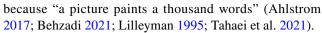
was recommended by majority of journals to use verbs in past tense and their passive forms; however, this shows a changing trend, as more and more journals recommend the use of the active voice.

Materials and methods

As the materials and methods section constitutes the skeleton of a paper (being indicative of the quality of the data), this section is known as the keystone of the research. A poor, flawed or incorrect methodology may result in the direct rejection of manuscripts, especially in high IF journals, because it cannot link the introduction section into the results section (Haralambides 2018; Meo 2018). In other words, the methods are used to test the study's hypothesis and the readers judge the validity of a research by the released information in this section. This part of manuscript belongs to specialists and researchers; thus, the application of subheadings in a determined and relevant manner will support the readers to follow information in a right order at the earliest. The presentation of the methodologies in a correct and logical order in this section clarifies the direction of the methods used, which can be useful for those who want to replicate these procedures (Haralambides 2018; Juhász et al. 2021; Meo 2018). An effective, accurate, comprehensive and sufficient description guarantees the clarity and transparency of the work and satisfies the skeptical reviewers and readers regarding the basis of the research. The following questions should be answered in this section: "What was done?" and "How was it done?" and "Why was it done?"

The cornerstones of the methods section including defining the type of study, materials (e.g., concentration, dose, generic and manufacturer names of chemicals, antibiotics), participants (e.g., humans, animals, microorganisms), demographic data (e.g., age, gender, race, time, duration, place), the need for and the existence of an ethical approval or waiver (in accordance with the Declaration of Helsinki and its revisions) for humans and animals, experimental designs (e.g., sampling methods, time and duration of the study, place), protocols, procedures, rationale, criteria, devices/tools/techniques (together with their manufacturers and country of origin), calibration plots, measurement parameters, calculations, statistical methods, tests and analyses, statistical software tools and version among many other things should be described here in methods section (Haralambides 2016; Stájer et al. 2020). If the details of protocols make this section extremely long, mention them in brief and cite the related papers (if they are already published). If the applied protocol was modified by the researcher, the protocol should be mentioned as modified protocol with the related address. Moreover, it is recommended to use flow charts (preferably standard flow charts) and tables to shorten this section,

because "a picture paints a thousand words" (Ahlstrom 2017; Behzadi 2021; Lilleyman 1995; Tahaei et al. 2021).

The used online guidelines in accordance with the type of study should be mentioned in the methods section. In this regard, some of these online check lists, including the CONSORT (Consolidated Standards of Reporting Trials) statement (http://www.consort-statement.org/) (to improve the reporting randomized trials), the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement (http://www.prisma-statement.org/) (to improve the reporting of systematic reviews and meta-analyses), the STARD (Standards for Reporting Diagnostic accuracy studies) statement (http://www.equator-network.org/wp-content/uploads/2015/03/STARD-2015-checklist.pdf) (to improve the reporting of diagnostic accuracy studies), the STORBE (STrengthening the Reporting of OBservational studies in Epidemiology) statement (https://www.strobe-statement.org/index.php?id=strobe-home) (to improve the reporting of observational studies in Epidemiology), should be mentioned and highlighted in medical articles. Normally, the methods section begins with mentioning of exclusion (depicting safe selection) and inclusion (depicting no bias has happened) criteria (regarding the populations studied) and continues by the description of procedures and data collection. This section usually ends by the description of statistical data analyses. As mentioned in a previous section, older recommendations in "Instructions for authors" suggested the use of verbs in past tense, in 3rd person and passive forms, whereas novel guidelines suggest more text written in the active voice (Ahlstrom 2017; Behzadi 2021; Lilleyman 1995; Tahaei et al. 2021).

Results

The results including negative and positive outcomes should be reported clearly in this section with no interpretation (Audisio et al. 2009; Behzadi et al. 2013). The most original information of an IMRAD paper originates from the results section. Indeed, the reported findings are the main core of the study which answers to the research question (hypothesis) "what was found?" The results section should answer all points brought up in the methods section. Categorization of findings by subheadings from the major to minor results, chronologically or by any logical order, facilitates readers to comprehend the results in an effective and influent manner (Ahlstrom 2017; Behzadi 2021; Lilleyman 1995; Tahaei et al. 2021).

Representing the motive of experiments, the related experimental setups, and the gained outcomes supports the quality and clarity of your results, because these components create logical and influent communications between obtained data, observations and measurements. The results section should represent all types of data (major to minor),

variables (dependent and independent), variables effects and even accidental findings. The statistical analyses should be represented at the end of results section. The statistical significance should be represented by an exact amount of p value ($p < 0.05$ is usually recognized and set as the threshold for statistical significance, while $p > 0.05$ depicts no statistical significance). Moreover, the mentioning of the 95% confidence intervals and related statistical parameters is also needed, especially in epidemiological studies (Mišak et al. 2005).

It is recommended to use tables, figures, graphs and charts in this section to give an influent representation of results to the readers. Using well-structured tables deeply impresses the readers. Usually the limitation of the number of figures, graphs, tables and charts is represented in the section of instructions for authors of the journal. Remember that well-designed tables and figures act as clean mirrors which transfer a clear and sharp illustration of your work and your efforts in preparing the manuscript. Thus, a well-designed graph, table, charts or figure should be understood easily; in other words, they should be represented as self-explanatory compartments. Avoid repeating the represented data in figures, tables, charts and graphs within the text. Citing figures, graphs, charts and tables in right positions within the text increases the impact and quality of your manuscript (Ahlstrom 2017; Behzadi 2021; Lilleyman 1995; Tahaei et al. 2021). Showing the highest and lowest amounts in tables by bolding or highlighting them is very effective. Normally, the legends are placed under graphs and figures and above the tables. It is recommended to begin the figure legends with conclusion and finish it by important technical key points.

Discussion and conclusion

This section represents the interpretations of results. In other words, discussion describes what these results do mean by the help of mechanistic interpretations of causes and effects. This argument should be achieved sharp and strong in a logical manner (Gajdács 2020; Rasko et al. 2016). The interpretations should be supported by relevant references and evidences. Usually, the first paragraph of discussion involves the key points of results. The represented data in results section should not be repeated within the discussion section. Magnification and exaggeration of data should never occur! "A good wine needs no bush." Care about the quality of discussion section, because this part of the manuscript is determinative item for the acceptance of the paper (Ahlstrom 2017; Behzadi 2021).

Avoid representing new data in discussion, which were not mentioned in the results section. The following paragraphs should represent the novelty, differences and/or similarities of the obtained findings. Unusual and findings not predicted should be highlighted (Gajdács 2020; Rasko et al.

2016). It is important to interpret the obtained results by the strong references and evidences. Remember that citation of strong and relevant references enforces your evaluations and increases the quality of your points of view (Mack 2018; Shakeel et al. 2021). The probable weaknesses or strengths of the project should be discussed. This critical view of the results supports the discussion of the manuscript. The discussion section is finished by the final paragraph of conclusion. A critical paragraph in which the potential significance of obtained findings should be represented in brief (Ahlstrom 2017; Behzadi 2021). The bring/take-home message of the study in conclusion section should be highlighted. For writing a conclusion, it is recommended to use non-technical language in perfect English as it should be done in abstract section (Alexandrov 2004). It is suggested to use verbs in present tense and passive forms, if not otherwise mandated by the journal's instructions. In accordance with policy of journals, the conclusion section could be the last part of discussion or presented within a separate section after discussion section (Ahlstrom 2017; Behzadi 2021).

Acknowledgements

Conflict of interest

If the authors have any concerns regarding moral or financial interests, they should declare it unambiguously, because the related interests may lead to biases and suspicions of misconducts (Ahlstrom 2017; Behzadi 2021; Lilleyman 1995; Tahaei et al. 2021). This section usually comes right after acknowledgements and before references.

References

Application of relevant and pertinent references supports the manuscript's scientific documentary. Moreover, utilization of related references with high citation helps the quality of the manuscript. For searching references, it is recommended to use search engines like Google Scholar (https://scholar.google.com/), databases such as MEDLINE (https://www.nlm.nih.gov/bsd/medline.html) and NCBI (https://www.ncbi.nlm.nih.gov/) and Web sites including SCOPUS

(https://www.scopus.com/), etc.; in this regard, the keywords are used for a successful and effective search. Each journal has its own bibliographic system; hence, it is recommended to use reference management software tools, e.g., EndNote®. The most common bibliographic styles are APA American Psychological Association, Harvard and Vancouver. Nevertheless, the authors should aware of retracted articles and making sure not to use them as references (Ahlstrom 2017; Behzadi 2021; Lilleyman 1995; Tahaei et al. 2021). Depending on the journal, there are different limitations for the number of references. It is recommended to read carefully the instructions for authors section of the journal.

Conclusions for future biology

From the societal standpoint, the publication of scientific results may lead to important advances in technology and innovation. In medicine, patient care—and the biomedical sciences in general—the publication of scientific research may also lead to substantial benefits to advancing the medical practice, as evidence-based medicine (EBM) is based on the available scientific data at the present time. Additionally, academic institutions and many academic centers require young medical professionals to be active in the scientific scene for promotions and many employment prospects. Although scientific writing is part of the curricula for many medical programs, not every physician may have adequate knowledge on formulating research results for publication adequately. The present review aimed to briefly and concisely summarize the details of creating a favorable original article to aid early career researchers in the submission to peer-reviewed journal and subsequent publication. Although not all concepts have been discussed in detail, the paper allows for current and future authors to grasp the basic ideas regarding scientific writing and the authors hope to encourage everyone to take the "leap of faith" into scientific research in medicine and to submit their first article to international journals.

Declarations

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