Checklists for reporting research in *Advances in Clinical and Experimental Medicine*: How to choose a proper one for your manuscript?

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Abstract

Various guidelines for authors of research papers and the checklists that often accompany these statements play an important role in the creation of carefully written scientific papers – for authors, they serve as tools to ensure the correct structure and content of the manuscript, increasing the chances that a paper will be published in a journal with a high rejection rate. The aim of this editorial is to provide a concise outline of the checklists most frequently used to guide the structuring of papers published in *Advances in Clinical and Experimental Medicine*, and to support current and prospective authors of this journal in choosing a checklist for their manuscript.

The EQUATOR website is presented as a useful tool in choosing a checklist: https://www.equator-network.org/. Then, 8 checklists that are most popular among authors who publish their work in *Advances in Clinical and Experimental Medicine* are outlined: STROBE – for observational studies; ARRIVE – for any area of bioscience research using laboratory animals; CASP – for qualitative studies; CONSORT – for parallel group randomized trials; PRISMA – for all reviews and meta-analyses; SQUIRE – for studies on quality improvement in healthcare; STARD – for diagnostic accuracy studies; REMARK – for tumor marker prognostic studies. Each of the 8 presented checklists is discussed in a following order: 1) the name of the checklist is explained; 2) the type of articles to which it is intended is pointed out; 3) the structure of the checklist is explained; 4) if there are any extensions of the presented checklist for specific subtypes of papers, they are listed; 5) the most important literature on the presented checklist is provided.

As a take-home message, basic tips for choosing a checklist are formulated. Finally, examples of papers adhering to each discussed checklist are provided.

Key words: quality, checklist, scientific journal, EQUATOR network, medical writing

Introduction

Authors of research papers often – and for various reasons – fail to report specific details about their study.[1] In response to the poor quality of reporting medical research, guidelines intended for various types of study designs have been developed. Implementation of these guidelines will lead to improvements in the quality of medical research reporting – to accurate reporting, complete transparency and easier assessment of the validity of reported research findings. That means that the proper utilization of the checklists as a tool for enhancing the quality of papers is beneficial for both authors and journal editors. For the former, it increases the possibility that the paper will be published and cited; for the latter, it ensures the quality of the submitted papers and may result in a higher citation score and prestige of the journal.

Currently, the EQUATOR network (Enhancing the QUAlity and Transparency Of health Research) has registered 256 guidelines on varying topics of medical research.[2–6] In 1988, the International Committee of Medical Journal Editors (ICMJE) stated in its guidelines that statistical methods should be presented precisely and exhaustively enough to allow a reviewer to verify the results. In 1994, the first attempt was made to develop reporting guidelines, which eventually formed the basis for the development of the Consolidated Standards of Reporting Trials (CONSORT) in 1996.[7] Since then, many other checklists to be used for various types of medical papers have been released, and the use of several such tools has been endorsed, recommended or required by editorial offices of many high-profile medical journals.

In our journal, it is mandatory to use the EQUATOR website to select the appropriate checklist for the study: https://www.equator-network.org/. For qualitative studies, the CASP checklist is required: https://casp-uk.net/casp-tools-checklists/. Eight checklists are presented in this editorial, to which most manuscripts published in *Advances in Clinical and Experimental Medicine* conform, in the order in which they were most frequently selected by our authors. The presented checklists have been chosen for 2 reasons: they are the checklists most frequently chosen for papers published in *Advances in Clinical and Experimental Medicine*, and, because the scope of this journal encompasses a broad array of medical sciences, this set of checklists partly reflects the most popular tools of this kind among authors of scientific medical papers in general.

Notes of the editor

The mandatory use of checklists was introduced in *Advances in Clinical and Experimental Medicine* in 2020. Based on more than 2 years of experience with these tools, the following observations can be made:

1. Although various checklists have gradually become a part of the scientific landscape in the last 10–15 years, not only in medical field, still many researchers declare that they encounter them for the first time when they submit a manuscript to our journal. However, it should be emphasized that such tools are more and more often used by the editors of scientific journals to improve the quality of the submitted papers and to maintain their satisfactory methodological level. It is therefore of utmost importance for all researchers to familiarize themselves with the most common checklists in their field.
2. Before filling out a particular checklist, you should read it carefully, because the formats of the various instruments of this type are by no means uniform. Some require authors to provide page numbers where relevant sections of the manuscript are located; others stipulate that a relevant passage of text be included; still others require only a yes/no response to one or more items. Not only must the checklist be completed – it must be completed correctly.
3. Common mistakes that less experienced authors make when preparing the checklist include: resubmitting the cover letter or main body of the text instead of a completed relevant checklist, submitting an incomplete checklist, and selecting the wrong checklist (in some cases, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist is submitted with an original paper even though it is clearly intended for reviews and meta-analyses only).

Objectives

The aim of this editorial is to provide a concise outline of the checklists most frequently used to guide the structuring of papers published in *Advances in Clinical and Experimental Medicine*, and to support current and prospective authors of this journal in choosing a checklist for their manuscript. Selecting a proper checklist and submitting its filled-in form is a prerequisite for the initial assessment of the manuscript in this journal; at the same time, we are aware that such choice poses a problem for many authors.

Each of the 8 presented checklists is discussed in a following order: 1) the name of the checklist is explained; 2) the type of articles to which it is intended is pointed out; 3) the structure of the checklist is explained; 4) if there are any extensions of the presented checklist for specific subtypes of papers, they are listed; 5) the most important literature on the presented checklist is provided. To complement this guide, examples of papers adhering to each discussed checklist are provided in Table 1.

STROBE

STrengthening the Reporting of OBservational studies in Epidemiology (STROBE) serves as a guide for reporting

all observational studies, particularly cohort, case-control and cross-sectional studies. There are separate STROBE checklists for these 3 types of studies and a combined version for all 3.

These guidelines were developed in order to ensure that observational research is reported transparently to let the readers understand what was planned, investigated and elucidated, and what conclusions were reached. The STROBE statement consists of a 22-item checklist divided into 6 sections: 1) title and abstract; 2) introduction (background/rationale and objectives); 3) methods (study design, setting, participants, variables, data sources/measurement, bias, study size, quantitative variables, and statistical methods); 4) results (participants, descriptive data, outcome data, main results, and other analyses); 5) discussion (key results, limitations, interpretation, and generalizability); and 6) other information (funding). Eighteen of the items are identical for the 3 types of studies (cohort, case-control and cross-sectional studies), while 4 items differ; therefore, make sure you have chosen the right version of this checklist or use the combined version. The STROBE checklist is available in PDF and DOC/DOCX formats, but please note these versions are not identical – the latter is fillable and is the one, not simply the statement in PDF, that should be used. For each element in each item, a page number should be provided where the respective issue is mentioned, and if it is not discussed, a dash or N/A (not applicable) should be written. The guide is not to be followed strictly – the presentation of information should depend on the style of the journal, preferences of the authors and traditions of a given research field.

Several extensions of this checklist have been released, including a version for genetic association studies (STREGA), observational studies in molecular epidemiology (STROBE-ME), studies on molecular epidemiology for infectious diseases (STROME-ID), studies in epidemiology for respondent-driven sampling studies (STROBE-RDS), epidemiological studies on antimicrobial resistance (STROBE-AMS), studies on nutritional epidemiology (STROBE-nut), studies of newborn infections (STROBE-NI), and studies in epidemiology using Mendelian randomization (STROBE-MR).

Two fundamental papers on the STROBE guidelines were published by Vandenbroucke et al. and von Elm et al.[8,9] Experiences from using this checklist were summarized by Ghaferi et al. and Cuschieri,[10,11] while da Costa et al. provided an overview of the misuse of this tool.[12]

ARRIVE

We require that Animal Research: Reporting of In Vivo Experiments (ARRIVE) checklist be followed in the preparation of studies involving live animals, from mammals to fish and invertebrates.

The goal of this tool is to optimize the quality and reliability of published work, which ensures completeness and transparency, and allows other researchers to evaluate and replicate the research and results presented. The authors can choose between 2 versions of this checklist – basic and full. The ARRIVE Essential 10 (E10) constitutes the minimum requirements for reporting animal research and includes information allowing reviewers and readers to assess the reliability of the findings. The Recommended Set complements the E10 and adds important context to the study described. Reporting this information is considered the best practice.

The ARRIVE E10 consists of 10 items which cover different, but interconnected aspects of the study. These are: 1) study design; 2) sample size; 3) inclusion and exclusion criteria (introduced to prevent ad hoc exclusion of data); 4) randomization; 5) blinding; 6) outcome measures; 7) statistical methods; 8) experimental animals; 9) experimental procedures; and 10) results. Each item points out what details should be provided regarding this particular aspect of research. These items are the basic minimum to include in a manuscript. Without this information, readers and reviewers cannot assess the reliability of the findings. When filling in this checklist, the authors must report a section/line number where the respective issue is discussed, or a reason for not reporting.

The 2.0 version of the ARRIVE checklist was published in 2020 by Percie du Sert et al.[13] Percie du Sert et al. have explained this tool in more detail,[14,15] while Kilkenny et al. have provided valuable explanations of how this checklist should be used.[16,17]

CASP

The Critical Appraisal Skills Programme (CASP) core checklists are not a single tool, but a group of checklists of similar design. Regarding papers submitted to *Advances in Clinical and Experimental Medicine*, the CASP checklist for qualitative studies is required. This is the only checklist not included in the EQUATOR website – it can be downloaded from the CASP initiative website (https://casp-uk.net/casp-tools-checklists/).

The CASP checklist for qualitative studies consists of 10 questions, whose main objective is to guide the authors in systematic thinking about the reported issues. The first 3 questions are screening ones and can be answered promptly: 1) Was there a clear statement of the aims of the research?; 2) Is a qualitative methodology appropriate?; 3) Was the research design appropriate to address the aims of the research? If the answer to both questions is "yes", it is worth continuing with the remaining 7 questions: 4) Was the recruitment strategy appropriate to the aims of the research?; 5) Was the data collected in a way that addressed the research issue?; 6) Has

the relationship between researcher and participants been adequately considered?; 7) Have ethical issues been taken into consideration?; 8) Was the data analysis sufficiently rigorous?; 9) Is there a clear statement of findings?; 10) How valuable is the research? Some of the questions overlap, but should be answered nevertheless. Most questions ask you to answer "yes", 'no" or "cannot say". A series of prompts in italics follows each question to remind why it is important. No page numbers from the manuscript need to be provided.

All CASP checklists are based on the 1994 *Journal of the American Medical Association* (JAMA) guides to the medical literature.[18] The most extensive presentation of this tool was published by Long et al.[19] Nadelson and Nadelson discussed it the context of teaching evidence-based practice,[20] while Chenail reported his experiences in using the tool during methodology courses.[21]

CONSORT

Consolidated Standards of Reporting Trials (CONSORT) is a guideline for reporting parallel group randomized controlled trials, intended to promote complete reporting and transparent research; its latest version dates from 2010.

Indirectly, this tool also influences study design, conduct and publication in order to prevent inadequately designed studies from being published. In addition, it contains a flowchart that provides an overview of the phases that patients go through in the study.

The CONSORT checklist consists of 25 points divided into 6 sections: 1) title and abstract; 2) introduction (background and objectives); 3) methods (trial design, participants, interventions, outcomes, sample size, randomization, allocation concealment mechanism, blinding, and statistical methods); 4) results (participant flow, recruitment, baseline data, numbers analyzed, outcomes and estimation, ancillary analyses, and harms); 5) discussion (limitations, generalizability and interpretation); and 6) other information (registration, protocol and funding). Some of the items contain 1 or 2 leading questions detailing the issues that need to be addressed. For each element in each item, a page number should be provided where the respective issue is discussed, and if it is not discussed, a dash or N/A should be written.

A detailed presentation of this tool was published by Moher et al.,[22] while Falci and Marques offered a more concise guide to its use.[23] Pandis et al. proposed an extension for person randomized trials,[24] while Schulz updated the CONSORT checklist for use in parallel group randomized trials.[25] Blanco et al. investigated whether CONSORT checklists submitted by authors properly summarize information that is actually reported in published articles,[26] and Turner et al. – whether the use of this tool makes the reporting of randomized controlled trials more complete.[27]

PRISMA

Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) are intended for all reviews and meta-analyses. They were designed to help systematic reviewers transparently report why the review was done, what the authors did and what they found.

The PRISMA checklist consists of 27 items divided into 7 categories: 1) title; 2) abstract; 3) introduction (rationale and objectives); 4) methods (eligibility criteria, information sources, search strategy, selection process, data collection process, data items, study risk of bias assessment, effect measures, synthesis methods, reporting bias assessment, and certainty assessment); 5) results (study selection, study characteristics, risk of bias in studies, results of individual studies, results of syntheses, reporting biases, and certainty of evidence); 6) discussion; and 7) other information (registration and protocol, financial support, competing interests, and availability of data, code and other materials). Some of the items are divided into subitems, and all contain leading questions detailing the issues that need to be addressed.

Several extensions of this checklist have been released, including a version for studies in health equity (PRISMA-Equity), for abstracts only (PRISMA-Abstracts), for systematic reviews and meta-analysis protocols (PRISMA-P), for systematic reviews and meta-analyses of individual participant data (PRISMA-IPD), for systematic reviews and meta-analyses of complex interventions (PRISMA-CI), for systematic reviews and meta-analyses of diagnostic test accuracy studies (PRISMA-DTA), for scoping reviews (PRISMA-ScR), and for literature searches in systematic reviews (PRISMA-S).

The PRISMA checklist was first presented in 2005 as an update of QUality Of Reporting Of Meta-analyses (QUOROM) statement to reflect conceptual and practical advances in the science of systematic reviews.[28] The most important publications on PRISMA are a paper by Moher et al.[29] and a detailed presentation of an updated version of this checklist published by Page et al.[30] Liberati et al. provided a meticulous explanation and elaboration of its practical application,[31] while Sarkis-Onofre et al. offered a more concise guide for authors.[32]

It is important to emphasize that when submitting a manuscript that adheres to the PRISMA guidelines, the flowchart depicting the selection process of the studies analyzed must be included as one of the figures.

SQUIRE

The Standards for QUality Improvement Reporting Excellence (SQUIRE) checklist is intended for reports that describe system-level work to improve the quality, safety and value of health-care, and use various methods to demonstrate that observed outcomes are related

to the intervention(s). The SQUIRE checklist can be adapted to many approaches in this field of study.

SQUIRE 2.0, published in 2015,[33] contains 18 items divided into 6 sections related to each part of the paper: 1) title and abstract; 2) introduction (problem description, available knowledge, rationale, and specific objectives); 3) methods (context, intervention(s), study of intervention(s), measures, analyses, and ethical considerations); 4) results; 5) discussion (summary, interpretation, limitations, and conclusions); and 6) information on funding sources.

This checklist does not require filling in – authors have to carefully confront their paper with the requirements listed in each item, and then submit the used checklist together with the manuscript. Authors should consider each item from SQUIRE, but including each item in the paper may be inappropriate or unnecessary. The items can be used in the manuscript in an order different to the sequence in which they appear in the checklist.

The most important publication on this instrument is the presentation of SQUIRE 2.0 by Ogrinc et al.[33] A team led by the same investigator also provided a valuable explanation and elaboration of the previous version of this checklist – most of their comments apply to the revised version as well.[34] McQuillan and Wong also provided valuable explanations of this instrument,[35] while Goodman et al. discussed version 2.0 in detail.[36]

STARD

The Standards for Reporting Diagnostic Accuracy (STARD) statement is intended for diagnostic accuracy studies. A study is identified as a diagnostic accuracy study if the authors used at least 1 measure of accuracy, such as sensitivity, specificity, predictive values, or area under the curve (AUC). The STARD statement was designed to apply to all types of medical tests.

The 30-item STARD checklist is organized into 7 sections: 1) title and abstract (identification as a study of diagnostic accuracy); 2) abstract (its structure); 3) introduction (scientific and clinical background and study objectives and hypotheses); 4) methods (study design, participants, test methods, and analysis); 5) results (flow of participants using a diagram, test results); 6) discussion (study limitations, including sources of potential bias and statistical uncertainty, generalizability, implications for practice, including the intended use and clinical role of the index test); and 7) other information (registration, where the full study protocol can be accessed, and funding).

The tool was created by the STARD initiative.[37] The most recent version is STARD 2015, presented by Bossuyt et al.,[38] and each item was explained in detail and with examples by Cohen et al.[39] A special version of this checklist for journal and conference abstracts only was published by Cohen et al.[40] The impact of implementing this tool was reported by Stahl et al., who investigated whether the STARD statement improved the quality of reporting of diagnostic accuracy studies published in *European Radiology*.[41]

REMARK

REporting recommendations for tumor MARKer prognostic studies (REMARK) is a more specific checklist developed for studies exploring only 1 (albeit extensively researched) area – tumor marker prognostic studies.

This checklist generally applies to any studies involving prognostic factors (whether these factors are biological markers, imaging assessments, clinical assessments, or measures of functional status in activities of daily living), as well as to studies on other diseases in addition to cancer. The processes of measuring and reporting the aforementioned factors may be different in different papers, but the study reporting principles remain the same.

Similarly to several other such tools, the REMARK checklist uses the IMRaD (Introduction, Methods, Results, and Discussion) structure and provides authors with detailed guidelines for each section of a given manuscript. Therefore, this checklist consists of 20 items grouped into 4 sections. The Introduction should state the markers studied, the study objectives and any prespecified hypotheses. In the Methods section, information about patients, sample characteristics, test methods, study design, and statistical analysis methods should be provided. The Results guidelines explain how the obtained data should be presented and interpreted (with separate suggestions for univariate and multivariate analyses). The Discussion section should interpret the results in the context of the hypotheses formulated and relevant studies cited, identify the limitations of the study, and discuss implications for future research and clinical utility.

A paper by McShane et al. presents this tool,[42] while Altman et al. and Sauerbrei et al. provided elaborations and explanations of each item in this checklist.[43,44] Mallett et al. published a review of articles related to the guidelines from REMARK.[45]

Discussion

When comparing the 8 checklists presented above, it can be observed that all of them, excluding the CASP tool, follow the IMRaD structure, although the number of categories into which the items are divided ranges from 5 to 7. A situation when all or virtually all items apply to one paper seems impossible, but when the authors leave an N/A acronym or a dash in most of the items, it can imply that a wrong checklist has been chosen. Such danger stems from the fact that several items, especially those outside the Methods and Results section (which are specific to a given type of articles), address similar issues and

it is possible to apply them to manuscripts of a type different from the checklist is intended to check.

Ideally, the checklist should be chosen before writing the paper – following the selected guidelines will ensure a proper structure and content of the article and result in a quicker initial assessment of the paper after the submission since deeper changes in order to conform to the requirements of the checklist will not be necessary. The influence of adhering to a given checklist is more profound when its requirements and recommendations are implemented already when the paper is being written than when it is adjusted to the editor's comments during the initial assessment.

Limitations

In the authors' view, the most important limitation of this paper is that it presents only some of the checklists used by authors of medical articles published in English. Several frequently chosen checklists were not discussed – e.g., CARE (for case reports), AGREE (for reporting clinical practice guidelines), ENTREQ (for syntheses of qualitative research), and SPIRIT (for reporting clinical trial reports and related documents) – because the present paper focuses solely on checklists for which examples of usage can be found in papers published in *Advances in Clinical and Experimental Medicine*.

Conclusions

Checklists play an important role in the preparation of carefully written scientific papers – for authors, they serve as a tool to ensure the correct structure and content of the manuscript, which in turn increases the chances that a paper will be published in a journal with a high rejection rate. They serve this purpose only if authors not only select and complete an appropriate checklist, but also modify the manuscript to meet the requirements of a particular checklist. Therefore, it is advisable to select a checklist not when submitting the paper, but already when deciding on the type and form of the paper – changes (e.g., restructuring the Materials and Methods section) are then not necessary during the initial assessment by the editorial office following submission. The EQUATOR network diagram facilitates the selection of a suitable checklist – it is important to analyze this tool thoroughly, because for most papers submitted to scientific medical journals a suitable checklist can be found in this diagram. Choosing the most appropriate checklist and implementing it in one's own work is a win-win strategy: both the authors

Table 1. Examples of papers adhering to respective checklists, published in ***Advances in Clinical and Experimental Medicine*** in 2021 and 2022[46–65]

Checklist and URL	Authors	Reference
ARRIVE – for any area of bioscience research using laboratory animals https://arriveguidelines.org/resources/author-checklists	Yu et al.	[46]
	Tosun et al.	[47]
	Gündüz et al.	[48]
CASP – for qualitative studies https://casp-uk.net/images/checklist/documents/CASP-Qualitative-Studies-Checklist/CASP-Qualitative-Checklist-2018.pdf	Wang et al.	[49]
	Içduygu et al.	[50]
	Wang et al.	[51]
CONSORT – for parallel group randomized trials https://www.consort-statement.org/	Tong et al.	[52]
	Kara et al.	[53]
	Ada et al.	[54]
PRISMA – for all reviews and meta-analyses https://prisma-statement.org/PRISMAStatement/Checklist.aspx	Rachwalik et al.	[55]
	Liu et al.	[56]
	Rakoczy et al.	[57]
REMARK – for tumor marker prognostic studies https://www.equator-network.org/reporting-guidelines/reporting-recommendations-for-tumour-marker-prognostic-studies-remark/	Annus et al.	[58]
SQUIRE – for studies on quality improvement in healthcare http://www.squire-statement.org/index.cfm?fuseaction=Page.ViewPage&PageID=471	Charong et al.	[59]
	Kolasa et al.	[60]
STARD – for diagnostic accuracy studies https://www.equator-network.org/reporting-guidelines/stard/	Fang et al.	[61]
	Yang et al.	[62]
STROBE – for observational studies (cohort, case-control and cross-sectional studies) https://www.strobe-statement.org/checklists/	Dominiak et al.	[63]
	Floer et al.	[64]
	Rams et al.	[65]

ARRIVE – Animal Research: Reporting of In Vivo Experiments; CASP – Critical Appraisal Skills Programme; CONSORT – Consolidated Standards of Reporting Trials; PRISMA – Preferred Reporting Items for Systematic Reviews and Meta-Analyses; REMARK – REporting recommendations for tumor MARKer prognostic studies; SQUIRE – Standards for QUality Improvement Reporting Excellence; STARD – Standards for Reporting Diagnostic Accuracy; STROBE – STrengthening the Reporting of OBservational studies in Epidemiology.

as well as the editors and reviewers benefit from popularization of such tools.

As an important complement, we would like to offer readers 20 examples of good papers published in our journal in the last 2 years that conform to 8 different checklists, along with links to the respective checklists (Table 1).

Take-home message – practical suggestions

1. The checklists should be seen not only as another requirement, but as a way to improve the quality of the manuscript by following guidelines formulated by experienced researchers.

2. To choose a checklist, enter the EQUATOR website: https://www.equator-network.org/. If your manuscript is a qualitative study, use the CASP checklist: https://casp-uk.net/casp-tools-checklists/.

3. We suggest choosing a checklist before you start writing the paper.

4. The choice of the checklist for a manuscript should be based on the type of the article – there is always only one possibility for a given type of manuscript, and the checklists available on the EQUATOR website together with the CASP checklists cover all types of manuscripts submitted to *Advances in Clinical and Experimental Medicine*. The type of papers for which the given checklist is intended appears either in its title/heading or on the subpage of a given checklist on the EQUATOR website. When in doubt, the authors are recommended to read the checklists carefully and decide which is the most appropriate, even if some of the items of the chosen checklist would not be applicable.

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