

ORIGINAL ARTICLE

Increased endorsement of TRIPOD and other reporting guidelines by high impact factor journals: survey of instructions to authors

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Abstract

Objectives: To assess the endorsement of reporting guidelines by high impact factor journals over the period 2017–2022, with a specific focus on the Transparent Reporting of a multivariable prediction model for Individual Prognosis Or Diagnosis (TRIPOD) statement.

Study Design and Setting: We searched the online ‘instructions to authors’ of high impact factor medical journals in February 2017 and in January 2022 for any reference to reporting guidelines and TRIPOD in particular.

Results: In 2017, 205 out of 337 (61%) journals mentioned any reporting guideline in their instructions to authors and in 2022 this increased to 245 (73%) journals. A reference to TRIPOD was provided by 27 (8%) journals in 2017 and 67 (20%) in 2022. Of those journals mentioning TRIPOD in 2022, 22% provided a link to the TRIPOD website and 60% linked to TRIPOD information on the Enhancing the QUALity and Transparency Of health Research (EQUATOR) Network website. Twenty-five percent of the journals required adherence to TRIPOD.

Conclusion: About three-quarters of high-impact medical journals endorse the use of reporting guidelines and 20% endorse TRIPOD. Transparent reporting is important in enhancing the usefulness of health research and endorsement by journals plays a critical role in this. © 2023 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

Keywords: TRIPOD; Prediction model; Reporting guideline; Endorsement; Implementation; Adherence

1. Introduction

Complete and accurate research reports enable clinicians, researchers, and other readers to make optimal use of the available evidence. Without a clear description of the research question addressed, the methods used, the results and implications, the usability and potential impact of research are reduced, and the research efforts can be considered as less valuable [1,2]. In particular, incomplete

reporting can lead to difficulty in assessing a study’s validity and using its data in evidence syntheses [3].

To prevent this form of research waste and assist researchers in writing transparent and informative reports, reporting guidelines have been developed. A reporting guideline is defined as a checklist, flow diagram, or structured text to guide authors in reporting a specific type of research, developed using explicit methodology [4]. Many reporting guidelines exist for various types of study designs. The CONSolidated Standards Of Reporting Trials (CONSORT) statement, Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement, Strengthening the Reporting of OBServational studies in Epidemiology (STROBE) statement, and STANDards for Reporting of Diagnostic Accuracy (STARD) statement are well-known examples [5–8]. A comprehensive collection of reporting guidelines is maintained by the Enhancing the QUALity and Transparency Of health Research

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What is new?

Key findings

- Between 2017 and 2022, the percentage of journals that mentioned any reporting guideline in their instructions to authors increased from 61% to 73%.
- The reporting guidelines that were most frequently listed by journals were the same in 2017 and 2022 and were CONSORT, PRISMA, and STROBE.
- The proportion of journals that specifically recommended or required the use of the TRIPOD statement increased from 8% to 20%. Endorsement was usually paired with a link to TRIPOD information on the EQUATOR Network or with a link to the TRIPOD website.

What this adds to what was known?

- This study shows that endorsement of reporting guidelines by journal editors through the instructions for authors is increasing over time. This was true for reporting guidelines in general, as well as for TRIPOD specifically.

What is the implication and what should change now?

- It is encouraging that about three-quarters of medical journals endorse reporting guidelines to promote completeness of reporting and thereby usability of research.
- Implementation of TRIPOD and other reporting guidelines could be further advanced by clear instructions to authors, as endorsement of reporting guidelines by medical journals is currently operationalized in various ways.

(EQUATOR) Network, an international collaboration launched in 2008 that aims to promote responsible reporting of health research by providing resources and training, and by assisting in reporting guideline development, dissemination, and implementation [9,10]. At the time of writing, the EQUATOR Network holds 584 reporting guidelines.

To promote the use of a reporting guideline (implementation) more is needed than just its publication [11]. One of the recommended postpublication activities is encouraging medical journals to support the use of the reporting guideline by incorporating it in their editorial policies and instructions to authors. Such explicit support (endorsement) was associated with more complete reporting for CONSORT, yet, for other reporting guidelines, to date, the evidence is lacking [12,13].

In 2015, the Transparent Reporting of a multivariable prediction model for Individual Prognosis Or Diagnosis (TRIPOD) statement was published, a reporting guideline aiming to improve the completeness and transparency of diagnostic and prognostic prediction model reports [14,15]. Prediction models are used in health care to aid clinicians in estimating the probability that an individual, with a given set of characteristics, currently has a disease or condition (diagnostic prediction model) or will have a particular event in the future (prognostic prediction model) [14].

We aimed to assess the endorsement of reporting guidelines by medical journals over the period 2017–2022, with a specific focus on TRIPOD. Our interest in TRIPOD stems from our department's significant involvement in its development, making its implementation a subject of particular interest. We expected endorsement of reporting guidelines in general to increase over time, as awareness of their value grows among journal editors. Specifically, we expected greater endorsement of TRIPOD in 2022 compared to 2017 due to its publication in 2015, which allows for increased recognition and adoption.

2. Methods

2.1. Study design

We performed a longitudinal survey study using a set of journals that was used in a previous study on the reporting of multivariable prediction model studies [16]. This set consisted of the top 10 journals with the highest journal impact factor within each of 37 clinical domains (subject categories, 2012 Journal Citation Reports) [17]. A comparable strategy was adopted in previous research on the endorsement of CONSORT [18–20].

2.2. Exploration of instructions to authors

For each of the journals, we assessed the instructions to authors on the journals' websites for information on reporting guidelines in general and TRIPOD in particular. The following search terms were used: 'reporting', 'guideline', 'statement', 'checklist', 'endorse', 'EQUATOR', 'TRIPOD', and 'CONSORT'. Because of the large number of reporting guidelines, it was not possible to search for every guideline separately [4]. Although we extracted information on any mentioned reporting guideline, CONSORT was explicitly included in the search terms because it is one of the oldest reporting guidelines and is highly cited and endorsed [20,21]. Links in the instructions for authors to other locations on the journal's website or to other websites were followed if they seemed relevant to reporting and information presented there was included. In the case of different journals providing the same instructions, these were included for every individual journal separately.

2.3. Data extraction

We extracted information on which reporting guidelines were mentioned and whether the EQUATOR Network was acknowledged. We also checked whether the journal provided a functioning link to additional information regarding these reporting guidelines or the EQUATOR Network. Furthermore, with regard to TRIPOD, we noted which source of additional information was referenced (website, publication, checklist, other) and whether adhering to TRIPOD was required (using explicit language, like ‘authors must follow,’ ‘authors are required to’); recommended (using less insistent wording, like ‘authors should adhere to,’ ‘authors are recommended to use’); or suggested (providing authors the option by statements like ‘authors can follow,’ ‘authors are encouraged to use’).

One author (P.H., J.A.A.G.D., E.K., or M.S.V.-J.) first assessed the instructions to authors on the journals’ websites between November 28, 2016, and February 26, 2017. A second author checked the websites of the journals for which information regarding reporting guidelines was not identified (anymore). The assessment of the instructions to authors was performed again between January 24 and January 27, 2022, this time by a single author (D.I.).

2.4. Data analysis

Data were summarized descriptively using frequencies and percentages. To evaluate the changes in endorsement over time, we statistically tested the change in mentions of any reporting guideline, the EQUATOR Network, and TRIPOD using McNemar’s test. All data extraction and analysis were performed in Microsoft Excel.

3. Results

Of the 370 journals in our set, 341 unique journals remained after deduplication (Fig. 1, Supplemental Table 1). Four journals were excluded because we were unable to identify a journal website. This resulted in a set of 337 included journals with a median impact factor of 4.5 (25th–75th percentile [P_{25} – P_{75}]: 3.2–7.1) in 2012. In this set of journals, the most recent median impact factors for the extraction in 2017 and 2022 were 4.6 (3.1–7.5) and 6.2 (4.1–10.3), respectively [22,23].

The number of journals mentioning any reporting guideline in their instructions to authors increased from 205 (61%) in 2017 to 245 (73%) in 2022 ($P < 0.001$). Also, the EQUATOR Network was mentioned by more journals in 2022 (138/337; 41%) compared to 2017 (79/337; 23%) ($P < 0.001$). The reporting guideline most frequently listed by the journals, in 2017 as well as in 2022, was CONSORT (2022: 204/337; 61%), followed by PRISMA (2022: 166/337; 49%), and STROBE (2022: 137/337; 41%) (Table 1, Supplemental Table 2). Of the 250 journals mentioning any reporting guideline or the EQUATOR Network in

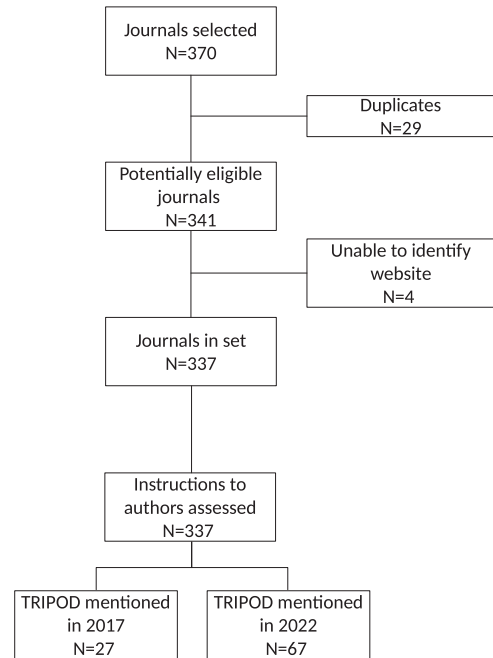


Fig. 1. Flow of journals through the study. TRIPOD, Transparent Reporting of a multivariable prediction model for Individual Prognosis Or Diagnosis.

2022, 249 provided a functioning web link to additional information compared to 175 of the 206 journals (85%) in 2017.

TRIPOD was mentioned by 27 (8%) journals in 2017 and 67 (20%) journals in 2022 ($P < 0.001$). Twenty-four journals mentioned TRIPOD in both years, so three journals mentioning TRIPOD in 2017 did not do so anymore in 2022. The median journal impact factor for journals that mentioned TRIPOD was 5.1 (interquartile range [IQR] 3.7–9.0) in 2017 and 8.3 (IQR 4.8–10.9) in 2022, whereas the median journal impact factor for journals that did not was 4.7 (IQR 3.1–7.6) in 2017 and 6.0 (IQR 4.0–10.1) in 2022. There were nine clinical domains that did have journals that mentioned TRIPOD in 2022 but not in 2017, and two domains for which the situation was reversed (oncology and transplantation).

Two (3%) of the 67 journals mentioning TRIPOD in 2022 provided a web link to the TRIPOD checklist (Table 2). Forty journals (60%) linked to TRIPOD information on the website of the EQUATOR Network and 15 linked to the TRIPOD website (22%). Three journals (4%) referenced the publication of the TRIPOD statement. A reference to the general homepage of the EQUATOR website was provided by 61 journals (91%).

With regard to the type of guidance provided by the journals, there were 17 journals (25%) that required authors to follow TRIPOD or upload a completed TRIPOD checklist when submitting an article about a multivariable prediction model. All other journals used less explicit language and recommended (50/67 journals; 75%) to follow

Table 1. Top 10 of reporting guidelines most often mentioned by instructions to authors (ranked by 2022 percentages)

Reporting guideline	2017 (<i>n</i> = 341 journals)	2022 (<i>n</i> = 341 journals)
CONSORT (COnsolidated Standards Of Reporting Trials)	170 (50%)	204 (61%)
PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses)	115 (34%)	166 (49%)
STROBE (Strengthening the Reporting of Observational Studies in Epidemiology)	88 (26%)	137 (41%)
ARRIVE (Animal Research: Reporting of In Vivo Experiments)	80 (24%)	132 (39%)
STARD (Standards for Reporting Diagnostic accuracy studies)	82 (24%)	111 (33%)
TRIPOD (Transparent Reporting of a multivariable prediction model for Individual Prognosis Or Diagnosis)	27 (8%)	67 (20%)
CHEERS (Consolidated Health Economic Evaluation Reporting Standards)	25 (7%)	62 (18%)
MOOSE (Meta-analysis Of Observational Studies in Epidemiology)	52 (15%)	62 (18%)
STROBE-Extensions (Strengthening the Reporting of Observational Studies in Epidemiology)	27 (8%)	60 (18%)
RECORD (REporting of studies Conducted using Observational Routinely-collected Data)	6	30
STREGA (STrengthening the REporting of Genetic Association Studies)	18	24
STROME-ID (Strengthening the reporting of molecular epidemiology for infectious diseases)	1	1
Not specified	2	5
SQUIRE (Standards for QUality Improvement Reporting Excellence)	18 (5%)	54 (16%)

Number of journals (%).

TRIPOD or complete its checklist. A general recommendation to consult the EQUATOR Network was given by 58 journals (87%).

Eight of the eleven journals that published the TRIPOD statement in 2015 were included in our set. All but one of these (88%) mentioned reporting guidelines or EQUATOR in their instructions to authors and provided web links. Four of them (50%) mentioned TRIPOD in their instructions to authors.

4. Discussion

We found that about three-quarters of high-impact medical journals endorse reporting guidelines by mentioning them in the journal's online instructions to authors. We noticed an increase from 61% in February 2017 to 73% in January 2022. Most well-known and endorsed guidelines were CONSORT, PRISMA, and STROBE (in 2022, mentioned by 61%, 49%, and 41% of the journals, respectively). In 2022, 20% of the journals mentioned TRIPOD, compared to 8% in 2017. Most journals provided a link to the TRIPOD checklist; however, its use was mostly recommended rather than required.

Compared to other reporting guidelines, the percentage of included journals mentioning TRIPOD (20%) is still relatively low. However, published in 2015, TRIPOD is a relatively young reporting guideline (70% of other mentioned reporting guidelines were published before TRIPOD) and it is known that changing practice takes time. Comparably, the first evaluation of endorsement of CONSORT by medical journals was performed 7 years after its publication and showed that about 20% of high impact

journals referred to it [18]. Other assessments of instructions to authors in diverse clinical fields showed varying endorsement rates of reporting guidelines [24–30]. They did, however, agree on ambiguity in the guidance provided to authors, as journals were vague about to what extent adherence to reporting guidelines was required. For TRIPOD, we found that only 25% of journals required adherence. All other journals used less stringent wording and recommended or suggested to follow the TRIPOD guideline or checklist. In comparison, Shamseer et al. [20] reported that in 2014 the use of CONSORT was required in 42% of high-impact medical journals and that 53% recommended its use.

A limitation of our study is that we used the complete set of journals for assessing the endorsement of TRIPOD, including journals that do not or hardly publish prediction model studies and thus have no reason to endorse TRIPOD. Therefore, a likely underestimation of endorsement of TRIPOD should be kept in mind when interpreting our results. On the other hand, we have only included the highest impact factor journals from each clinical domain. We expect journals with higher impact factors to be more rigorous in the endorsement of reporting guidelines, which could lead to an overestimation of the endorsement when generalizing our findings to all medical journals. A challenge regarding the assessment of the online instructions to authors was that journals changed their websites during the study period. In some cases, in 2022, even after double checking, we could not find the information extracted in 2017 (e.g., three of the 27 journals mentioning TRIPOD in 2017 did not mention TRIPOD in 2022). In future studies, this could be mitigated by capturing or saving the content of the instructions for authors for assessment. As

Table 2. Details regarding TRIPOD resources referenced and guidance provided by the journals mentioning TRIPOD in their instructions to authors

	2017 (<i>n</i> = 27 journals)	2022 (<i>n</i> = 67 journals)
Resources referenced^a		
TRIPOD website	2 (7%)	15 (22%)
TRIPOD checklist	8 (30%)	2 (3%)
TRIPOD statement paper	2 (7%)	3 (4%)
TRIPOD explanatory paper	0 (0%)	1 (1%)
TRIPOD information on EQUATOR Network website	7 (26%)	40 (60%)
EQUATOR Network website homepage	19 (70%)	61 (91%)
Guidance^a		
Obligation to follow TRIPOD or provide completed checklist	0 (0%)	17 (25%)
Recommendation to follow TRIPOD or provide completed checklist	12 (44%)	50 (75%)
Suggestion to follow TRIPOD or provide completed checklist	9 (33%)	0 (0%)
General recommendation to consult EQUATOR Network	21 (78%)	58 (87%)
No TRIPOD specific guidance, nor referral to EQUATOR Network	4 (15%)	0 (0%)

Number of journals (%).

Abbreviations: EQUATOR, Enhancing the QUALity and Transparency Of health Research; TRIPOD, Transparent Reporting of a multivariable prediction model for Individual Prognosis Or Diagnosis.

^a Numbers add up to over 27 and 67, as more than one category could apply to a journal.

endorsement of reporting guidelines by medical journals is currently operationalized in various ways, implementation would benefit from clear instructions to authors. There are several examples that a more active editorial strategy to implement reporting guidelines led to better adherence [31,32]. Requiring adherence to reporting guidelines and checking author compliance are expected to enhance complete reporting [33]. The authors of a scoping review on interventions to improve adherence to reporting guidelines suggested the following additional strategies that journals could implement: use of subheadings forcing complete reporting, offering guidance to authors in preparing their manuscript, introducing peer review and editorial checks of completeness of reporting, and training of editorial staff [34]. Nevertheless, regardless of whether a journal enforces adherence to reporting guidelines, authors have a responsibility to report their research findings in a complete and transparent way. The abundance of available reporting guidelines is, however, a potential barrier, as it may not always be easy to identify the most applicable guideline (extension) and tools for a particular study. Several reporting guidelines could be applicable to a specific study. For example, in the case of a randomized trial of a complex implementation intervention CONSORT would apply, as well as the Template for Intervention Description and Replication (TIDieR), the Standards for Reporting Implementation Studies (StaRI) Statement, and the Standards for Quality Improvement Reporting Excellence (SQUIRE 2.0) [35–37]. Additionally, for some specific study designs, there may not be any reporting guideline that precisely fits. The EQUATOR Network has an important, central role in providing resources and in making the selection of the pertinent reporting guideline easier. It does provide the user with a search tool, as well as a toolkit to help select the

most appropriate reporting guideline for their article [38]. It is likely that software solutions will increasingly become available that can assist authors, peer reviewers, and editors in selecting the relevant guideline (e.g., the EQUATOR Wizard) and checking compliance with it (e.g., StatReviewer) [38,39]. In addition, automatization will reduce the workload, which at present is another important barrier to using reporting guidelines.

5. Conclusion

About 75% of high-impact medical journals endorse the use of one or more reporting guidelines, which is encouraging, as journal endorsement is an important step in implementing these guidelines. Currently, 20% of the journals specifically endorsed TRIPOD in their instructions to authors. Completeness of reporting may be further enhanced by clear instructions to authors, requiring adherence to reporting guidelines, and checking author compliance. Wider adoption of TRIPOD will promote adequate reporting of prediction model studies, making them more useable and thereby preventing research waste.

CRedit authorship contribution statement

Pauline Heus: Conceptualization, Methodology, Investigation, Data curation, Writing – original draft. **Demy L. Idema:** Investigation, Data curation, Formal analysis, Writing – review & editing. **Emma Kruihof:** Investigation, Writing – review & editing. **Johanna A.A.G. Damen:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Maud S. Verhoef-Jurgens:**

Investigation, Writing — review & editing. **Johannes B. Reitsma:** Conceptualization, Methodology, Writing — review & editing. **Karel G.M. Moons:** Conceptualization, Methodology, Writing — review & editing. **Lotty Hooff:** Conceptualization, Methodology, Writing — review & editing, Supervision.

Data availability

Data will be made available on request.

Declaration of competing interest

None.

Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.jclinepi.2023.10.004>.

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