Review of Research Reporting Guidelines for Radiology Researchers

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Prior articles have reviewed reporting guidelines and study evaluation tools for clinical research. However, only some of the many available accepted reporting guidelines at the Enhancing the QUAlity and Transparency Of health Research Network have been discussed in previous reports. In this paper, we review the key Enhancing the QUAlity and Transparency Of health Research reporting guidelines that have not been previously discussed. The study types include diagnostic and prognostic studies, reliability and agreement studies, observational studies, analytical and descriptive, experimental studies, quality improvement studies, qualitative research, health informatics, systematic reviews and meta-analyses, economic evaluations, and mixed methods studies. There are also sections on study protocols, and statistical analyses and methods. In each section, there is a brief overview of the study type, and then the reporting guideline(s) that are most applicable to radiology researchers including radiologists involved in health services research are discussed.

Key Words: Analytical observational studies; descriptive observational studies; diagnostic studies; economic evaluations; experimental studies; health informatics; health services research reporting guidelines; mixed methods studies; prognostic studies; qualitative research; quality improvement studies; radiology research; reliability and agreement studies; statistical analyses and methods; systematic reviews and meta-analyses; study protocols.

INTRODUCTION

In 2006, the Enhancing the QUAlity and Transparency Of health Research (EQUATOR) Network was formed to standardize and improve the quality of the reporting of health research with the development of research reporting guidelines. This article reviews how to report research in health care for the following study designs: diagnostic and prognostic studies, reliability and agreement studies, observational studies, experimental studies, quality improvement studies, qualitative research, health informatics, systematic reviews and meta-analyses, economic evaluations, mixed methods studies; and study protocols are discussed, as well as the reporting of statistical analysis. In each section, there is a brief overview of the study type, and then the available guideline(s) on how to report these different study types of health research are discussed. In this paper, we complete the review of the key EQUATOR reporting guidelines most applicable to radiology researchers including radiologists involved in health services research. The aim of this paper is to increase awareness in the radiology community of the available resources to enable researchers to produce scientific articles with a high standard of reporting of the research content and with a clear writing style. Where guideline checklists (and where applicable flow charts) are easily available from the EQUATOR Network Web site (or guideline statement Web site or other Web site), these Web links are provided. When guideline checklists are less easily available, they are summarized in tables.

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DIAGNOSTIC AND PROGNOSTIC STUDIES

Diagnostic test accuracy studies evaluate a test for the diagnosis of a disease by comparing the test in patients with and without disease using a reference standard. Diagnostic test accuracy studies provide evidence on how well a test correctly identifies or rules out disease and informs subsequent decisions about treatment for clinicians, their patients, and healthcare providers (1). This research study design is one of the most commonly used in radiology research. Prognosis refers to the possible outcomes of a disease and the frequency with which they can be expected to occur. Sometimes the characteristics of a particular patient can be used to more accurately predict that patient's eventual outcome. These characteristics are called prognostic factors, and they can be used to predict outcome. Prognostic factors need not necessarily cause the outcomes, but may have a strong enough association to predict their development. Prognostic studies aim to predict the course of a disease following its onset. A prediction model is a mathematical equation that combines information from multiple predictors measured from an individual to predict the

TABLE 1. Summary of New Items in STARD 2015 (16–18)

#	Section and Topic Item	Checklist Item and Rationale
2	**Abstract** Structured abstract	Abstracts are increasingly used to identify key elements of study design and results.
3	**Introduction** Intended use and clinical role of the test	Describing the targeted application of the test helps readers to interpret the implications of reported accuracy estimates.
4	**Introduction** Study hypotheses	Not having a specific study hypothesis may invite generous interpretation of the study results and "spin" in the conclusions.
18	**Methods** Sample size	Readers want to appreciate the anticipated precision and power of the study and whether authors were successful in recruiting the targeted number of participants.
26–27	**Discussion** Structured discussion	To prevent jumping to unwarranted conclusions, authors are invited to discuss study limitations and draw conclusions keeping in mind the targeted application of the evaluated tests (see item 3).
28	**Other information** Registration	Prospective test accuracy studies are trials, and, as such, they can be registered in clinical trial registries, such as ClinicalTrials.gov, before their initiation, facilitating identification of their existence and preventing selective reporting.
29	**Other information** Protocol	The full study protocol, with more information about the predefined study methods, may be available elsewhere, to allow more fine-grained critical appraisal.
30	**Other information** Sources of funding	Awareness of the potentially compromising effects of conflicts of interest between researchers' obligations to abide by scientific and ethical principles and other goals, such as financial ones; test accuracy studies are no exception.

STARD, STAndards for Reporting of Diagnostic accuracy.

probability of the presence (diagnosis) or future occurrence (prognosis) of a particular disease or outcome. Other names for a prediction model include risk prediction model, predictive model, prediction rule, and risk score (2). The EQUATOR Network has recently changed its study type section from a section for diagnostic test accuracy studies to a section that includes both diagnostic and prognostic studies. Currently, there are nine reporting guidelines for this section with the key reporting guidelines being STAndards for Reporting of Diagnostic accuracy (STARD) 2015 and Transparent Reporting of a Multivariable Prediction Model for Individual Prognosis or Diagnosis (TRIPOD).

Toward Complete and Accurate Reporting of Studies of Diagnostic Accuracy: The STARD Initiative

This is a reporting guideline for studies of diagnostic accuracy (3–14). The objective of the STARD initiative is to improve the accuracy and completeness of reporting of studies of diagnostic accuracy, to allow readers to assess the potential for bias in the study (internal validity) and to evaluate its generalizability (external validity) (15). The initial STARD statement (now known as STARD 2003) consisted of a checklist of 25 items. The STARD statement has been recently updated with the updated statement known as STARD 2015. In STARD 2015, the updated list now contains 30 essential items that should be included in every report of a diagnostic accuracy study. A summary of new items in STARD 2015 is shown in Table 1. This update incorporates recent evidence about sources of bias and variability in diagnostic accuracy studies. The statement also recommends the use of a flow diagram that describes the design of the study and the flow of patients (15). It is hoped that STARD 2015 will help to improve completeness and transparency in the reporting of diagnostic accuracy studies. More than 200 biomedical journals encourage the use of the STARD statement in their instructions for authors (15). This has been covered in depth in an article in the previous Radiology Alliance for Health Services Research (RAHSR) edition (19). The STARD and STARD 2015 checklist and flow diagram are available to download from the STARD Web site and the EQUATOR Network (15,20–22).

TRIPOD

The TRIPOD Statement is an evidence-based, minimum set of recommendations for the reporting of both diagnostic and prognostic prediction modeling studies. It comprises a 22-item checklist that focuses on reporting how the study was designed, conducted, analyzed, and interpreted. The main components of the TRIPOD checklist are available to download from the TRIPOD Web site and the EQUATOR Network (2). It is hoped that this will aid their critical appraisal, interpretation, and uptake by potential users. On January 6, 2015, 11 journals simultaneously published the TRIPOD Statement (2,23). It is endorsed by a large number of prominent general medical journals and leading editorial organizations.

RELIABILITY AND AGREEMENT STUDIES

Reliability and agreement are important issues in the conduct of clinical studies (24). Results of reliability and agreement