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

TABLE 2. Guidelines for Reporting Reliability and Agreement Studies (GRRAS), a Guideline for Reporting Reliability and Agreement Studies (24,25)

Section and Topic Item	#	Checklist Item
Title and abstract	1	Identify in title or abstract that interrater/intrarater reliability or agreement was investigated
Introduction	2	Name and describe the diagnostic or measurement device of interest explicitly
	3	Specify the subject population of interest
	4	Specify the rater population of interest (if applicable)
	5	Describe what is already known about reliability and agreement and provide a rationale for the study (if applicable)
Methods	6	Explain how the sample size was chosen. State the determined number of raters, subjects/objects, and replicate observations
	7	Describe the sampling method
	8	Describe the measurement/rating process (eg, time interval between repeated measurements, availability of clinical information, blinding)
	9	State whether measurements/ratings were conducted independently
	10	Describe the statistical analysis
Results	11	State the actual number of raters and subjects/objects that was included and the number of replicate observations that was conducted
	12	Describe the sample characteristics of raters and subjects (eg, training, experience)
	13	Report estimates of reliability and agreement including measures of statistical uncertainty
Discussion	14	Discuss the practical relevance of results
Auxiliary material	15	Provide detailed results if possible (eg, online)

studies provide information about the amount of error inherent in any diagnosis, and the amount of measurement error determines the validity of the study results (24). The terms "reliability" and "agreement" are often used interchangeably. However, the two concepts are conceptually distinct (24). Reliability may be defined as the ratio of variability between subjects (eg, patients) or objects (eg, computed tomography scans) to the total variability of all measurements in the sample. Therefore, reliability can be defined as the ability of a measurement to differentiate between subjects or objects (24). Agreement is the degree to which scores or ratings are identical (24).

Reliability and agreement studies are commonly performed in radiology research. In diagnostic test accuracy, studies' attention is generally focused on items such as sensitivity, specificity, predictive values, and likelihood ratios. This is important; however, if those interpreting the test cannot agree on the interpretation, the test results will be of little use. Interobserver variation can be measured when two or more independent observers are evaluating the same thing. The calculation is based on the difference between how much agreement is actually present compared to how much agreement would be expected to be present by chance alone. This can be measured using the kappa statistic. Kappa is a measure of this difference. The intraclass correlation assesses the reliability of ratings by comparing the variability of different ratings of the same subject to the total variation across all ratings and all subjects. The ratings are quantitative. Currently, on the EQUATOR Network, there are two reporting guidelines for this section with the key reporting guideline being Guidelines for Reporting Reliability and Agreement Studies (GRRAS).

GRRAS

This is a reporting guideline for reliability and agreement studies (24,25). There is a need for rigorous conduct of interrater and intrarater reliability and agreement studies. However, in these studies, information about sample selection, study design, and statistical analysis is often incomplete (24,25). Because of this inadequate reporting, interpretation and synthesis of study results are often difficult. Therefore, eight experts in reliability and agreement investigation developed guidelines for reporting (24,25). This consists of a list of 15 issues that should be addressed when reliability and agreement studies are reported (24,25). The main components of the GRRAS checklist are shown in Table 2.

OBSERVATIONAL STUDIES: ANALYTICAL OR DESCRIPTIVE

Observational studies may be analytical or descriptive. Analytical observational studies include cohort studies, case-control, and cross-sectional studies. Cohort studies can be prospective or retrospective. A prospective cohort study design follows a group of similar individuals over time that differ with respect to certain factors under study, to determine how these factors affect rates of a certain outcome. A retrospective cohort study design looks back at events that already have taken place. In a case-control study design, two existing groups differing in outcome are identified and compared on the basis of some supposed causal attribute. Subjects who have that condition/disease ("cases") are compared to patients who do not have the condition/disease but are otherwise similar ("controls"). A nested case-control study design is a variation of a

TABLE 3. A Suggested Guideline and Checklist for Reporting Case Series (36)

#	Checklist Item
1	Explicitly state the hypothesis/hypotheses under consideration
2	Explicitly provide eligibility criteria for subjects in the report
3	Precisely describe how treatments were administered or define potential risk factors
4	Compare observed results with those in an appropriate external comparison group; discuss potential biases arising from such comparison
5	Perform appropriate statistics, ensuring that assumptions of the statistical methods are reasonable in this setting
6	Discuss the biological plausibility of the hypothesis in light of the report's observations
7	Explicitly discuss the report's limitations and how these limitations could be overcome in future studies

case-control study in which only a subset of "controls" are compared to the "cases." In a cross-sectional study design, data are collected from a population, or a representative subset, at one specific point in time. They differ from case-control studies in that they aim to provide data on the entire population under study. Cross-sectional studies are descriptive studies (neither longitudinal nor experimental). Descriptive observational studies also include case series and case reports. A case series is a descriptive medical research study design that tracks patients with a known exposure given similar treatment or examines their medical records for exposure and outcome. It can be retrospective or prospective. It usually involves a smaller number of patients than more powerful case-control studies. Case series may be consecutive or nonconsecutive. A case report is a detailed report of the symptoms, signs, diagnosis, treatment, and follow-up of an individual patient. Case reports usually describe an unusual or novel occurrence. Some case reports also contain a literature review of other reported cases. Uncontrolled case series and case reports are the least methodologically robust study designs, but can make up a substantial proportion of publications submitted to radiology journals. Radiology journals are now more reluctant to accept studies of this design. However, when used appropriately, they can serve an important and legitimate purpose in furthering medical knowledge, particularly when for ethical or logistical reasons other study designs are not possible, or as a first step in clinical investigation. Overall, observational trial design is the most commonly used study design in radiology research. Currently, there are 63 reporting guidelines for this section with the 10 key reporting guidelines including STARD, STrengthening the Reporting of OBservational studies in Epidemiology (STROBE), REporting of studies Conducted using Observational Routinely-collected Data (RECORD), checklist for the Citation of BioResources used in scientific journal Articles (CoBRA), TRIPOD, Template for Intervention Description and Replication (TIDieR), and Case Report (CARE). STARD and TRIPOD are already discussed. Some are less relevant to radiology. In this section, STROBE, CARE, RECORD, and Checklist for Reporting Results of Internet E-Surveys (CHERRIES) are discussed.

STROBE is an international, collaborative initiative of epidemiologists, methodologists, statisticians, researchers, and journal editors involved in the conduct and dissemination of observational studies (26). The STROBE Statement contains a checklist of 22 items that should be included in articles reporting observational research (26–34). There is a combined STROBE checklist for cohort, case-control, and cross-sectional studies (26). The STROBE Statement is being endorsed by at least 119 biomedical journals (26). It is not an instrument to evaluate the quality of observational research (26). The STOBE checklist is available to download from the STROBE Web site and the EQUATOR Network (20,26).

Cohort Studies, Cross-sectional Studies, and Case-Control Studies

Similar to the generic STROBE Statement, there are also individual STROBE guidelines and 22-point checklists for the reporting of each of these study designs: cohort studies, cross-sectional studies, and case-control studies (26). These are very similar to the combined guidelines (26).

Case Series

There is a reporting guideline for the reporting of case series data (35). There is also a reporting guideline for the reporting of uncontrolled case series (36). The suggested seven-point checklist for the reporting of case series is shown in Table 3.

Case Reports

Instructions to authors for case reporting are limited. Sorinola et al. have created a core journal list (37). The suggested nine-point checklist for the reporting of case reports is shown in Table 4.

The CARE Guidelines: Consensus-based Clinical Case Reporting Guideline Development

This is a reporting guideline for completeness, transparency, and data analysis in case reports and data from the point of care (38–42). The acronym CARE was created from CA, the first two letters in case, and RE, the first two letters in reports. The initial CARE tools are the CARE checklist, a 13-point checklist (although some points have subpoints), and the Case

TABLE 4. A Suggested Guideline and Checklist for Writing Case Reports Based on Advice in Existing Literature (37)

Section and Topic Item	#	Checklist Item
Title	1	Should facilitate retrieval with electronic searching.
Introduction	2	Describe whether the case is unique. If not, does the case have an unusual diagnosis, prognosis, therapy, or harm?
	3	Describe how the case contributes to scientific knowledge.
	4	Describe the instructive or teaching points that add value to this case.
Methods and results	5	Describe the history, examination, and investigations adequately. Is the cause of the patient's illness clear-cut? What are other plausible explanations?
	6	Describe the treatments adequately. Have all available therapeutic options been considered? Are outcomes related to treatments?
Discussion	7	Report a literature review of other similar cases. Describe how this case is different.
	8	Explain the rationale for reporting the case. What is unusual about the case? Does it challenge prevailing wisdom?
	9	In the future, could things be done differently in a similar case?

Report Writing Template. These tools support the writing of case reports and provide data that inform clinical practice guidelines and provide early signals of effectiveness, harms, and cost (43). The CARE steering group has also developed a flow diagram illustrating how to collect data so that it can be systematically collected, and written with the CARE guidelines. The CARE checklist and time line sample format (following the CARE guidelines) are available to download from the CARE Web site (43). The CARE checklist and flow diagram are available to download from the EQUATOR Network Web site (44).

Big data offers the potential to answer an unprecedented variety of questions, many of which would have been impossible to even contemplate let alone answer only a few years ago. Big data is ideal for tracking trends in practice over time, planning service delivery across a healthcare system, and may be the only way of detecting rare adverse events (45). However, large datasets may not have been designed to answer the question under investigation. This creates issues of bias and methodological issues including misclassification bias, lumping, confounding, proxy outcomes, and power issues (45). If codes used for the disease or procedure classification are incomplete, this may result in misclassification bias. Subgroups of patients are often lumped together for the purposes of coding or billing, which may lead to erroneous conclusions. When attempting to link risk factors to outcomes, routine datasets seldom contain all of the confounding factors of relevance to the research. The outcomes data routinely collected may not be the outcome of interest to clinicians or patients. Therefore, a proxy or surrogate measure may have to be used. The statistical power of the data may be unduly great, such that nonclinical significant differences may become statistically significant (45).

The EQUATOR Network has developed reporting guidelines for big data. These guidelines, the RECORD statement, are based on the STROBE Statement. It is an international collaborative that developed reporting guidelines for studies conducted using routinely collected health data (such as health administrative data, electronic medical record data, primary care surveillance data, and disease registries) (46). RECORD was developed with the input from stakeholders who use routinely collected health data, ranging from health researchers, physicians, and journal editors, all of whom hold differing specializations across all aspects of health care (46). The RECORD checklist and flow diagram are available to download from the RECORD and the EQUATOR Network Web sites (46,47).

The aim of comparative effectiveness research (CER) is to provide relevant evidence to inform and improve real-life healthcare decisions for patients, providers, and policymakers. The key elements of CER are (1) head-to-head comparisons of diagnostic tests/treatments, (2) study populations typical of day-to-day clinical practice, and (3) a focus on evidence to inform care tailored to the characteristics of individual patients. Methods of CER include observational research, randomized trials, and decision analysis. Observational studies are especially vulnerable because they use data that directly reflect the decisions made in usual practice. In an attempt to improve the transparency, consistency, and scientific rigor, the EQUATOR Network contains good research practices for CER. These include defining, reporting, and interpreting approaches to mitigate bias and confounding in the design, and analytic methods to improve causal inference of nonrandomized studies using secondary data sources. This has been developed by the International Society For Pharmacoeconomics and Outcomes Research (ISPOR) Good Research Practices for Retrospective Database Analysis Task Force (48–50). The Agency for Healthcare Research and Quality has also developed a methods guide for effectiveness and comparative effectiveness reviews (51,52).

Survey methodology studies sample individuals from a population. Surveys are undertaken with a view toward making statistical inferences about the population being studied. Investigators may administer questionnaires to patients or to clinicians about their knowledge, attitudes, and practices to generate or refine research questions and to evaluate its impact on practice. In imaging, it is important to understand how

TABLE 5. A Suggested Reporting Guideline for Conduct and Reporting of Survey Research (53)

Section and Topic Item	#	Checklist Item
Introduction	1	Explain the purpose or aim of the research, with the explicit identification of the research question.
	2	Explain why the research was necessary and place the study in context, drawing upon previous work in relevant fields (the literature review).
	3	Describe in (proportionate) detail how the research was done.
Methods	4	State the chosen research method or methods, and justify why this method was chosen.
	5	Describe the research tool. If an existing tool is used, briefly state its psychometric properties and provide references to the original development work. If a new tool is used, you should include an entire section describing the steps undertaken to develop and test the tool, including results of psychometric testing.
	6	Describe how the sample was selected and how data were collected, including:
	6a	How were potential subjects identified?
	6b	How many and what type of attempts were made to contact subjects?
	6c	Who approached potential subjects?
	6d	Where were potential subjects approached?
	6e	How was informed consent obtained?
	6f	How many agreed to participate?
	6g	How did those who agreed differ from those who did not agree?
	6h	What was the response rate?
	7	Describe and justify the methods and tests used for data analysis.
Results	8	Present the results of the research. The results section should be clear, factual, and concise.
Discussion	9	Interpret and discuss the findings. This "discussion" section should not simply reiterate results; it should provide the author's critical reflection upon both the results and the processes of data collection. The discussion should assess how well the study met the research question, should describe the problems encountered in the research, and should honestly judge the limitations of the work.
	10	Present conclusions and recommendations.

our expensive and rapidly evolving technologies and comparative technologies affect physician decision making (ie, commencing or withholding therapies) and therefore affect patient outcomes. It is also important to understand patient preferences for imaging technologies. Survey quality depends strongly on the survey questions used. Survey research is an important form of scientific inquiry that should be performed with rigorous design and analysis. Like all other forms of research, surveys can be of high quality (and real value) or low quality, and the reporting of the survey research can be well done or poorly done. To improve the quality of reporting of survey research, several guidelines exist for reporting surveys.

Good Practice in the Conduct and Reporting of Survey Research

This is a reporting guideline to provide a checklist of good practice in the conduct and reporting of survey research, and to assist the researchers in producing high-quality survey work (53). This is a 10-point checklist (although some points have subpoints) (Table 5).

Improving the Quality of Web Surveys: CHERRIES

This is a reporting guideline for the reporting of Web-based surveys (54). The internet is increasingly used for online surveys and Web-based research. The CHERRIES statement was developed to give readers a better understanding of the sample (self-)selection and its possible differences from a "representative" sample. It is also hoped that author adherence to the checklist will increase the usefulness of such reports. The CHERRIES checklist has 30 points. The main components of the CHERRIES checklist with explanations are shown in Table 6.

A Guide for the Design and Conduct of Self-administered Surveys of Clinicians

This is a reporting guideline for the design and conduct of self-administered postal and electronic surveys of clinicians that are amenable to quantitative analysis (55). The main components of the suggested checklist outline the reporting of the study design, development, testing, and administration of valid questionnaires with minimal bias. The checklist has 30 points (Table 7).

EXPERIMENTAL STUDIES

Experimental studies can be nonrandomized or quasi-experimental trials that share similarities with the randomized controlled trial (RCT), but they specifically lack the element of random assignment to treatment or control groups. RCTs can be nonblinded in which both the researchers and the

TABLE 6. Checklist for Reporting Results of Internet E-Surveys (CHERRIES) (54)

Section and Topic Item	#	Checklist Item	Explanation
Design	1	Describe survey design	Describe target population, sample frame. Is the sample a convenience sample? (In "open" surveys, this is most likely.)
Institutional review board (IRB) approval and informed consent process	2	IRB approval	Mention whether the study has been approved by an IRB.
	3	Informed consent	Describe the informed consent process. Where were the participants told the length of time of the survey, which data were stored and where and for how long, who was the investigator, and what was the purpose of the study?
	4	Data protection	If any personal information was collected or stored, describe what mechanisms were used to protect unauthorized access.
Development and pretesting	5	Development and testing	State how the survey was developed, including whether the usability and the technical functionality of the electronic questionnaire had been tested before fielding the questionnaire.
Recruitment process and description of the sample having access to the questionnaire	6	Open survey versus closed survey	An "open survey" is a survey open for each visitor of a site, whereas a closed survey is only open to a sample that the investigator knows (password-protected survey).
	7	Contact mode	Indicate whether the initial contact with the potential participants was made on the Internet. (Investigators may also send out questionnaires by mail and allow for Web-based data entry.)
	8	Advertising the survey	How/where was the survey announced or advertised? Some examples are off-line media (newspapers), or online (mailing lists—If yes, which ones?) or banner ads (Where were these banner ads posted and what did they look like?). It is important to know the wording of the announcement as it will heavily influence who chooses to participate. Ideally, the survey announcement should be published as an appendix.
Survey administration	9	Web/E-mail	State the type of e-survey (eg, one posted on a Web site, or one sent out through e-mail). If it is an e-mail survey, were the responses entered manually into a database, or was there an automatic method for capturing responses?
	10	Context	Describe the Web site (for mailing list/newsgroup) in which the survey was posted. What is the Web site about, who is visiting it, and what are visitors normally looking for? Discuss to what degree the content of the Web site could preselect the sample or influence the results. For example, a survey about vaccination on a anti-immunization Web site will have different results from a Web survey conducted on a government Web site.
	11	Mandatory/voluntary	Was it a mandatory survey to be filled in by every visitor who wanted to enter the Web site, or was it a voluntary survey?
	12	Incentives	Were any incentives offered (eg, monetary, prizes, or nonmonetary incentives such as an offer to provide the survey results)?
	13	Time/Date	In what time frame were the data collected?
	14	Randomization of items or questionnaires	To prevent biases, items can be randomized or alternated.
	15	Adaptive questioning	Use adaptive questioning (certain items, or only conditionally displayed based on responses to other items) to reduce number and complexity of the questions.
	16	Number of items	What was the number of questionnaire items per page? The number of items is an important factor for the completion rate.
	17	Number of screens (pages)	Over how many pages was the questionnaire distributed? The number of items is an important factor for the completion rate.
	18	Completeness check	It is technically possible to do consistency or completeness checks before the questionnaire is submitted. Was this done, and if "yes," how (usually JAVAScript)? An alternative is to check for completeness after the questionnaire has been submitted (and highlight mandatory items). If this has been done, it should be reported. All items should provide a nonresponse option such as "not applicable" or "rather not say," and selection of one response option should be enforced.
	19	Review step	State whether respondents were able to review and change their answers (eg, through a back button or a review step that displays a summary of the responses and asks the respondents if they are correct).
Response rates	20	Unique site visitor	If you provide view rates or participation rates, you need to define how you determined a unique visitor. There are different techniques available, based on IP addresses or cookies or both.
	21	View rate (ratio of unique survey visitors/unique site visitors)	Requires counting unique visitors to the first page of the survey, divided by the number of unique site visitors (not page views!). It is not unusual to have view rates of less than 0.1% if the survey is voluntary.
	22	Participation rate (ratio of unique visitors who agreed to participate/ unique first survey page visitors)	Count the unique number of people who filled in the first survey page (or agreed to participate, for example, by checking a checkbox), divided by visitors who visit the first page of the survey (or the informed consents page, if present). This can also be called "recruitment" rate.
	23	Completion rate (ratio of users who finished the survey/users who agreed to participate)	The number of people submitting the last questionnaire page, divided by the number of people who agreed to participate (or submitted the first survey page). This is only relevant if there is a separate "informed consent" page or if the survey goes over several pages. This is a measure for attrition. Note that "completion" can involve leaving questionnaire items blank. This is not a measure for how completely questionnaires were filled in. (If you need a measure for this, use the word "completeness rate.")

continued on next page

TABLE 6. (*continued*).

Section and Topic Item	#	Checklist Item	Explanation
Preventing multiple entries from the same individual	24	Cookies used	Indicate whether cookies were used to assign a unique user identifier to each client computer. If so, mention the page on which the cookie was set and read, and how long the cookie was valid. Were duplicate entries avoided by preventing users' access to the survey twice, or were duplicate database entries having the same user ID eliminated before analysis? In the latter case, which entries were kept for analysis (eg, the first entry or the most recent)?
	25	IP check	Indicate whether the IP address of the client computer was used to identify potential duplicate entries from the same user. If so, mention the period of time for which no two entries from the same IP address were allowed (eg, 24 hours). Were duplicate entries avoided by preventing users with the same IP address access to the survey twice, or were duplicate database entries having the same IP address within a given period of time eliminated before analysis? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?
	26	Log file analysis	Indicate whether other techniques to analyze the log file for identification of multiple entries were used. If so, please describe.
	27	Registration	In "closed" (nonopen) surveys, users need to log in first and it is easier to prevent duplicate entries from the same user. Describe how this was done. For example, was the survey never displayed a second time once the user had filled it in, or was the username stored together with the survey results and later eliminated? If the latter, which entries were kept for analysis (eg, the first entry or the most recent)?
Analysis	28	Handling of incomplete questionnaires	Were only completed questionnaires analyzed? Were questionnaires that terminated early (where, for example, users did not go through all questionnaire pages) also analyzed?
	29	Questionnaires submitted with an atypical time stamp	Some investigators may measure the time people needed to fill in a questionnaire and exclude questionnaires that were submitted too soon. Specify the time frame that was used as a cutoff point, and describe how this point was determined.
	30	Statistical correction	Indicate whether any methods such as weighting of items or propensity scores have been used to adjust for the nonrepresentative sample; if so, please describe the methods.

participants know which treatment is being administered. In single-blind experiments, information that could introduce bias or otherwise skew the result is withheld from the participants, but the experimenter will be in full possession of that information. In double-blind experiments, information that could introduce bias or otherwise skew the result is withheld from both the subjects and the conductors to minimize unrecognized biases. In triple-blind experiments, an extension of the double-blind design, the committee monitoring response variables is not aware of the identity of the groups. The RCT is a specific type of scientific experiment. It is considered the gold standard for a clinical trial. RCTs are often used to test the efficacy of various types of medical intervention or treatment within a patient population. RCTs may also provide an opportunity to gather useful information about adverse effects.

The key distinguishing feature of the usual RCT is that study subjects, after assessment of eligibility and recruitment but before the intervention to be studied begins, are randomly allocated to receive one or other of the alternative interventions or treatments under study. After randomization, the two (or greater than 2) groups of subjects are followed in exactly the same way, and the only differences between the interventions or the treatments they receive. The most important advantage of proper randomization is that it minimizes allocation bias, balancing both known and unknown prognostic factors, in the assignment of treatments. RCT study designs include parallel group design, in which each participant is randomly assigned to a group, and all the participants in the group receive (or do not receive) an intervention. They also include crossover design, in which over time, each participant receives (or does not receive) an intervention in a random sequence. Cluster design is another variation of the RCT, in which pre-existing groups of participants (eg, clinics) are randomly selected to receive (or not receive) an intervention.

This research trial design is not commonly used in radiology. It is probably used more in interventional radiology than in diagnostic radiology but can be used in screening trials, with the National Lung Screening Trial being an example (56). Currently, there are 87 reporting guidelines for this section with 14 key reporting guidelines. These include CONsolidated Standards of Reporting Trials (CONSORT) and its extensions CoBRA, Standard Protocol Items: Recommendations for Interventional Trials (SPIRIT), and TIDieR. The most important of these to radiology are CONSORT and the CONSORT extensions, and Transparent Reporting of Evaluations with Nonrandomized Designs (TREND), which are discussed in the following section.

The CONSORT 2010 Statement is intended to improve the reporting of parallel group RCT, enabling readers to understand a trial's design, conduct, analysis, and interpretation, and to assess the validity of its results (57). CONSORT 2010 was developed through collaboration between clinical trial methodologists, guideline developers, knowledge translation specialists, and journal editors (57). CONSORT 2010 is the current version of the guideline and supersedes the 2001 and 1996 versions (57). It contains a 25-point checklist (although some points have subpoints) and a flow diagram, which describes the design of the study and the flow of patients (57). CONSORT 2010 Statement: updated guidelines for reporting parallel group randomized trials is a reporting guideline for parallel group randomized trials (58–65). This has been

TABLE 7. A Suggested Guideline for the Design and Conduct of Self-administered Surveys of Clinicians When Preparing a Report of Findings From Postal Surveys (55)

Section and Topic Item	#	Checklist Item
Abstract	1	Is the objective clearly stated?
	2	Is the design of the study stated?
	3	Is the study setting well described?
	4	Is the survey population described?
	5	Is the response rate reported?
	6	Are the outcome measures identified?
	7	Are the main results clearly reported?
	8	Are the conclusions appropriate?
Introduction	9	Is the problem clearly stated?
	10	Is the pertinent literature cited and critically appraised?
	11	Is the relevance of the research question explained?
	12	Is the objective clearly stated?
Methods	13	Is the study design appropriate to the objective?
	14	Is the setting clearly described?
	15	Are the methods described clearly enough to permit other researchers to duplicate the study?
	16	Is the survey sample likely to be representative of the population?
	17	Is the questionnaire described adequately?
	18	Have the validity and reliability of the questionnaire been established?
	19	Was the questionnaire administered in a satisfactory way?
	20	Are the statistical methods used appropriately?
Results	21	Do the results address the objective?
	22	Are all respondents accounted for?
	23	Are the results clearly and logically presented?
	24	Are the tables and figures appropriate?
	25	Are the numbers consistent in the text and the tables?
Discussion	26	Are the results succinctly summarized?
	27	Are the implications of the results stated?
	28	Are other interpretations considered and refuted?
	29	Are the limitations of the study and its results explained?
	30	Are appropriate conclusions drawn?

discussed in a previous RAHSR edition paper (19). The CONSORT checklist and flow diagram are available to download from the CONSORT Web site and the EQUATOR Network (20,57).

The main CONSORT Statement is based on the "standard" two-group parallel design. However, there are several different types of randomized trials, some of which have different designs, interventions, and data (57). To help improve the reporting of these trials, the CONSORT Group has been involved in extending and modifying the main CONSORT Statement for application in these various areas, resulting in the CONSORT extensions (57). There are nine current official extensions of the CONSORT Statement. Three are for different trial designs. These are cluster trials, noninferiority and equivalence trials, and pragmatic trials (57). Three are for different types of interventions. These are herbal medicinal interventions, acupuncture interventions, and nonpharmacological treatment (NPT) interventions (57). Herbal medicinal interventions and acupuncture interventions are clearly not applicable to radiology research but NPT interventions are. Three are for different types of data. These are CONSORT-Patient-Reported Outcome (PRO) for PROs, harms, and abstracts (57).

Reporting of Cluster Randomized Trials: An Extension of the CONSORT 2010 Statement

This is a reporting guideline for cluster trials. In cluster trials, one randomizes the intervention to groups of patients rather than to individual patients (66). The main problem associated with their design, conduct, analysis, and interpretation, compared to individually randomized trials, is that there are two different units of measurement: the cluster and the patient. Each needs to be reported carefully. An extension to the CONSORT Statement for cluster randomized trials has been developed. Included in it are recommendations for the reporting of these trials with an explanation of each suggested modification to the main CONSORT checklist (57). The extension checklist (which is a 25-point checklist [although some points have subpoints]) is available to download from the CONSORT Web site (67).

Reporting of Noninferiority and Equivalence Randomized Trials: An Extension of the CONSORT 2010 Statement

This is a reporting guideline for the reporting of noninferiority and equivalence randomized trials (68). Equivalence trials aim to determine whether one diagnostic test is similarly accurate to another, or whether one intervention is therapeutically similar to another. Noninferiority trials aim to determine whether one treatment is no worse than another. Noninferiority and equivalence trials have methodological features that differ from superiority trials and present particular difficulties in design, conduct, analysis, and interpretation. Although the rationale for such trials occurs frequently, those designed and described specifically as noninferiority or equivalence trials appear less commonly in medical literature (57). The extension checklist (which is a 22-point checklist) is available to download from the CONSORT Web site (69).

Reporting of Trials Assessing NPT: An Extension of the CONSORT 2010 Statement

This is a reporting guideline for trials assessing NPT (70). In general, trials of NPT such as invasive procedures or technical interventions remain suboptimal (57). This extension to the CONSORT Statement for RCTs of NPT builds upon the CONSORT checklist, taking into consideration specific issues when assessing NPT, such as difficulties of blinding, the complexity of the intervention and the influence of care providers' expertise, and volume of care of centers on treatment effect (57). The extension checklist (which is a 22-point checklist [although some points have subpoints]) is available to download from the CONSORT Web site (71).

Better Reporting of Harms in Randomized Trials: An Extension of the CONSORT Statement

This is a reporting guideline for reporting of harms in randomized trials (72). Evidence suggests that reporting of harms-related data from RCTs needs improvement (57). As a result, 10 new recommendations about reporting harms-related issues have been added to the main CONSORT checklist (57). The extension checklist (which is a 22-point checklist) is available to download from the CONSORT Web site (73).

Improving the Reporting of Pragmatic Trials: An Extension of the CONSORT Statement

This is a reporting guideline for the reporting of pragmatic trials in health care (74,75). Pragmatic trials are designed to measure effectiveness, that is, whether an intervention works when used in usual conditions of care. To ensure applicability/generalizability in a wide range of usual care settings, pragmatic trials should include in the trial the participants to whom the intervention will be applied in the real-world setting, once its effectiveness is established (57). The need for purchasers, providers, and recipients of health care to use evidence from trials in policy decisions has increased the focus on pragmatic trials. However, poor reporting can reduce their usefulness (57). The CONSORT extension for pragmatic trials builds upon the existing CONSORT checklist and gives specific guidance for eight of the 22 checklist items in relation to pragmatic trials. For each of the eight items, the standard CONSORT text and additional guidance is presented. In addition, an example of good reporting for the item and an explanation of the issues are also presented (57). The extension explanation and elaboration is available to download from the CONSORT Web site (76).

As part of the article "Patient-centered Outcomes Research in Radiology: Trends in Funding and Methodology" published in last year's RAHSR edition, Lee and Jarvik elaborated on the pragmatic trial. They also discussed the pragmatic trial and its potential to be readily applied to evaluate the effectiveness of diagnostic imaging procedures and imaging-based interventions among diverse patient populations in real-world settings (77).

Reporting of PRO in Randomized Trials: The CONSORT-PRO Extension

This is a reporting guideline for PRO in randomized trials (78). The 2013 CONSORT-PRO extension provides guidance for authors of trials including such outcomes. Specifically, five additional checklist items are proposed to facilitate optimal reporting of RCTs in which PROs are primary or secondary end points (57). The extension checklist (which is a 25-point checklist [although some points have subpoints]) is available to download from the CONSORT Web site (79).

TREND

This is a report guideline for nonrandomized trial designs (80). As stated previously, experimental studies can be nonrandomized or quasi-experimental trials. These have similarities with the RCT but they specifically lack the element of random assignment to treatment or control. The mission of the TREND group is to improve the reporting standards of nonrandomized evaluations. The TREND statement is a 22-item checklist specifically developed to guide standardized reporting of non-RCTs. The TREND statement complements the widely adopted CONSORT Statement developed for RCTs. There are often ethical, methodological, and financial reasons why RCTs may be difficult to perform in imaging. Imaging trials are usually nonrandomized trial designs. Therefore, this guideline may be more applicable to radiology researchers. The TREND checklist is available to download from the Centers for Disease Control and Prevention Web site and the EQUATOR Network (81).

QUALITY IMPROVEMENT STUDIES

Quality improvement studies assess the appropriateness, effectiveness, and quality of care provided. Their primary focus

is to make care better at (local) sites, rather than generate new, generalizable scientific knowledge (82). Despite its local focus, improvement frequently generates important new generalizable knowledge about systems of care and about how best to change those systems (82). Quality improvement studies are important in all areas of medicine including radiology. Currently, there are two reporting guidelines for this section with one key reporting guideline, the Standards for Quality Improvement Reporting Excellence (SQUIRE) guideline, which is discussed in the following section.

Publication Guidelines for Quality Improvement in Health Care: Evolution of the SQUIRE Project

This is a reporting guideline for quality improvement in health care (83–87). The SQUIRE Guidelines help authors to write excellent, usable articles about quality improvement in health care so that findings may be easily discovered and widely disseminated (82). These guidelines provide a framework for reporting formal, planned studies designed to assess the nature and effectiveness of interventions to improve the quality and safety of care (82). The SQUIRE guidelines consist of a checklist of 19 items (although some points have subpoints) that authors should consider when writing articles that describe studies of quality improvement. Most of the items in the checklist are common to all scientific reporting, but virtually all of them have been modified to reflect the unique nature of medical improvement work (82). The SQUIRE checklist is available to download from the SQUIRE Web site and the EQUATOR Network (20,82).

QUALITATIVE RESEARCH

Qualitative research aims to gather an in-depth understanding of human behavior and the reasons that govern such behavior. The qualitative method investigates the why and how of decision making, not just what, where, and when. Hence, smaller but focused samples are more often used than large samples. Qualitative methods produce information only on the particular cases studied, and any more general conclusions are only propositions (informed assertions). Quantitative research methods can then be used to seek empirical support for such research hypotheses. Currently, there are 12 reporting guidelines for this section, with three key reporting guidelines including the ENhancing Transparency in REporting the synthesis of Qualitative research (ENTREQ) and COnsolidated criteria for REporting Qualitative research (COREQ) guidelines.

COREQ: A Checklist for Interviews and Focus Groups

This is a reporting guideline for studies of qualitative research interviews and focus groups (88). This is a 32-item checklist for explicit and comprehensive reporting of qualitative studies, in-depth interviews, and focus groups. This has been covered in depth in an article in the previous RAHSR edition (19). The COREQ checklist is available to download from the EQUATOR Network (20).

HEALTH INFORMATICS

Information technology (IT) systems have an essential role in the delivery of modern health care especially in radiology. Health professionals and the organizations they work for are also heavily dependent on IT systems. Therefore, it is imperative that they are thoroughly assessed through robust evaluations as with any other form of health process or technology (89). This principle is advocated and elaborated in the Declaration of Innsbruck (89).

Statement on Reporting of Evaluation Studies in Health Informatics (STARE-HI)

This is a reporting guideline for evaluation studies in health informatics (89). There is growing published evidence of the impact of health informatics on health care. Concern has been raised that without proper guidelines for the design, planning, execution, and reporting of evaluation studies in health informatics, it would be difficult to build up a proper evidence base that can be used to make informed decisions regarding IT interventions in health care (89). The objective of STARE-HI is to provide guidelines for writing evaluation reports in health informatics that can be reliably interpreted by subsequent readers, and by so doing, the quality of published evaluation studies in health informatics is improved. It is hoped that this will improve the evidence base of health informatics (89). These objectives are achieved by presenting guidelines for reporting, which are formatted as a checklist with enough detail to guide authors (89). STARE-HI principles to be addressed in papers describing evaluations of health informatics interventions are presented (89). These principles include formulation of title and abstract, introduction (eg, scientific background, study objectives), study context (eg, organizational setting, system details), methods (eg, study design, outcome measures), results (eg, study findings, unexpected observations), and discussion and conclusion of an IT evaluation paper (89). The STARE-HI checklist is a 14-point checklist (although some points have subpoints). The main components of the STARE-HI checklist are shown in Table 8. The STARE-HI checklist is available to download from the EQUATOR Network (90).

SYSTEMATIC REVIEWS AND META-ANALYSES

Systematic reviews have the goal of reducing bias by identifying, appraising, and synthesizing all relevant studies on a particular topic. Often, systematic reviews include a meta-analysis component that involves the use of statistical techniques to synthesize the data from several studies into a single quantitative estimate or summary statistic. An ongoing issue is that systematic reviews and meta-analyses of diagnostic imaging

TABLE 8. The Statement on Reporting of Evaluation Studies in Health Informatics (STARE-HI) Principles: Items Recommended to be Included in Health Informatics Evaluation Reports and Guideline for Reporting Health Informatics Studies (89)

Section and Topic Item	#	Checklist Item
Title	1	Title
Abstract	2	Abstract
Keywords	3	Keywords
Introduction	4.1	Scientific background
	4.2	Rationale for the study
	4.3	Objectives of study
Study context	5.1	Organizational setting
	5.2	System details and system in use
Methods	6.1	Study design
	6.2	Theoretical background
	6.3	Participants
	6.4	Study flow
	6.5	Outcome measures or evaluation criteria
	6.6	Methods for data acquisition and measurement
	6.7	Methods for data analysis
Results	7.1	Demographic and other study coverage data
	7.2	Unexpected events during the study
	7.3	Study findings and outcome data
	7.4	Unexpected observations
Discussion	8.1	Answers to study questions
	8.2	Strengths and weaknesses of the study
	8.3	Results in relation to other studies
	8.4	Meaning and generalizability of the study
	8.5	Unanswered and new questions
Conclusion	9	Conclusion
Authors' contribution	10	Authors' contribution
Competing interests	11	Competing interests
Acknowledgement	12	Acknowledgment
References	13	References
Appendices	14	Appendices

accuracy studies have differences from meta-analyses of therapeutic studies related to literature search, heterogeneity, and small sample size bias. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist is a reasonable checklist to ensure the transparent and complete reporting of systematic reviews and meta-analyses of diagnostic imaging accuracy studies. A PRISMA extension for the meta-analysis diagnostic accuracy studies is in development and will be a welcome addition. Currently, there are 23 reporting guidelines for this section with eight key reporting guidelines including PRISMA and its extensions, TIDieR and ENTREQ. PRISMA, Meta-analysis Of Observational Studies in Epidemiology (MOOSE), and ENTREQ are discussed in the following section.

The PRISMA Statement

This is a reporting guideline for systematic reviews and meta-analyses (91–94). PRISMA is an evidence-based minimum set of items for reporting in systematic reviews and meta-analyses (95). The PRISMA Statement consists of a 27-item checklist and a four-phase flow diagram (95). This has been covered in depth in an article in the previous RAHSR edition (19). The PRISMA checklist and flow diagram are available to download from the PRISMA Web site and the EQUATOR Network (20,95). PRISMA has been predominantly developed for the inclusion of RCTs in the meta-analysis. An issue with radiology is that most radiology studies are observational studies rather than RCTs.

MOOSE: A Proposal for Reporting. MOOSE Group

This is a reporting guideline for meta-analysis of observational studies in epidemiology (96). It was developed as meta-analyses increasingly evaluate observational studies (96). MOOSE consists of a checklist containing specifications for the reporting of meta-analyses of observational studies in epidemiology, including background, search strategy, methods, results, discussion, and conclusion. It is hoped that use of the checklist should improve the usefulness of meta-analyses for

TABLE 9. Meta-analyses of Observational Studies (MOOSE) Checklist and Guideline for the Reporting of Meta-Analyses of Observational Studies (96)

#	Checklist Item
Reporting of background should include	
1	Problem definition
2	Hypothesis statement
3	Description of study outcome(s)
4	Type of exposure or intervention used
5	Type of study designs used
6	Study population
Reporting of search strategy should include	
7	Qualifications of searchers (eg, librarians and investigators)
8	Search strategy, including time period included in the synthesis and key words
9	Effort to include all available studies, including contact with authors
10	Databases and registries searched
11	Search software used, name and version, including special features used (eg, explosion)
12	Use of hand searching (eg, reference lists of obtained articles)
13	List of citations located and those excluded, including justification
14	Method of addressing articles published in languages other than English
15	Method of handling abstracts and unpublished studies
16	Description of any contact with authors
Reporting of methods should include	
17	Description of relevance or appropriateness of studies assembled for the assessment of the hypothesis to be tested
18	Rationale for the selection and coding of data (eg, sound clinical principles or convenience)
19	Documentation of how data were classified and coded (eg, multiple raters, blinding, and interrater reliability)
20	Assessment of confounding (eg, comparability of cases and controls in studies where appropriate)
21	Assessment of study quality, including blinding of quality assessors, stratification, or regression on possible predictors of study results
22	Assessment of heterogeneity
23	Description of statistical methods (eg, complete description of fixed or random effects models, justification of whether the chosen models account for predictors of study results, dose-response models, or cumulative meta-analysis) in sufficient detail to be replicated
24	Provision of appropriate tables and graphics
Reporting of results should include	
25	Graphic summarizing individual study estimates and overall estimate
26	Table giving descriptive information for each study included
27	Results of sensitivity testing (eg, subgroup analysis)
28	Indication of statistical uncertainty of findings

authors, reviewers, editors, readers, and decision makers (96). The MOOSE checklist is a 28-point checklist (Table 9). The MOOSE checklist is available to download from the EQUATOR Network (97).

Meta-analysis of Individual Participant Data: Rationale, Conduct, and Reporting

This is a reporting guideline for meta-analysis of individual participant data (98). Meta-analyses can be performed at a study level (using study data) or at an individual patient level using individual patient data. Meta-analyses of individual patient data require individual patient level data, which are not always available. However, if it is available, individual patient data meta-analysis has a number of advantages. First, it avoids ecological/aggregate bias; second, it extends the accuracy of the meta-analysis. In addition, assessment at an individual patient data level allows more reliable meta-regression (through avoidance or ecological bias) and easier assessment of heterogeneity. An example of an individual patient data meta-analysis in the radiology literature is an article by Foerster et al. assessing the diagnostic accuracy of diffusion tensor imaging in amyotrophic lateral sclerosis using individual patient data (99). Table 10 shows a suggested 18-point checklist when reporting data from an individual participant data meta-analysis, to supplement those reporting guidelines of PRISMA and MOOSE.

ENTREQ

This is a reporting guideline provided for synthesis of qualitative research (100). The synthesis of qualitative research is an expanding and evolving methodological area. The ENTREQ statement is designed to help researchers report

TABLE 10. Suggested Information to Report From an Individual Participant Data Meta-analysis, to Supplement Those Reporting Guidelines of PRISMA and MOOSE (98)

#	Checklist Item
1	Whether there was a protocol for the individual participant data project, and where it can be found
2	Whether ethics approval was necessary and (if appropriate) granted
3	Why the individual participant data approach was initiated
4	The process used to identify relevant studies for the meta-analysis
5	How authors of relevant studies were approached for individual participant data
6	How many authors (or collaborating groups) were approached for individual participant data, and the proportion that provided such data
7	The number of authors who did not provide individual participant data, the reasons why, and the number of patients (and events) in the respective study
8	Whether those authors who provided individual participant data gave all their data or only a proportion; if the latter, then describe what information was omitted and why
9	Whether there were any qualitative or quantitative differences between those studies providing individual participant data and those studies not providing individual participant data (if appropriate)
10	The number of patients within each of the original studies and, if appropriate, the number of events
11	Details of any missing individual level data within the available individual participant data for each study, and how this was handled within the meta-analyses performed
12	Details and reasons for including (or excluding) patients who were originally excluded (or included) by the source study investigators
13	Whether a one-step or a two-step individual participant data meta-analysis was performed, and the statistical details thereof, including how clustering of patients within studies was accounted for
14	How many patients from each study were used in each meta-analysis performed
15	Whether the assumptions of the statistical models were validated (for example, proportional hazards) within each study
16	Whether the individual participant data results for each study were comparable to the published results, and, if not, why not (for example, individual participant data contained updated or modified information)
17	How individual participant data and nonindividual participant data studies were analyzed together (if appropriate)
18	The robustness of the meta-analysis results following the inclusion or exclusion of nonindividual participant data studies (if appropriate)

MOOSE, Meta-analysis Of Observational Studies in Epidemiology; PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

the stages most commonly associated with the synthesis of qualitative health research: searching and selecting qualitative research, quality appraisal, and methods for synthesizing qualitative findings. It is a two-item checklist. This has been covered in depth in an article in the previous RAHSR edition (19). The ENTREQ checklist is available to download from the EQUATOR Network (20).

ECONOMIC EVALUATIONS

Economic evaluations in health care are concerned with issues related to efficiency, effectiveness, value, and behavior in the production and consumption of health care. Health economists evaluate multiple types of financial information including costs, charges, and expenditures. Economic evaluations in health care differ from other economic evaluations because of extensive government intervention and intractable uncertainty in several dimensions. Uncertainty is intrinsic to health, both in patient outcomes and in financial concerns. Other differences include barriers to entry, the presence of asymmetric information, externalities, and the presence of a third-party agent. The knowledge gap that exists between a physician and a patient creates a situation of distinct advantage for the physician, which is called asymmetric information. Externalities occur when in an effort to avoid getting an illness, a person's other decision making is affected. Currently, there are 12 reporting guidelines for this section with one key reporting guideline: the Consolidated Health Economic Evaluation Reporting Standards (CHEERS) guideline.

CHEERS Statement

This is a reporting guideline for economic evaluations of health interventions (101–110). It is a 24-point checklist (although some points have subpoints). This guideline is available to authors and reviewers, and aims to support the quality, consistency, and transparency of health economic and outcomes research reporting in the biomedical literature. This has been covered in greater depth in an article in the previous RAHSR edition (19). The CHEERS checklist is available to download from the International Society For Pharmacoeconomics and Outcomes Research Web site and the EQUATOR Network (111,112).

TABLE 11. Good Reporting of a Mixed Methods Study (GRAMMS), Guidelines for the Reporting of Mixed Methods Studies (113)

#	Checklist Item
1	Describe the justification for using a mixed methods approach to the research question
2	Describe the design in terms of the purpose, priority, and sequence of methods
3	Describe each method in terms of sampling, data collection, and analysis
4	Describe where integration has occurred, how it has occurred, and who has participated in it
5	Describe any limitation of one method associated with the present of the other method
6	Describe any insights gained from mixing or integrating methods

MIXED METHODS STUDIES

Mixed methods research is an emerging methodological movement and one that is gaining in popularity. A common criticism of mixed methods studies reported in academic journals is the lack of a justification or rationale for the use of mixed methods and how the study has integrated the data or findings from the study. Mixed methods studies are common in health services research. They consist of two separate components of data collection and analysis within a single study. There is a quantitative component with structured data collection and statistical analysis, and a qualitative component with less structured data collection and thematic analysis. Currently, there are four reporting guidelines for this section. They are not specific to radiology; one guideline is specific to health services research and is discussed in the following section.

The Quality of Mixed Methods Studies in Health Services Research

This is a reporting guideline for mixed methods studies in health services research (113). O'Cathain et al. have created a list of issues that should be considered when designing a mixed methods study. This list is based on suggested items by Creswell in conjunction with the literature on the quality of mixed methods studies. This has lead to guidelines for Good Reporting of A Mixed Methods Study (GRAMMS). GRAMMS is a six-item checklist (Table 11).

As part of the article "Patient-centered Outcomes Research in Radiology: Trends in Funding and Methodology" published in last year's RAHSR edition, Lee and Jarvik elaborated on mixed methods (with both qualitative and quantitative methods) (77). They also discussed how mixed methods are one of the key features of Patient-Centered Outcomes Research methodology (77). Also, in today's funding environment, there is growing expectation that applicants include mixed methods in their grant proposals (77).

STUDY PROTOCOLS

The protocol of a clinical trial serves as the foundation for study planning, conduct, reporting, and appraisal. However, trial protocols and existing protocol guidelines vary greatly in content and quality (114). Radiology study protocols are rare. However, we are pleased that the article "IMpact of Platelet Rich Plasma OVer Alternative Therapies in Patients with Lateral Epicondylitis (IMPROVE): Protocol for a Multicenter Randomized Controlled Study: A Multicenter, Randomized Trial Comparing Autologous Platelet-rich Plasma, Autologous Whole Blood, Dry Needle Tendon Fenestration, and Physical Therapy Exercises Alone on Pain and Quality of Life in Patients with Lateral Epicondylitis" published in last year's RAHSR edition was an example of a study protocol (115). In the article, Chiavaras et al. describe a multicenter, single-blinded, four-arm RCT comparing platelet-rich plasma, whole blood injection, dry needle tendon fenestration, and sham injection with physical therapy alone for the treatment of lateral epicondylitis (115). Currently, there are six reporting guidelines for this section with three key reporting guidelines including the SPIRIT, Preferred Reporting Items for Systematic Review and Meta-analysis Protocols (PRISMA-P), and TIDieR guidelines. SPIRIT and PRISMA-P are discussed in the following section.

SPIRIT 2013 Statement: Defining Standard Protocol Items for Clinical Trials

This is a reporting guideline for the definition of standard protocol items for clinical trials (114). The protocol of a clinical trial is essential for study conduct, review, reporting, and interpretation. SPIRIT is an international initiative that aims to improve the quality of clinical trial protocols by defining an evidence-based set of items to address in a protocol (116). It recommends a minimum set of scientific, ethical, and administrative elements that should be addressed in a clinical trial protocol. It consists of a 33-item checklist and figure (116). The SPIRIT checklist and figure are available to download from the SPIRIT Web site and the EQUATOR Network (20,116).

PRISMA-P 2015 Statement

As of January 2015, PRISMA-P has been published in the journal *Systematic Reviews*. The 17-item checklist (although some points have subpoints) aims to facilitate the preparation and reporting of a robust protocol for the systematic review

TABLE 12. Reporting guidelines by Research Study Design, Acronym, Website URL, and Bibliographic reference

Research Study Design	Reporting Guideline(S) Provided For	Reporting Guideline Acronym	Reporting Guideline Website URL	Full-Text If Available	Full Bibliographic Reference	
Diagnostic and prognostic studies	Studies of diagnostic accuracy	STARD	http://www.stard-statement.org/	Full-text PDF documents of the STARD Statement, checklist, flow diagram and the Explanation and Elaboration document	Bossuyt PM, Reitsma JB, Bruns DE, Gatsonis CA, Glasziou PP, Irwig LM, Lijmer JG, Moher D, Rennie D, de Vet HC. Towards complete and accurate reporting of studies of diagnostic accuracy: the STARD initiative. Standards for Reporting of Diagnostic Accuracy.	Clin Chem. 2003; 49(1):1-6. PMID: 12507953 (14). BMJ. 2003; 326(7379):41-44. PMID: 12511463 (4). Radiology. 2003; 226(1):24-28. PMID: 12511664 (5). Ann Intern Med. 2003; 138(1):40-44. PMID: 12513043 (6). Am J Clin Pathol. 2003; 119(1):18-22. PMID: 12520693 (7). Clin Biochem. 2003; 36(1):2-7. PMID: 12554053 (8). Clin Chem Lab Med. 2003; 41(1):68-73. PMID: 12636052 (3).
	Studies of diagnostic accuracy	STARD 2015	http://www.stard-statement.org/	The full-text of the STARD 2015 reporting guideline for diagnostic accuracy studies is available to download as a PDF file. STARD 2015 checklist (PDF) STARD 2015 flow diagram (PDF)	Bossuyt PM, Reitsma JB, Bruns DE, Gatsonis CA, Glasziou PP, Irwig L, LijmerJG Moher D, Rennie D, de Vet HCW, Kressel HY, Rifai N, Golub RM, Altman DG, Hooft L, Korevaar DA, Cohen JF, For the STARD Group. STARD 2015: An Updated List of Essential Items for Reporting Diagnostic Accuracy Studies.	BMJ. 2015;351:h5527. PMID: 26511519 Radiology. 2015:151516. PMID: 26509226 Clinical Chemistry. 2015. pii: clinchem.2015.246280. PMID: 26510957
	Reporting of studies developing, validating, or updating a prediction model, whether for diagnostic or prognostic purposes.	TRIPOD	http://www.tripod-statement.org/	Full-text PDF and WORD documents of the TRIPOD Statement checklist for prediction model development and validation http://www.tripod-statement.org/TRIPOD/TRIPOD-Checklists http://www.tripod-statement.org/Downloads	Moons KG, Altman DG, Reitsma JB, Ioannidis JP, Macaskill P, Steyerberg EW, Vickers AJ, Ransohoff DF, Collins GS. Transparent Reporting of a multivariable prediction model for Individual Prognosis Or Diagnosis (TRIPOD): Explanation and Elaboration.	Ann Intern Med. 2015;162(1):W1-W73. PMID: 25560730 (120)
Reliability and Agreement Studies	Reliability and agreement studies	GRRAS			Kottner J, Audigé L, Brorson S, Donner A, Gajeweski BJ, Hróbjartsson A, Robersts C, Shoukri M, Streiner DL. Guidelines for reporting reliability and agreement studies (GRRAS) were proposed.	J Clin Epidemiol. 2011;64(1):96-106 PMID: 21130355 (21). Int J Nurs Stud. 2011;48(6):661-671. PMID: 21514934 (22).
Observational Studies	Observational studies in epidemiology (cohort, case-control studies, cross-sectional studies)	STROBE	http://www.strobe-statement.org/index.php?id=strobe-home	Full-text PDF copies of the STROBE Statement and explanation and elaboration papers. STROBE checklists http://www.strobe-statement.org/index.php?id=strobe-publications http://www.strobe-statement.org/index.php?id=available-checklists	von Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) Statement: guidelines for reporting observational studies.	Ann Intern Med. 2007; 147(8):573-577. PMID: 17938396 (24) PLoS Med. 2007;4(10):e296. PMID: 17941714 (25) BMJ. 2007;335(7624):806-808. PMID: 17947786 (26) Prev Med. 2007;45(4):247-251. PMID: 17950122 (27) Epidemiology. 2007;18(6):800-804. PMID: 18049194 (28) Lancet. 2007;370(9596):1453-1457. PMID: 18064739 (29)
	For completeness, transparency and data analysis in case reports and data from the point of care.	CARE	http://www.care-statement.org/	The CARE Checklist The CARE Writing Template The 2016 updated CARE Checklist as PDF and Word file. The CARE Writing Template for Authors as PDF and a Word file.	Gagnier JJ, Kienle G, Altman DA, Moher D, Sox H, Riley D; the CARE Group. The CARE Guidelines: Consensus-based Clinical Case Reporting Guideline Development.	BMJ Case Rep. 2013; doi: 10.1136/bcr-2013-201554 PMID: 24155002 (35). Global Adv Health Med. 2013;10.7453/gahmj.2013.008 Dtsch Arztebl Int. 2013;110(37):603-608. PMID: 24078847 Full-text in English / Full-text in German J Clin Epidemiol. 2013. Epub ahead of print. PMID: 24035173 (38). J Med Case Rep. 2013;7(1):223. PMID: 24228906 (37). J Diet Suppl. 2013;10(4):381-90. PMID: 24237192 (39).
	Reporting items specific to observational studies using routinely collected health data.	RECORD	http://record-statement.org/	The full-text of this reporting guideline can be accessed at: http://journals.plos.org/plosmedicine/article?id=10.1371/journal.pmed.1001885	Benchimol EI, Smeeth L, Guttmann A, Harron K, Moher D, Petersen I, Sørensen HT, von Elm E, Langan SM; RECORD Working Committee. The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement.	PLoS Med. 2015;12(10):e1001885 PMID: 26440803
	Reporting Web-based surveys	CHERRIES			Eysenbach G. Improving the quality of Web surveys: the Checklist for Reporting Results of Internet E-Surveys (CHERRIES).	J Med Internet Res. 2004; 6(3):e34. PMID: 15471760 (51)

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TABLE 12. (*continued*).

Research Study Design	Reporting Guideline(S) Provided For	Reporting Guideline Acronym	Reporting Guideline Website URL	Full-Text If Available	Full Bibliographic Reference	
Experimental Studies	Parallel group randomised trials	CONSORT	http://www.consort-statement.org/	Full-text PDF documents of the CONSORT 2010 Statement, CONSORT 2010 checklist, CONSORT 2010 flow diagram and the CONSORT 2010 Explanation and Elaboration document CONSORT checklist (Word) CONSORT flow diagram (Word)	Schulz KF, Altman DG, Moher D, for the CONSORT Group. CONSORT 2010 Statement: updated guidelines for reporting parallel group randomised trials.	Ann Int Med. 2010;152(11):726-32. PMID: 20335313 (55). BMC Medicine. 2010;8:18. PMID: 20334633 (56). BMJ. 2010;340:c332. PMID: 20332509 (57). J Clin Epidemiol. 2010;63(8): 834-40. PMID: 20346629 (58). Lancet. 2010;375(9721):1136 supplementary webappendix. Obstet Gynecol. 2010;115(5):1063-70. PMID: 20410783 (59). Open Med. 2010;4(1):60-68. PLoS Med. 2010;7(3): e1000251. PMID: 20352064 (60). Trials. 2010;11:32. PMID: 20334632 (61).
	Cluster randomised trials	CONSORT Cluster	http://www.consort-statement.org/extensions/designs/cluster-trials/	The full-text of the extension for cluster randomised trials	Campbell MK, Piaggio G, Elbourne DR, Altman DG; for the CONSORT Group. Consort 2010 statement: extension to cluster randomised trials.	BMJ. 2012;345:e5661. PMID: 22951546 (63).
	Reporting of noninferiority and equivalence randomized trials	CONSORT Non-inferiority	http://www.consort-statement.org/extensions/designs/non-inferiority-and-equivalence-trials/	The full-text of the extension for noninferiority and equivalence randomized trials	Piaggio G, Elbourne DR, Pocock SJ, Evans SJ, Altman DG; CONSORT Group. Reporting of noninferiority and equivalence randomized trials: extension of the CONSORT 2010 statement.	JAMA. 2012;308(24):2594-2604. PMID: 23268518 (65).
	Reporting of pragmatic trials in healthcare	CONSORT Pragmatic trials	http://www.consort-statement.org/extensions/designs/pragmatic-trials/	The full-text of the extension for pragmatic trials in healthcare	Zwarenstein M, Treweek S, Gagnier JJ, Altman DG, Tunis S, Haynes B, Oxman AD, Moher D; CONSORT group; Pragmatic Trials in Healthcare (Practihc) group. Improving the reporting of pragmatic trials: an extension of the CONSORT statement.	BMJ. 2008;337:a2390. PMID: 19001484 (71).
	Trials assessing nonpharmacologic treatments	CONSORT Nonpharmacological treatment interventions	http://www.consort-statement.org/extensions/interventions/non-pharmacologic-treatment-interventions/	The full-text of the extension for trials assessing nonpharmacologic treatments	Boutron I, Moher D, Altman DG, Schulz K, Ravaud P, for the CONSORT group. Methods and Processes of the CONSORT Group: Example of an Extension for Trials Assessing Nonpharmacologic Treatments.	Ann Intern Med. 2008:W60-W67. PMID: 18283201 (67).
	Patient-reported outcomes in randomized trials	CONSORT-PRO	http://www.consort-statement.org/extensions/data/pro/	The full-text of the extension for patient reported outcomes (PROs)	Calvert M, Blazeby J, Altman DG, Revicki DA, Moher D, Brundage MD; CONSORT PRO Group. Reporting of patient-reported outcomes in randomized trials: the CONSORT PRO extension.	JAMA. 2013;309(8):814-822. PMID; 23443445 (75).
	Reporting of harms in randomized trials	CONSORT Harms	http://www.consort-statement.org/extensions/data/harms/		Ioannidis JPA, Evans SJW, Gotzsche PC, O'Neill RT, Altman DG, Schulz K, Moher D, for the CONSORT Group. Better Reporting of Harms in Randomized Trials: An Extension of the CONSORT Statement.	Ann Intern Med. 2004; 141(10):781-788. PMID: 15545678 (69).
	Reporting randomised trials in journal and conference abstracts	CONSORT for abstracts	http://www.consort-statement.org/extensions/data/abstracts/	The full-text of the extension for journal and conference abstracts	Hopewell S, Clarke M, Moher D, Wager E, Middleton P, Altman DG, Schulz KF, the CONSORT Group. CONSORT for reporting randomised trials in journal and conference abstracts.	Lancet. 2008;371(9609):281-283. PMID: 18221781 (121).
	Reporting of intervention evaluation studies using nonrandomized designs	TREND	http://www.cdc.gov/trendstatement/		Des Jarlais DC, Lyles C, Crepaz N, Trend Group. Improving the reporting quality of nonrandomized evaluations of behavioral and public health interventions: the TREND statement.	Am J Public Health. 2004;94(3):361. PMID: 14998794 (77)
Quality Improvement Studies	Quality improvement in health care	SQUIRE	http://squire-statement.org/	The full-text of the SQUIRE 2.0 update, published in 2015, is available from:SQUIRE 2.0 SQUIRE 2.0 checklist (PDF) - 2015 update	Davidoff F, Batalden P, Stevens D, Ogrinc G, Mooney S. Publication guidelines for quality improvement in health care: evolution of the SQUIRE project.	Qual Saf Health Care. 2008;17 Suppl 1:i3-i9. PMID: 18836063 (80). BMJ. 2009; 338:a3152. PMID: 19153129 (81). Jt Comm J Qual Patient Saf. 2008;34(11):681-687. PMID: 19025090 (82). Ann Intern Med. 2008;149(9):670-676. PMID: 18981488 (83). J Gen Intern Med. 2008;23(12):2125-2130. PMID: 18830766 (84)
Qualitative research	Qualitative research interviews and focus groups	COREQ	http://intqhc.oxfordjournals.org/content/19/6/349.long		Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups.	Int J Qual Health Care. 2007;19(6):349-357. PMID: 17872937 (85)
	Qualitative research reviews	RATS	http://www.biomedcentral.com/authors/rats		The RATS guidelines modified for BioMed Central Instructions to Authors are copyright Jocalyn Clark, BMJ. They can be found in Clark JP: *How to peer review a qualitative manuscript*. In *Peer Review in Health Sciences*. Second edition. Edited by Godlee F, Jefferson T. London	BMJ Books; 2003:219-235

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TABLE 12. (*continued*).

Research Study Design	Reporting Guideline(S) Provided For	Reporting Guideline Acronym	Reporting Guideline Website URL	Full-Text If Available	Full Bibliographic Reference	
Health Informatics	Evaluation studies in health informatics	STARE-HI			Talmon J, Ammenwerth E, Brender J, de Keizer N, Nykanen P, Rigby M. STARE-HI - Statement on reporting of evaluation studies in Health Informatics.	Int J Med Inform. 2009;78(1):1-9. PMID: 18930696 (86).
Systematic Reviews/Meta-analyses/HTA	Systematic reviews and meta-analyses	PRISMA	http://www.prisma-statement.org/	Full-text PDF documents of the PRISMA Statement, checklist, flow diagram and the PRISMA Explanation and Elaboration PRISMA checklist (Word) PRISMA flow diagram (Word)	Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement.	PLoS Med. 2009; 6(7):e1000097. PMID: 19621072 (88). BMJ. 2009; 339:b2535. PMID: 19622551 (89). Ann Intern Med. 2009;151(4):264-269, W64. PMID: 19622511 (90). J Clin Epidemiol. 2009;62(10):1006-1012. PMID: 19631508 (91). Open Med. 2009;3(3);123-130
	Reporting systematic reviews in journal and conference abstracts	PRISMA for Abstracts			Beller EM, Glasziou PP, Altman DG, Hopewell S, Bastian H, Chalmers I, Gøtzsche PC, Lasserson T, Tovey D; PRISMA for Abstracts Group. PRISMA for Abstracts: Reporting Systematic Reviews in Journal and Conference Abstracts..	PLoS Med. 2013;10(4):e1001419. PMID: 23585737 (122).
	Meta-analysis of observational studies in epidemiology	MOOSE			Stroup DF, Berlin JA, Morton SC, Olkin I, Williamson GD, Rennie D, Moher D, Becker BJ, Sipe TA, Thacker SB. Meta-analysis of observational studies in epidemiology: a proposal for reporting. Meta-analysis Of Observational Studies in Epidemiology (MOOSE) group.	JAMA. 2000; 283(15):2008-2012. PMID: 10789670 (93)
	Meta-analysis of individual participant data				Riley RD, Lambert PC, Abo-Zaid G. Meta-analysis of individual participant data: rationale, conduct, and reporting.	BMJ. 2010;340:c221. PMID: 20139215 (95).
	Synthesis of qualitative research	ENTREQ			Tong A, Flemming K, McInnes E, Oliver S, Craig J. Enhancing transparency in reporting the synthesis of qualitative research: ENTREQ.	BMC Med Res Methodol. 2012;12(1):181. PMID: 23185978 (97).
Economic Evaluations	Economic evaluations of health interventions	CHEERS	http://www.ispor.org/taskforces/EconomicPubGuidelines.asp	Information about the CHEERS Statement and a full-text PDF copy of the CHEERS checklist A full-text PDF copy of the CHEERS checklist is available from: http://www.ispor.org/workpaper/CHEERS/revised-CHEERS-Checklist-Oct13.pdf	Husereau D, Drummond M, Petrou S, Carswell C, Moher D, Greenberg D, Augustovski F, Briggs AH, Mauskopf J, Loder E. Consolidated Health Economic Evaluation Reporting Standards (CHEERS) statement	Eur J Health Econ. 2013;14(3):367-372. PMID: 23526140 (98). Value Health. 2013;16(2):e1-e5. PMID: 23538200 (99). Clin Ther. 2013;35(4):356-363. PMID: 23537754 (100). Cost Eff Resour Alloc. 2013;11(1):6. PMID: 23531194 (101). BMC Med. 2013;11:80. PMID: 23531108 (102). BMJ. 2013;346:f1049. PMID: 23529982 (103). Pharmacoeconomics. 2013;31(5):361-367. PMID: 23529207 (104). J Med Econ. 2013;16(6):713-719. PMID: 23521434 (105). Int J Technol Assess Health Care. 2013;29(2):117-122. PMID: 23587340 (106). BJOG. 2013;120(6):765-770. PMID: 23565948 (107).
Mixed Methods Studies	Mixed methods studies in health services research	GRAMMS			O'Cathain A, Murphy E, Nicholl J. The quality of mixed methods studies in health services research..	J Health Serv Res Policy. 2008;13(2):92-98. PMID: 18416914 (110).
Study Protocols	Defining standard protocol items for clinical trials	SPIRIT	http://www.spirit-statement.org/	The full-text of the SPIRIT 2013 Statement The full-text of the SPIRIT 2013 Statement is available from: http://www.spirit-statement.org/publications-downloads/	Chan A-W, Tetzlaff JM, Altman DG, Laupacis A, Gøtzsche PC, Krleža-Jerić K, Hróbjartsson A, Mann H, Dickersin K, Berlin J, Doré C, Parulekar W, Summerskill W, Groves T, Schulz K, Sox H, Rockhold FW, Rennie D, Moher D. SPIRIT 2013 Statement: Defining standard protocol items for clinical trials.	Ann Intern Med. 2013;158(3):200-207. PMID: 23295957 (111).
	Systematic review and meta-analysis protocols	PRISMA-P		PRISMA-P checklist (Word)	Moher D, Shamseer L, Clarke M, Ghersi D, Liberati A, Petticrew M, Shekelle P, Stewart LA. Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) 2015 statement.	Syst Rev. 2015;4(1):1. PMID: 25554246 (114)
	Systematic reviews in health care		http://www.york.ac.uk/inst/crd/index_guidance.htm			
Statistical methods and analyses	Basic statistical reporting for articles published in biomedical journals	SAMPL	SAMPL Guidelines (pdf)		Lang TA, Altman DG. Basic Statistical Reporting for Articles Published in Biomedical Journals: The "Statistical Analyses and Methods in the Published Literature" or The SAMPL Guidelines"	Smart P, Maisonneuve H, Polderman A (eds). Science Editors' Handbook, European Association of Science Editors, 2013. Int J Nurs Stud. 2015 Jan;52(1):5-9. PMID: 25441757 (116)

(117). This is available through the EQUATOR Network (118).

STATISTICAL ANALYSES AND METHODS

So far, this article has discussed reporting guidelines based on study design. The EQUATOR Network also has a guideline specifically for the reporting of statistical analysis in healthcare research (20).

Statistical Analyses and Methods in the Published Literature (SAMPL)

The guidelines were developed in response to the long-standing, widespread, and potentially serious problem of poor statistical reporting (including basic statistics), often unrecognized by most readers of the medical literature. SAMPL is a set of guidelines for authors, journal editors, and reviewers that aim to educate on how to report basic statistical methods and results. SAMPL consists of recommendations for the general principles for the reporting of statistical methods including preliminary analyses, primary analyses, and supplementary analyses. It outlines principles for the reporting numbers and descriptive statistics, reporting risk, rates, and ratios, reporting hypothesis tests, reporting association analyses, reporting correlation analyses, and reporting regression analyses. It also outlines the principles for reporting analyses of variance or of covariance, reporting survival (time-to-event) analyses, and reporting Bayesian analyses (119).

CONCLUSION

Standard and accepted tools can be used to report clinical research in a standard format for a specific research design. In this article, we describe different study designs (with their reporting guideline) for diagnostic and prognostic studies, for diagnostic accuracy studies (STARD), for prediction models for diagnostic and prognostic studies (TRIPOD), reliability and agreement studies (GRRAS), observational studies (STROBE, The CARE Guidelines, CHERRIES), experimental studies (CONSORT), quality improvement studies (SQUIRE), qualitative research (COREQ), health informatics (STARE-HI), systematic reviews and meta-analyses (PRISMA, MOOSE, and ENTREQ), economic evaluations (CHEERS), mixed methods studies (GRAMMS), and study protocols (SPIRIT). The available guidelines, which can be found at the EQUATOR Network, are summarized in Table 12. We hope that this article completes the review of the key EQUATOR reporting guidelines for radiology researchers including radiologists involved in health services research. We also hope that this article can be used in academic programs to educate the faculty and trainees of the available resources at the EQUATOR Network to improve our health research.

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APPENDIX

TABLE A1 Glossary of Terms

Abbreviation	Full Text
STARD	STAndards for Reporting of Diagnostic accuracy
TRIPOD	Transparent Reporting of a multivariable prediction model for Individual Prognosis Or Diagnosis
GRRAS	Guidelines for Reporting Reliability and Agreement Studies
STROBE	STrengthening the Reporting of OBservational studies in Epidemiology
RECORD	REporting of studies Conducted using Observational Routinely-collected Data
CARE	Case Report
CHERRIES	Checklist for Reporting Results of Internet E-Surveys
CONSORT	CONsolidated Standards Of Reporting Trials
CONSORT PRO	CONsolidated Standards of Reporting Trials Patient-Reported Outcomes
TREND	Transparent Reporting of Evaluations with Nonrandomized Designs
SQUIRE	Standards for Quality Improvement Reporting Excellence
COREQ	COnsolidated criteria for REporting Qualitative research
STARE-HI	STAtement on the Reporting of Evaluation studies in Health Informatics
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analyses
PRISMA-P	Preferred Reporting Items for Systematic Reviews and Meta-Analyses-Protocols
MOOSE	Meta-analysis Of Observational Studies in Epidemiology
ENTREQ	ENhancing Transparency in REporting the synthesis of Qualitative research
CHEERS	Consolidated Health Economic Evaluation Reporting Standards
GRAMMS	Good Reporting of A Mixed Methods Study
SPIRIT	Standard Protocol Items: Recommendations for Interventional Trials
SAMPL	Statistical Analyses and Methods in the Published Literature