Original Investigation

Characteristics, Trends, and Quality of Systematic Review and Meta-Analysis in General Radiology between 2007 and 2015

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Rationale and Objectives: To evaluate the trends, characteristics, and quality of systematic review and meta-analysis in general radiology journals.

Materials and Methods: We performed a PubMed search to identify systematic reviews and meta-analyses that had been carried out in the field of radiology between 2007 and 2015. The following data were extracted: journal, impact factor, type of research, year of publication, radiological subspecialty, imaging modalities used, number of authors, affiliated department of the first and corresponding authors, presence of a radiologist and a statistician among the authors, discordance between the first and corresponding authors, funding, country of first author, methodological quality, methods used for quality assessment, and statistics.

Results: Ultimately, we included 210 articles from nine general radiology journals. The *European Journal of Radiology* was the most common journal represented (47 of 210; 22.4%). Meta-analyses ($n = 177$; 84.3%) were published about five times more than systematic reviews without meta-analysis ($n = 33$; 15.7%). Radiology of the gastrointestinal tract was the most commonly represented subspecialty ($n = 49$, 23.3%). The first authors were most frequently located in China ($n = 64$; 30.3%). In terms of modality, magnetic resonance imaging was used most often ($n = 59$; 28.1%). The number of authors tended to progressively increase over time, and the ratio of discordance between the first and corresponding authors also increased significantly, as did the proportion of research that has received funding from an external source. The mean AMSTAR assessment score improved over time (5.87/11 in 2007–2009, 7.11/11 in 2010–2012, and 7.49/11 in 2013–2015). In this regard, the journal *Radiology* had the highest score (7.59/11).

Conclusions: The quantity and quality of radiological meta-analyses have significantly increased over the past 9 years; however, specific weak areas remain, providing the opportunity for quality improvement.

Key Words: Bibliometrics; meta-analysis; publications; radiology; systematic review.

INTRODUCTION

To evaluate all of the information that has been gathered to date on a particular topic, researchers often perform a systematic review. In a systematic review, researchers identify and screen relevant research articles; they then review and analyze data from the screened research to evaluate the effects of therapeutic interventions or the accuracy of diagnostic tests (1,2). Meta-analysis is a kind of systematic review that uses statistical methods to integrate data from multiple primary studies. Recently, the need for systematic review and meta-analysis in radiological literature has increased because imaging modalities and technology have improved rapidly, and our understanding of evidence-based medicine has increased.

Systematic review and meta-analysis can increase the validity and reduce the bias of the primary studies by integrating the results of multiple studies (1–3). In this way, appropriately performed systematic reviews and meta-analyses provide better quality results. Nonetheless, several published systematic reviews and meta-analyses have used an inappropriate study design (4,5).

The technique of bibliometry allows researchers to evaluate articles that have been published in a particular field over a certain period of time (6,7). Using bibliometric analysis, investigators can assess the characteristics and current status of the given field; they can also guide the future direction of research in that field (6,7).

In the field of radiology research, a few studies have investigated the quality of systematic review and meta-analysis

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(1,8). These reports have focused on the association the study quality with completeness or reporting (1,8). However, none of these recent bibliometric studies have focused on trends and quality assessment in recent systematic reviews and meta-analyses in the field of radiology.

Therefore, the purpose of the present study was to assess the trends, characteristics, and quality of systematic reviews and meta-analyses in general radiology journals between 2007 and 2015.

MATERIALS AND METHODS

Approval was not required from our institutional review board in the present study because bibliometric analysis does not involve human subjects.

Search Strategy

We searched the National Library of Medicine's PubMed database for articles that had been published between January 2007 and December 2015 to identify systematic reviews and meta-analyses in the field of radiology. Specifically, we used the following search filters, as previously reported: ("diagnostic test accuracy" or dta[tiab] or sensitivity) and (specificity[mh] or specificit*[tw] or "false negative"[tw] or accuracy[tw]) (9).

In the search, we only included general radiology journals with an impact factor (IF) above 1.5 points (based on the 2014 ranking by the Thomson Institute of Science Information). In this way, we ensured that all the articles included had been presented to a broad audience in the field of radiology research. In addition, this threshold helped to limit the number of studies that were reviewed.

We excluded articles that covered specific, narrow subspecialties such as *Abdominal Imaging*, Circulation*: Cardiovascular Imaging*, *American Journal of Neuroradiology*, *Pediatric Radiology*, *Skeletal Radiology*, and so on. Detailed information regarding the excluded journals is given in Appendix E1. Articles that had been published in the fields of radiation oncology and nuclear medicine were also excluded. Full-text articles were independently reviewed by two reviewers (J.H.K and J.Y.P), and any disagreements were resolved by a third reviewer (K.H.L.—a radiologist with 23 years' experience). Finally, after a full-text review, articles that contained original research, review articles, and guidelines were also excluded.

Data Extraction

The two reviewers mentioned previously extracted the following information from each article: journal of publication, IF, type of research (systematic review or meta-analysis), year of publication, radiological suspecialty (breast, cardiology, chest, gastrointestinal, genitourinary, head and neck, musculoskeletal, neuroradiology, pediatric, vascular and intervention, or miscellaneous [ie, not conforming to any of the previous categories; eg, whole-body imaging, nuclear medicine, physics, basic science, radiation oncology, contrast media, and radiation protection]), and imaging modalities used (conventional radiography, fluoroscopy, sonography, computed tomography [CT], magnetic resonance imaging [MRI], mammography, nuclear medicine [positron emission tomography, positron emission tomography-computed tomography, single photon emission computed tomography, and scintigraphy], combined [more than one imaging technique used], or other [brain image databank, results of core needle biopsy, computer-assisted analysis, infrared thermal imaging, or automated breast-volume scanner]). In addition, we recorded number of authors (<4, 4–7, >7), affiliation department of the first and corresponding authors (radiology, medicine or surgery, statistics, nuclear medicine, or radiation oncology), the presence of a radiologist and a statistician among the authors, discordance between the first and corresponding authors, funding, country of first author, methodological quality, methods of quality assessment, and methods of statistical analysis (univariate, bivariate, summary receiver operating characteristic [ROC] curve, hierarchic summary ROC curve, or a combination of these methods).

If the first author was affiliated with a department of epidemiology, he or she was included in a group along with those from departments of statistics. If the first author was affiliated with more than one country, the study's country of origin was determined by checking the corresponding author's country of origin.

For the purposes of assessment, we divided the research period into three stages: 2007–2009, 2010–2012, and 2013–2015.

Quality Assessment of Methodology

To evaluate the quality of the systematic reviews and meta-analyses, each of the included articles were independently assessed by two investigators (J.H.K and J.Y.P) using the *Assessing the Methodological Quality of Systematic Reviews* (AMSTAR) checklist (Appendix E2). Each question was rated "yes," "no," "can't answer," or "not applicable." If the answer to a given question was "yes" or "not applicable," it was assigned a point; the total score for all 11 questions was 11 points. In particular, in item 9 of the AMSTAR checklist, systematic review was "not applicable" and was assigned a point. Before all the articles were reviewed, the two reviewers discussed the first 10 papers to identify conflicts in their rating methods. Discrepancies were discussed with a third investigator (K.H.L) until a consensus had been reached.

Statistical Analysis

The studies were divided in terms of stage: 2007–2009, 2010–2012, and 2013–2015. Continuous variables were compared among these groups using analysis of variance. In the case of categorical variables, the Cochran-Armitage test for trend in proportions was used; this was combined with the linear-by-linear association test, where appropriate. Statistical analyses