



ORIGINAL ARTICLE / *Research and innovation*

## Agreement studies in radiology research

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### KEYWORDS

Agreement;  
Reliability;  
Inter-observer;  
Intra-observer;  
Reproducibility

### Abstract

*Purpose:* The goal of this study was to estimate the frequency and the quality of agreement studies published in diagnostic imaging journals.

*Materials and methods:* All studies published between January 2011 and December 2012 in four radiology journals were reviewed. Four trained readers evaluated agreement studies using a 24-item form that included the 15 items of the Guidelines for Reporting Reliability and Agreement Studies criteria.

*Abbreviations:* PRISMA, Preferred Reporting Items for Systematic reviews and Meta-Analysis; GRRAS, Guidelines for Reporting Reliability and Agreement Studies; PRIME, Patients, Raters, Index parameter, Methods, Evaluation; STARD, Standards for Reporting of Diagnostic Accuracy; DEF, Data Extraction Form.

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<http://dx.doi.org/10.1016/j.diii.2016.05.014>

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**Results:** Of 2229 source titles, 280 studies (13%) reported agreement. The mean number of patients per study was  $81 \pm 99$  (SD) (range, 0–180). Justification for sample size was found in 9 studies (3%). The number of raters was  $\leq 2$  in 226 studies (81%). No intra-observer study was performed in 212 (76%) articles. Confidence intervals and interpretation of statistical estimates were provided in 98 (35%) and 147 (53%) of the studies, respectively. In 168 studies (60%), the agreement study was not mentioned in the discussion section. In 8 studies (3%), reporting of the agreement study was judged to be adequate. Twenty studies (7%) were dedicated to agreement. **Conclusion:** Agreement studies are preliminary and not adequately reported. Studies dedicated to agreement are infrequent. They are research opportunities that should be promoted.

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## Introduction

Substantial attention in radiology research is devoted to diagnostic accuracy. Comparatively, agreement studies have not received as much attention. Imaging is increasingly used when gold standard validation is not available. In such circumstances, only agreement studies can assess the objectivity of imaging results. Discrepancies in clinical imaging interpretations are common and the problem has been recognized for a long time [1]. Agreement on routine radiological verdicts can be directly verified in practice and studies are relatively easy to perform [2]. Thus we should expect agreement studies to be commonly reported. Authors of research reports have been encouraged by editors 'to include more observers in their studies, so that meaningful variability measures between observers can be obtained and reported' [3].

The Guidelines for Reporting Reliability and Agreement Studies (GRRAS) to improve reporting of reliability and agreement studies in health care were proposed by Kottner et al. in 2011 [4]. Authors remarked that 'after reviewing many reliability and agreement studies, it becomes apparent that important information about the study design and statistical analysis is often incomplete' [4].

We hypothesized that agreement studies were infrequent and sub-optimally reported in the radiology literature. The goal of our study was to estimate the frequency and the quality of agreement studies published in diagnostic imaging journals.

## Materials and methods

### Protocol

A detailed protocol including objectives, a plan for collecting and analyzing data, and a detailed data extraction form (DEF) were inspired from the Preferred Reporting Items for Systematic reviews and Meta-Analysis (PRISMA) statement [5]. Seminal work by Feinstein et al. were reviewed to assist determining proper items to be included [6–8]. The 24-item DEF includes the 15 items of GRRAS proposed by Kottner et al. [4].

The 24-item DEF was tested and modified when used by 12 readers with varying levels of experience from medical

students to senior staff radiologists. A training set of 5 articles was used to select and prepare the evaluators. As a retrospective analytical research of the literature, this study was exempted from institutional review board approval.

### Articles

We surveyed all articles published during a period of two years (January 2011–December 2012) in four journals (Radiology, *Journal de Radiologie Diagnostique et Interventionnelle* formerly known as *Journal de Radiologie* (J Radiol), American Journal of Neuroradiology (AJNR Am J Neuro-radiol), Canadian Association of Radiologists Journal (Can Assoc Radiol J)). These journals were selected for representing two most cited journals in general radiology, one in English and one in French (Radiology, *Journal de Radiologie*), one most cited in a clinical neuroimaging subspecialty (AJNR) and one national radiological association journal (CARJ). All articles that contained an abstract and full text written in English or French were electronically searched. A literature search for studies published in these journals was performed by using the advanced search tool of each journal website:

(<http://pubs.rsna.org/search/advanced>;  
<http://www.sciencedirect.com/science/journal/02210363>;  
<http://www.sciencedirect.com/science/journal/22115706>;  
<http://www.ajnr.org/search>; <http://www.carjonline.org/issues>). Keywords were (any of): "agreement, observer, inter, kappa, inter-observer" in the title, abstract or text.

All 928 titles were reviewed by one author (B.F.). Editorials, reviews, commentaries and references to other published studies were excluded. Studies were retained if they reported an inter-observer agreement study, identified by the use of any of the following terms: 'inter-observer, -reader, -rater, -assessor, -reviewer, -examiner, -evaluator, -operator', and 'agreement, reliability, reproducibility, repeatability, variability'. Studies dedicated to agreement or reliability were defined as those mentioning agreement or reliability in the title.

### Evaluations

Articles were randomly distributed in batches of 5 or 10 over a period of one year (2013) to 4 trained evaluators with various levels of experience (2, 5, 10 and 29 years). All articles

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