ORIGINAL ARTICLE

# Discrepancy Rates and Clinical Impact of Imaging Secondary Interpretations: A Systematic Review and Meta-Analysis

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## Abstract

**Purpose:** To conduct a meta-analysis of studies investigating discrepancy rates and clinical impact of imaging secondary interpretations and to identify factors influencing these rates.

**Methods:** EMBASE and PubMed databases were searched for original research investigations reporting discrepancy rates for secondary interpretations performed by radiologists for imaging examinations initially interpreted at other institutions. Two reviewers extracted study information and assessed study quality. Meta-analysis was performed.

**Results:** Twenty-nine studies representing a total of 12,676 imaging secondary interpretations met inclusion criteria; 19 of these studies provided data specifically for oncologic imaging examinations. Primary risks of bias included availability of initial interpretations, other clinical information, and reference standard before the secondary interpretation. The overall discrepancy rate of secondary interpretations compared with primary interpretations was 32.2%, including a 20.4% discrepancy rate for major findings. Secondary interpretations were management changing in 18.6% of cases. Among discrepant interpretations with an available reference standard, the secondary interpretation accuracy rate was 90.5%. The overall discrepancy rates by examination types were 28.3% for CT, 31.2% for MRI, 32.7% for oncologic imaging, 43.8% for body imaging, 39.9% for breast imaging, 34.0% for musculoskeletal imaging, 23.8% for neuroradiologic imaging, 35.5% for pediatric imaging, and 19.7% for trauma imaging.

**Conclusion:** Most widely studied in the context of oncology, imaging secondary interpretations commonly result in discrepant interpretations that are management changing and more accurate than initial interpretations. Policymakers should consider these findings as they consider the value of, and payment for, secondary imaging interpretations.

**Key Words:** Secondary interpretation, cancer, systematic review, meta-analysis

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## INTRODUCTION

Secondary interpretation in radiology refers to a radiologist rendering of a formal secondary report for an imaging examination that was originally performed and interpreted at another institution [1]. Such secondary interpretations may occur when patients are referred to more specialized health care centers. In this context, the secondary interpretation may be considered to reflect a more expert opinion with the potential to impact patient care. By requesting a secondary interpretation of the initially obtained examination, the secondary interpretation may avoid the need to repeat the study at the referral center simply to obtain a formal expert review [1].

An analysis of Medicare Part B claims for CT examinations from 1999 to 2012 demonstrated an 811% growth in claims for secondary interpretations,

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greatly outpacing a concurrent 56% increase for primary interpretations [2]. Over that time, Medicare reimbursement coverage rates for secondary interpretations improved, and they are now similar to those for primary interpretations [2]. This growth in utilization and spending for secondary interpretations, however, has caught the attention of payers and policymakers seeking to better understand the value of these services, which at first glance may seem duplicative. Indeed, the CMS has recently sought guidance from the public regarding imaging secondary interpretations, soliciting feedback specifically regarding whether and to what extent it should pay for such services [3].

To better inform policy decisions regarding secondary interpretations, it is important to understand the impact of the secondary interpretations on final rendered radiologic diagnoses as well as clinical decision making. Numerous studies have explored this issue, typically focusing on discrepancy rates between the primary and secondary interpretations. Such studies, however, have occurred in widely varying contexts, often restricted to an individual modality, body region, or clinical scenario, without estimation of the overall rate of discrepant secondary interpretations or formal appraisal of the generalizability of reported discrepancy rates. Therefore, we conducted a meta-analysis of studies to investigate discrepancy rates and the impact on patient management of radiologist secondary interpretations, as well as to identify factors that influence these rates.

## METHODS

### Literature Search

A single fellowship-trained board-certified abdominal radiologist (AR) with 9 years of experience searched the MEDLINE and EMBASE databases to identify relevant articles. The search was conducted on August 13, 2017. The search phrases are provided within the online appendix.

### Study Selection

Figure 1 summarizes the study selection process. The previously noted investigator assessed all abstracts obtained from the initial search for relevancy to the study question. Full texts of articles were obtained when the abstract suggested a potentially relevant study (eg, outcomes related to imaging secondary interpretations). Articles reviewed at the full-text level were then included if all of the following criteria were fulfilled: (1) original research study was published in the English language; (2) the study involved examinations initially interpreted by a radiologist at a different institution; (3) a prospective secondary interpretation was performed by a radiologist; and (4) a discrepancy rate was reported specifically for the imaging interpretation between the primary and secondary interpretations. For studies reporting overlapping patient cohorts, the larger cohort was included. Based on these criteria, the following studies were excluded: (1) studies relating to faculty over-readings of trainee preliminary reports, (2) secondary interpretations of initial emergency setting interpretations within a single institution, and (3) retrospective secondary interpretations purely for purposes of a research investigation.

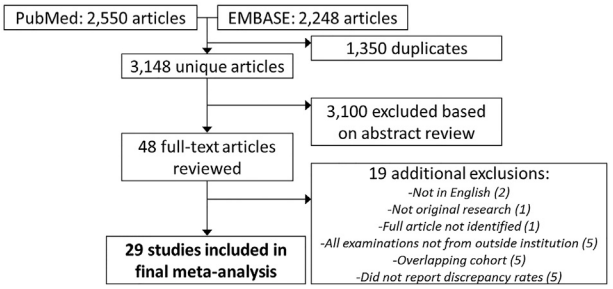


Fig 1. Flowchart of study inclusions and exclusions.

### Data Extraction

Studies meeting inclusion criteria were initially reviewed independently by two investigators (AR and SK, a fellowship-trained board-certified abdominal radiologist with 5 years of experience), with differences then resolved by consensus. The recorded study characteristics were author, year of publication, modality (classified as CT or MRI), body region (classified as brain, body, breast, or musculoskeletal), and clinical context (oncology, trauma or emergency, and pediatrics). The recorded outcome data were total number of cases, number of cases with a discrepancy, number of cases with a major discrepancy, number of cases with an increase or decrease in severity in interpretation, number of cases with a management-changing discrepancy, and number of discrepant cases that were accurate based on a reference standard. Outcome data were recorded at the patient level if available, but if not, at the examination level if available only in this form. The classification of discrepancies as major or minor was based on authors' designation of discrepancies as such within individual articles, when available; otherwise, the study investigators deemed discrepancies to be major when possible to do so