Journal of Clinical Epidemiology 76 (2016) 118−124

Journal of Clinical Epidemiology

Assessment of publication bias required improvement in oral health systematic reviews

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Accepted 22 February 2016; Published online 3 March 2016

Abstract

Objectives: To examine whether the assessment of publication bias in a broad cross-section of oral health systematic reviews (SRs) is in accordance with established methodology.

Study Design and Setting: The electronic databases of 15 dental journals and the Cochrane Database of Systematic Reviews (Oral Health Group) were searched between January 2008 and December 2014 to identify eligible SRs and meta-analyses. The method of publication bias assessment and a range of study characteristics at the SR and the meta-analysis level were recorded.

Results: Four hundred fifty-eight systematic reviews were identified. Quantitative synthesis was undertaken in 162. MEDLINE ($N = 454$, 99%), Cochrane ($N = 343$, 75%), and EMBASE ($N = 283$, 62%) were the most frequently searched databases, whereas search for unpublished literature was used in 40% of the reviews. Publication bias was assessed in 46 meta-analyses with only 46% having appropriately used established methodology, such as funnel plots or statistical tests. Of the 38 meta-analyses including at least 10 studies, only 21 (55%) performed the assessment of publication bias.

Conclusion: This empirical study highlights the shortcomings related to publication bias assessment in SRs within the field of oral health with publication bias either not assessed or done so inappropriately in more than half of the meta-analyses.

Keywords: Oral health; Review; Publication bias; Small-study effects; Meta-analysis; Funnel plot

1. Introduction

Synthesis of the available evidence regarding a particular research question through systematic reviews (SRs) and meta-analyses has been considered the gold standard of evidence-based medicine and clinical decision making [1−3]. The conclusions of SRs hinge on the ability of SRs to identify and include all relevant and eligible research articles from published and indeed unpublished literature, with the latter pertaining to those studies which are not readily accessible to systematic reviewers. There is evidence that original studies reporting significant treatment effects and commercially funded research with positive results are more likely to be published or are published more promptly [4−8]. Preferential publication of primary research based on the nature and direction of the results, commonly known as publication bias, might influence the conclusions of SRs and meta-analyses and by extension health care recommendations.

Publication bias is very often considered as an important threat to the validity of SR results within biomedical research [8−12]. At the SR level, comprehensive literature search both of published and unpublished literature in databases and trial registries, allied to personal communication with authors of included studies, have been recommended to mitigate against selection and publication bias at the search strategy stage [13]. At the meta-analysis level, the presence and extent of publication bias can be investigated

Conflict of interest: None.

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http://dx.doi.org/10.1016/j.jclinepi.2016.02.019
0895-4356/

What is new?

Key findings

- MEDLINE was the most frequent database searched for published literature, while only 40% of systematic reviews involved unpublished literature search.
- Publication bias assessment was improperly undertaken in most oral health–related meta-analyses.

What this adds to what was known?

- Further evidence of shortcomings related to conduct and reporting of systematic reviews in oral health literature are provided.

What is the implication and what should change now?

- The present empirical investigation underpins the need for improved conduct and reporting of systematic reviews as well as the importance of encouraging at all levels publication of individual trials. Approaches such as individual trial registration and awareness during the peer review process can help overcome the problem of publication bias.
- Careful evaluation of appropriateness and eligibility of studies for publication bias assessment should be standard procedure for authors, reviewers, and editors.

graphically and statistically either using methods based on funnel plots (such as the Egger's [14] or Begg and Mazumdars' test [15]) or by using selection models. For an overview of the most frequently used methods for exploring publication bias, see Mavridis and Salanti [16].

Standard funnel plots involve a graphical display of the effect estimate against a measure of its precision. This approach requires a sufficient number of studies (e.g., a minimum of 10 studies) reporting on the same outcome to give a reliable visual impression of symmetry or asymmetry [3]. Apparent asymmetry of the study-specific estimates around the summary estimate is not necessarily indicative of publication bias, as a number of other sources may cause the asymmetry including: true heterogeneity in treatment effects of the included studies, poor study quality, and selective outcome reporting [3,14,17]. Therefore, funnel plots are appropriate for the evaluation of small-study effects rather than publication bias, although these two factors can be related [16,17]. To distinguish between publication bias and other causes of asymmetry, the addition of shaded contours has been suggested that indicate the areas of statistical significance for the relative effects [18]. Meta-regression approaches are often used in tandem with funnel plots and allow mathematical expression of the possible association between relative effects and study size or study precision. Again, the inclusion of at least 10 studies has been suggested as the minimum requirement to statistically detect the presence of small-study effects. Selection models aim to model the mechanism by which studies are selected for publication by attributing to each study a prior probability to be published based on specific characteristics [19]. Selection models have been relatively rarely used as they require the expert and statistical opinion to make robust assumptions.

The reporting of publication bias within meta-analyses has recently been assessed in a subset of high-impact medical journals [20], prompted by the disappointing results of a previous study by Moher et al. [21], which reported that only a small proportion of SRs reported intention to assess publication bias at the SR level. However, there is no report exploring the appropriateness of the methods used to assess publication bias at the meta-analysis level itself within the biomedical literature. Therefore, in this empirical survey, we aimed to record SR characteristics associated with the reporting and presence of publication bias both at the SR and meta-analysis level and to assess whether publication bias was assesses using established methodology in a sample of SRs published in dental journals and the Oral Health Group of the Cochrane Database of Systematic Reviews (Cochrane).

2. Materials and methods

SRs and meta-analyses published in 15 general audience and specialty dental journals (non-Cochrane) with highest impact factor (IF) in 2013 in the field of Oral Health and the Cochrane Database of Systematic Reviews (Oral Health Group) between January 2008 and December 2014 were identified through electronic search within the journals' archives (Appendix Table 1 at www.jclinepi.com). Only SRs that followed a transparent and systematic search methodology were deemed eligible for inclusion. Diagnostic test accuracy, prognostic, prevalence reviews, or reviews with single-group comparisons due to absence of controls or before-after measurements were excluded, in line with a previous report [20], as publication bias assessment has not yet found widespread use in these types of reviews. Animal or laboratory studies were further excluded. Titles and abstracts were screened for inclusion by two authors, and full-text reports were further evaluated based on predefined eligibility criteria.

Data were collected by two authors after initial calibration on 30 studies, at the SR and meta-analyses level. At the SR level, information specific to the implemented literature search and general study characteristics were recorded. Specifically, databases searched, formal search for unpublished literature, communication with authors of included studies, publication year, methodologist involvement, number of authors, continent of authorship, and type of