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Methodological quality of umbrella reviews in endodontics: A cross-sectional study

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Methodological quality of umbrella reviews in endodontics: A cross-sectional study

Abstract

Introduction: In endodontics, the number of umbrella reviews has increased significantly over the last few years, but there is no evidence that they were methodologically sound. The aim of the current study was to appraise the methodological quality of umbrella reviews in endodontics, and to identify possible predictive factors associated with methodological quality.

Methods: Umbrella reviews published in the discipline of endodontics until December 2023 were included. The methodological quality of the reviews was evaluated using a checklist consisting of 11 items. Each item in the checklist was evaluated by two independent assessors who assigned a score of "1" if it was fully addressed, "0.5" if it was partially addressed, and "0" if it was not addressed. Bootstrapped multiple linear regression analysis was used to examine the association between the total scores awarded and five predictor variables (*a priori* protocol registration, year of publication, number of authors, journal impact factor and continent of the corresponding author). The statistical significance level was set as 5%.

Results: A total of 27 reviews were included. Ninety-six percent of the reviews adequately reported: eligibility criteria for selecting the reviews, details of the reviews, techniques for assessing the risk of bias or methodological quality of the individual systematic reviews they included. Only 30% of the reviews adequately managed overlapping primary studies within individual systematic reviews. Among the five predictors analyzed, *a priori* protocol registration and journals with impact factors were associated with significantly greater total methodological quality scores.

Discussion: Several methodological shortcomings in the umbrella reviews published within the field of endodontics were revealed. Umbrella reviews published in journals with impact factors and those with protocols registered *a priori* had significantly superior methodological quality scores.

Conclusion: In endodontics, authors intending to publish umbrella reviews should consider the limitations revealed in this study and follow the appropriate rules to ensure their reviews comply with the highest standards and provide accurate and dependable information and conclusions.

Keywords: Endodontics, methodological quality, systematic review, umbrella review.

1. Introduction

Systematic reviews published in journals within the scope of healthcare professionals synthesize evidence on specific topics to inform day-to-day clinical practice and allow decision-making (Aromataris & Pearson, 2014). The number of systematic reviews published annually has risen dramatically from 1,432 in 2000 to 5,013 in 2010 and to 29,073 in 2019 (Hoffmann et al., 2021). In 2019 this equates to more than 2,400 systematic reviews per month and approximately 80 systematic reviews per day (Hoffmann et al., 2021). This clearly demonstrates that the publication of systematic reviews has increased substantially in recent years, which makes it logical and essential to conduct umbrella reviews of systematic reviews on specific topics in order to ensure they are carried out meticulously and provide valid truthful outcomes (Aromataris et al., 2015).

Umbrella reviews are compilations and appraisals of previously published multiple systematic reviews on a research topic (Aromataris et al., 2015; Belbasis et al., 2022). They provide comprehensive overviews of the evidence available on a wide range of subjects, as well as a comprehensive in-depth evaluation of the quality of the evidence; they can also identify potential research priorities (Bebasis et al., 2022). As a result, they represent one of the highest levels of evidence synthesis that is available, and their influence on biomedical fields continues to increase (Fusar-Poli & Radua, 2018). In the scientific literature, umbrella reviews are often referred to as “overviews of reviews”, “reviews of reviews”, “summary of systematic reviews”, and “synthesis of reviews” (Aromataris et al., 2015).

It is generally accepted that inadequately conducted or reported systematic reviews are considered to be biased and of little use in healthcare fields (Cook et al., 1997; Pussegoda et al., 2017). Unfortunately, there is evidence to suggest that in endodontics the methodological quality of systematic reviews with and without meta-analyses (Suebunukarn et al., 2010; Kattan S et al., 2018; Nagendrababu et al., 2018), as well as systematic reviews with network meta-analyses (Nagendrababu et al., 2022) are often flawed and that improvements in methodology and reporting are required.

The number of umbrella reviews has risen substantially in the last decade (Fusar-Poli & Radua, 2018). In dentistry, particularly in endodontics, the number of umbrella reviews has risen steadily, but there is no evidence to indicate whether they were methodologically sound. This lack of evidence suggests it is necessary and timely to evaluate the methodological quality of umbrella reviews published in endodontics in order to identify methodological shortcomings that can be addressed in the future. In addition, the results of the current study could be used as the foundation for the establishment of methodological guidelines to assist authors undertaking umbrella reviews (Belbasis et al., 2023). Consequently, the primary objective of the current study was to appraise the methodological quality of umbrella reviews within the specialty of endodontics in the expectation that the findings will be used to enhance the planning and conduct of future umbrella reviews. The secondary objective was to identify the predictive factors associated to the methodological quality of umbrella reviews.

2. Methods

2.1 Literature search

Two individuals independently performed literature searches in three databases (PubMed, EbBSCoHost and SCOPUS) to identify umbrella reviews published in English from inception to December 2023. The following search strategy was used: (((((((("root canal") OR (endodontic)) OR (endodontology)) OR (pulpectomy)) OR (pulpotomy)) OR (pulp)) OR ("periapical surgery")) OR ("periradicular surgery")) OR (apicoectomy)) OR (apicectomy)) OR (revitalisation)) AND ((((((umbrella review) OR ("overview of reviews")) OR ("overview of systematic reviews")) OR ("review of reviews")) OR ("review of systematic reviews")) OR ("systematic review of reviews")) OR ("systematic review of systematic reviews")). A search of the grey literature was conducted in the OpenGrey database (opengrey.eu). Additionally, reference lists of the included reviews were screened. Disputes between the two individuals were resolved with the assistance of a third individual.

2.2 Inclusion criteria

- i) Umbrella reviews or overviews of systematic reviews or reviews of systematic reviews in endodontics.
- ii) Umbrella reviews published in English.

2.3 Umbrella review selection process

Independently and in duplicate, two individuals selected the umbrella reviews that matched the inclusion criteria. First, the evaluators examined the titles and abstracts of manuscripts identified through the search, and those that did not satisfy the inclusion criteria were excluded. In a second phase, the full text of the initially included articles was reviewed to determine their final inclusion. If full texts did not satisfy the inclusion criteria, they were excluded, with the reason for the exclusion being documented. Disputes between the two evaluators were resolved with the assistance of a third individual.

2.4 Data extraction

Two individuals carried out the process of data extraction independently. Disagreements were settled by discussion until unanimity was achieved. A third individual made the ultimate determination when disagreements persisted. For each umbrella review, the following items were included in the data extraction form:

- name of the first author,
- number of authors,
- countries of the first and corresponding author,
- year of publication,
- name of the journal,
- impact factor (IF) (JCR 2022) of journal in year publication appeared,
- the instrument used to appraise the methodological quality or risk of bias of the primary studies in each umbrella review,
- whether the protocol of the review had been registered? (YES/NO),
- name of the registry, in which the protocol has been registered.

2.5 Methodological quality of the umbrella reviews

Two individuals evaluated the methodological quality of the umbrella reviews independently. When disagreements occurred and persisted after discussion, the final decision was made by a third individual. If necessary, the corresponding authors of each review were contacted to provide ambiguous or missing information.

No standardized checklist or tool is available to assess the methodological quality of umbrella reviews. Therefore, the first stage of the analysis was dedicated to the development of a new checklist to assess the methodological quality of umbrella reviews using a combination of guidelines from two sources: 1. A Measurement Tool to Assess systematic Reviews (AMSTAR-2) checklist (Shea et al., 2017), and 2. the Cochrane overviews of reviews (Pollock et al., 2023). This resulted in the creation of a checklist containing 11 items (Supplementary Table 1) that was used to appraise the methodological quality of the included umbrella reviews. Among the 11 items, 10 were adapted and modified from the AMSTAR-2 checklist (Shea et al., 2017), and one item from the Cochrane overviews of reviews (Pollock et al., 2023). Items 1, 2, 4, 5, 6, 7, 8, 9, 10, 16 from the original AMSTAR-2 checklist were adapted and modified. Other items from the AMSTAR-2 checklist were not used because they did not fit the nature of umbrella reviews. One item [Did authors manage overlapping systematic reviews? (The degree of overlap in primary studies included in the SRs)] from the Cochrane guidance for overviews of systematic reviews was also included in the checklist to allow an understanding of the robustness of the methodology used by authors. Items in the form of questions were answered with the following scores: “1” if the review completely considered the item, “0.5” if the reviews partially considered the item, “0” if review did not consider the item. To ensure the scores were validated and to avoid any possible misinterpretation, they were disclosed to the authors of the individual reviews (Faggion et al., 2023).

2.6 Potential predictors

The relationship between the following five predetermined predictors and the methodological quality of umbrella review was assessed:

1. Number of authors,
2. *A priori* protocol published (yes or no),
3. Publication year,
4. JCR impact factor of the journal (yes or no),
5. Continent of corresponding author.

2.7 Data analysis

The data were inputted into an Excel spreadsheet. The score for each item on the checklist and the overall score for each umbrella review was calculated. A score of "1" was provided for an adequately addressed item, "0.5" for a partially addressed item, or "0" for an unaddressed item. In order to determine the overall score for each item, the sum of every score awarded for each review was used. The aggregate score for each umbrella review was determined by summing the points assigned to each individual item. As the checklist has 11 items in total, the highest possible score given to an umbrella review was 11, assuming that all items in the checklist were rated as "1".

The data extracted from the included umbrella reviews were tabulated in an Excel spreadsheet and analyzed statistically using Jamovi Computer Software (The jamovi project (2024), jamovi (Version 2.5, <https://www.jamovi.org>)) and SPSS software (Version 27, IBM Corp., Armonk, NY, USA). A multiple linear regression analysis was performed to study the association between the five predictor variables and the total scores. The two continuous predictor variables included in the model were number of authors and publication year, and the three categorical predictor variables were protocol registration status (yes or no), journal impact factor (present or absent) and continent (America, Europe, Asia). The reference category used for the categorical variables were lack of *a priori* protocol registration, absence of impact factor and American continent respectively. The p-value was set at 5%. To evaluate the reliability of the analysis and mitigate the effects of limited sample size, a bootstrapping process was used during the regression analysis. Bootstrapping is a resampling technique which involves drawing repeated samples from the dataset with replacement to estimate the sampling distribution of the regression coefficients. One thousand bootstrap resamples were conducted to derive Bias-corrected and accelerated (BCa) 95% confidence intervals for the coefficient estimates and their standard errors.

3. Results

3.1 Literature search

Initial literature searches resulted in 216 articles with 189 being subsequently excluded from consideration because they failed to meet the inclusion criteria, as determined by title and abstract screening. After reading the full texts, 27 umbrella reviews (Moreira et

al., 2017; Moore et al., 2020; Jakovljevic et al., 2020; Nagendrababu et al., 2020a; Nagendrababu et al., 2020b; Gizani et al., 2021; Leong et al., 2021; Lopes et al., 2021a; Lopes et al., 2021b; Barbosa et al., 2022; Caviedes-Bucheli et al., 2022; Di Spirito et al., 2022; Dotto et al., 2022; Fathi et al., 2022; Jakovljevic et al., 2022; Lin et al., 2022; Ahmad et al., 2022; Rojas-Gutiérrez et al., 2022; Singh et al., 2022; Tewari et al., 2022; Gupta et al., 2023; Só et al., 2023; Khademi et al., 2023; Pinto et al., 2023; Asgary et al., 2023; Lalfakawmi et al., 2023; Tan et al., 2023) were included with none being excluded after this phase. The entire literature search process is illustrated in Figure 1.

3.2 Characteristics of the included reviews

Table 1 contains the characteristics of the included umbrella reviews. The number of authors for each review varied between 2 and 10. Out of the total of 27 reviews, protocols for 21 were registered in the PROSPERO database, while the remaining 6 reviews were not registered. Out of the 27 reviews, 22 utilized the AMSTAR tool for appraisal, while 2 utilized the ROBIS tool, and 2 used both the AMSTAR and ROBIS tools. However, one umbrella review did not utilize any tool to appraise the individual reviews they included (Asgary & Eghbal, 2023). Among the 27 reviews, 1, 1, 3, 4, 11 and 7 were published in 2017, 2018, 2020, 2021, 2022 and 2023, respectively.

3.3 Methodological quality

The overall methodological quality scores awarded to each review are presented in Table 1. Among the 27 reviews, only two (Tewari et al., 2022; Tan et al., 2023) adequately addressed all the items in the checklist. Table 2 displays the adequate reporting rate (%) for each item included in the checklist. Ninety six percentage of reviews reported the following items adequately: Item 1 (Did the umbrella review include the eligibility criteria for selecting the systematic reviews?), Item 7 (Did the umbrella review authors describe the included systematic reviews in adequate detail?) and Item 8 (Did the umbrella review authors use a satisfactory technique for assessing the risk of bias (RoB) or methodological quality in systematic reviews that were included in the umbrella review?). Only 30% of reviews adequately reported item 11 (Did umbrella review authors manage overlapping systematic reviews?).

3.4 Predictors of methodological quality

A total of 27 reviews were considered for analysis. Overall, the multiple linear regression model demonstrated good fit measures, with an R-squared value of 0.618, indicating that approximately 61.8% of the variability in the total score was accounted by the five predictor variables included in the model. The Durbin-Watson Statistic of -1.95 indicated no significant autocorrelation ($p = 0.702$), validating the independence of residuals in the model. Cook's distance values indicated an absence of influential outliers, normality tests were satisfied and the assumption of homoskedasticity was met, ensuring that the variance of the residuals was consistent across different levels of predictor variables included in the model. The multiple linear regression model significantly predicted the total score [$F(6, 20) = 5.39, p = 0.002$], with an adjusted R-squared value of 0.503. The estimates, and their 95% CI values are presented in Table 3. Among the predictor variables, *a priori* protocol registration and presence of a journal impact factor had a significant positive impact on the total scores ($p < 0.05$), while continent, year of publication and the number of authors did not have a significant effect. Furthermore, the bootstrapped analysis provided additional insights into the stability and reliability of the regression coefficients. The Bias Corrected and Accelerated method (BCa) indicated that the estimated 95% confidence intervals for the two predictors (*a priori* protocol registration and presence of a journal impact factor) remained significant (Table 4), underscoring the robustness of the regression analysis.

Regarding the variable 'Year of publication', the p-value of 0.058 (bootstrapped p-value = 0.051) indicates a trend but does not provide strong evidence in this model as the p-value was above the conventional level of statistical significance (5%).

4. Discussion

Umbrella reviews offer clinicians and decision-makers in the healthcare sector an effective means to acquire a comprehensive understanding of a wide range of subjects (Aromataris et al., 2015). This study is the first to evaluate the methodological quality of umbrella reviews in the field of endodontics and analyzed a total of 27 umbrella reviews. This relatively low number indicates that the concept of umbrella reviews in endodontics is at an early phase. However, there has been a clear upward trend in the number of umbrella reviews in recent years. The findings of the present study provide clinicians and researchers with insight into the improvements that authors should make when

conducting umbrella reviews in endodontics to ensure they are of the highest quality. At the same time, it is advisable to conduct periodic investigations into the methodological quality of umbrella reviews to assess the level of trustworthiness that stakeholders can place in their conclusions.

Overall, 96% of the umbrella reviews evaluated in this study provided clear eligibility criteria for selecting the systematic reviews they included. Authors can use the PICO (population, intervention, comparison, and outcomes) framework to establish inclusion criteria when conducting umbrella reviews of interventions (Belbasis et al., 2022). The inclusion criteria must precisely align with and explicitly correspond to the objective and question(s) of the umbrella review (Aromataris et al., 2015).

The search strategy employed in an umbrella review should strive to find all pertinent studies related to the review question. The search strategy must be comprehensively documented, and the specific search filters should be provided in sequence (Aromataris et al., 2015; Aromataris & Riitano, 2014). In order to conduct a thorough umbrella review, it is also important to search the reference lists of the systematic reviews included.

It is worth noting that, among the 27 included umbrella reviews, 22 used the AMSTAR tool for appraisal, while 2 utilized the ROBIS tool, and 2 used both the AMSTAR and ROBIS tools. AMSTAR is a validated checklist with 11 items (Shea et al., 2017). AMSTAR-2 is an updated tool comprising 16 items (Shea et al., 2017) and is used to reliably evaluate the methodological quality of systematic reviews. Additionally, it can be used to determine the overall confidence in the results of a review (Shea et al., 2017). In endodontics, researchers have used the AMSTAR checklist in the past to assess the methodological quality of systematic reviews with meta-analysis (Kattan et al., 2018, Nagendrababu et al., 2018) and systematic reviews with network meta-analysis (Nagendrababu et al., 2022). These studies found that several items on the checklist were not addressed sufficiently by authors. The ROBIS tool is designed to evaluate the risk of bias in systematic reviews within umbrella reviews. ROBIS was developed specifically for conducting systematic reviews in healthcare settings that focus on therapies, diagnosis, prognosis, and aetiology (Whiting et al., 2016). Evidence suggests that ROBIS might be easier to rate than AMSTAR-2 when systematic reviews with meta-analyses are assessed.

However, generally, AMSTAR-2 seems to be more straightforward to use than ROBIS (Perry et al., 2021). Out of the 27 umbrella reviews included in the current study, the protocol for 21 reviews were registered *a priori*. Notably, all 21 reviews were registered in the PROSPERO database, an international database that is an archive for protocols of systematic reviews, rapid reviews, and umbrella reviews (<https://www.crd.york.ac.uk/prospero/>). PROSPERO compiles review protocols with the aim of preventing redundant work, minimizing reporting bias, and increasing transparency (Schiavo, 2019).

In the current study, only eight umbrella reviews assessed the potential overlapping of primary studies included in the systematic reviews. Due to the large number of systematic reviews now being published (Page et al., 2016), it is commonplace for authors of umbrella reviews to identify numerous systematic reviews that cover the same or related research topic and encompass a substantial number of the same primary studies. The presence of overlapping reviews in an umbrella review is likely to introduce bias by including the outcome data of the same primary study numerous times when they are included in multiple systematic reviews (Pollock et al., 2023).

It is good practice for authors of umbrella reviews to report funding sources for each included systematic review or note when that information is not available. It is acknowledged that commercially sponsored studies tend to favor a sponsor's products over independently funded ones (Shea et al., 2017; Lundh et al., 2017).

The present investigation found a positive association between the methodological quality of umbrella reviews and journals with impact factors. Nagendrababu et al., (2023) also found a similar association when they evaluated the methodological quality of systematic reviews in the field of dental traumatology. A potential explanation may be attributed to the fact that journals with an impact factor adhere to more rigorous peer review standards (Nagendrababu et al., 2021a). In the current study, the presence of *a priori* protocol registration was another factor associated with higher methodological quality. According to Dos Santos et al., (2020), registering a protocol in advance has a positive effect on the reporting quality of systematic reviews in the field of dentistry. Several journals, including *Plos journals*, the *British Journal of*

Dermatology, and the *International Endodontic Journal*, have made it compulsory to register systematic reviews before they can be published in recognition of the need for *a priori* protocol registration (PLOS Medicine Editors 2011; Abuabara et al., 2019; Nagendrababu et al., 2021b).

The variables such as the continent of the corresponding author and the number of authors did not have a significant impact in the scores awarded. This may be attributed to the fact that the majority (74%) of the reviews included in the current study were published in journals with impact factors. Regarding the year of publication, the p-value of 0.058 indicates a predictor of a pattern, however it lacks substantial evidence. The probable reason for this positive correlation is that authors and reviewers are acquiring a deeper knowledge of the processes involved when developing systematic reviews (Abushouk et al., 2021). A larger sample than was possible in the present study might provide more insights into the true relationship between the year of publication and the total quality scores of umbrella reviews. Researchers should be cautious about drawing definitive conclusions based on a borderline p-value, and consideration of sample size limitations is crucial in the interpretation of statistical results. Although the smaller number of observations is considered a potential limitation in the present study, bootstrapping was used to enhance the reliability of the regression analysis and to mitigate concerns about sample size and non-normality. The bias-corrected and accelerated (BCa) confidence intervals offered a thorough assessment of estimate variability thereby strengthening the validity of the findings. In the current study, only five variables were included in multiple linear regression analysis to study the association between these variables and the methodological quality of umbrella reviews. In the future, if more umbrella reviews are published, it is probable that a range of other variables may have a positive correlation with the methodological quality of umbrella reviews.

Another limitation of the current study is that it only appraised umbrella reviews written in English, which may create bias as it did not take into account relevant articles in other languages. A further limitation is the lack of a globally accepted and validated standard instrument to assess the methodological quality of umbrella reviews. To address this challenge, the current study employed a unique and customized checklist

that was created by adapting and modifying the AMSTAR-2 checklist, whilst incorporating additional elements from the Cochrane overviews of reviews. It is the opinion of the authors that items from AMSTAR-2 can be applied successfully to umbrella reviews. In fact, several domains of a systematic review are similar to those of an umbrella review, e.g., literature search, data extraction. It is important to emphasise that AMSTAR-2 is not designed for the purpose of generating a percentage score (Shea et al., 2017). In the present study, the overall scores for each item were awarded for descriptive purposes.

Finally, it must be acknowledged that the present study evaluated umbrella reviews by analyzing the information presented in the publications. However, there is a possibility that the authors of the individual umbrella reviews followed the appropriate methodology but did not report it in the publication. Failure to report crucial information may also have occurred because of demands on authors as they navigated the peer-review process, or the word count limitations imposed by journals. Therefore, in an attempt to address these constraints, the scores assigned to each review were sent to the respective authors to seek their opinion on the scores awarded. The authors were therefore able to evaluate the scores awarded and offer feedback on the accuracy and fairness of the assessment, which could ultimately improve the accuracy of the scoring system (Faggion et al., 2023).

5. Conclusion

Several methodological flaws were identified in the umbrella reviews published within the field of endodontics. Authors planning to publish umbrella reviews in future should take into account the flaws identified in this study and adhere to relevant guidelines in order to maintain a rigorous approach and provide more reliable information. Umbrella reviews published in journals with impact factors and reviews with *a priori* protocol registration had significantly higher methodological quality scores. In future, it would be beneficial to perform a study to evaluate the reporting quality of umbrella reviews in the field of endodontics, using the preferred reporting items for overviews of reviews (PRIOR) statement (Gates et al., 2022).

References

- Abuabara, K, van Zuuren, EJ, Flohr C. (2019) Why does the BJD require registration of systematic reviews and meta-analyses?. *Br J Dermatol*, 180, 249–250. doi: 10.1111/bjd.17246.
- Abushouk AI, Yunusa I, Elmeharth AO, Elmatboly AM, Fayek SH, Abdelfattah OM, Saad A, Isogai T, Shekhar S, Kalra A, Reed GW, Puri R, Kapadia S. Quality Assessment of Published Systematic Reviews in High Impact Cardiology Journals: Revisiting the Evidence Pyramid. *Front Cardiovasc Med*, 8, 671569. doi: 10.3389/fcvm.2021.671569.
- Aromataris E, Riitano D. (2014) Systematic reviews: constructing a search strategy and searching for evidence. *Am J Nurs*, 114, 49–56.
- Aromataris E, Pearson A. (2014) The systematic review: an overview. *AJN. Am J Nurs*, 114, 53–58.
- Aromataris E, Fernandez R, Godfrey CM, Holly C, Khalil H, Tungpunkom P. (2015) Summarizing systematic reviews: methodological development, conduct and reporting of an umbrella review approach. *JBIC Evidence Implementation*, 13, 132-140.
- Ahmad MZ, Merdad KA, Sadaf D. (2022) An overview of systematic reviews on endotoxins in endodontic infections and the effectiveness of root canal therapy in its removal. *Evid Based Dent*, 2022. doi: 10.1038/s41432-022-0826-x.
- Asgary S, Eghbal MJ. (2023) Challenging the Misnomer of Irreversible Pulpitis and Deliberating the Urgent Need for Reclassification of Pulpal Diseases Based on the Efficacy of Vital Pulp Therapies: An Overview of Systematic Reviews. *Iran Endod J*, 18, 202-205. doi: 10.22037/iej.v18i4.43035.
- Barbosa AFA, de Lima CO, Moreira T, Sassone LM, Fidalgo TKDS, Silva EJNL. (2022) Photodynamic therapy for root canal disinfection in endodontics: an umbrella review. *Lasers Med Sci*, 37, 2571-2580. doi:10.1007/s10103-022-03569-1.
- Belbasis L, Bellou V, Ioannidis JP. (2022) Conducting umbrella reviews. *BMJ medicine*, 22, e000071.
- Belbasis L, Brooker RD, Zavalis E, Pezzullo AM, Axfors C, Ioannidis JP. (2023) Mapping and systematic appraisal of umbrella reviews in epidemiological research: a protocol for a meta-epidemiological study. *Syst Rev*, 12, 123.

Caviedes-Bucheli J, Muñoz-Alvear HD, Lopez-Moncayo LF, Narvaez-Hidalgo A, Zambrano-Guerrero L, Gaviño-Orduña JF, Portigliatti R, Gomez-Sosa JF, Munoz HR. (2022) Use of scaffolds and regenerative materials for the treatment of immature necrotic permanent teeth with periapical lesion: Umbrella review. *Int Endod J*, 55:967-988. doi: 10.1111/iej.13799.

Cook DJ, Mulrow CD, Haynes RB. (1997) Systematic reviews: synthesis of best evidence for clinical decisions. *Ann Intern Med*, 126, 376–380. [https://doi: 10.7326/0003-4819-126-5-199703010-00006](https://doi.org/10.7326/0003-4819-126-5-199703010-00006).

Di Spirito F, Scelza G, Fornara R, Giordano F, Rosa D, Amato A. (2022) Post-Operative Endodontic Pain Management: An Overview of Systematic Reviews on Post-Operatively Administered Oral Medications and Integrated Evidence-Based Clinical Recommendations. *Healthcare (Basel)*, 10,760. doi:10.3390/healthcare10050760.

Dotto L, Giroto LPS, Correa Silva Sousa YT, Pereira GKR, Bacchi A, Sarkis-Onofre R. (2022) Factors influencing the clinical performance of the restoration of endodontically treated teeth: An assessment of systematic reviews of clinical studies. *J Prosthet Dent*, S0022-3913(22)00213-X. doi:10.1016/j.prosdent.2022.03.030.

Dos Santos MB, Agostini BA, Bassani R, Pereira GK, Sarkis-Onofre R. (2020) Protocol registration improves reporting quality of systematic reviews in dentistry. *BMC Med Res Methodol*, 20, 57. doi:10.1186/s12874-020-00939-7.

Faggion CM Jr, Nagendrababu V, Dummer PM. (2023) Should authors of overviews of systematic reviews invite the authors of the systematic reviews they analysed to attempt to replicate or validate their methodological analysis?. *J Clin Epidemiol*, 158, 177-178. doi: 10.1016/j.jclinepi.2023.03.021.

Fathi A, Ebadian B, Dezaki SN, Mardasi N, Mosharraf R, Isler S, Tabatabaei SS. (2022) An Umbrella Review of Systematic Reviews and Meta-Analyses Evaluating the Success Rate of Prosthetic Restorations on Endodontically Treated Teeth. *Int J Dent*, 2022:4748291. doi: 10.1155/2022/4748291.

Fusar-Poli P, Radua J. (2018) Ten simple rules for conducting umbrella reviews. *BMJ Ment Health*, 21, 95-100.

Gates M, Gates A, Pieper D, Fernandes RM, Tricco AC, Moher D, Brennan SE, Li T, Pollock M, Lunny C, Sepúlveda D, McKenzie JE, Scott SD, Robinson KA, Matthias K, Bougioukas KI, Fusar-Poli P, Whiting P, Moss SJ, Hartling L. Reporting guideline for overviews of reviews of healthcare interventions: development of the PRIOR statement. *BMJ*. 378, e070849. doi: 10.1136/bmj-2022-070849.

Gizani S, Seremidi K, Stratigaki E, Tong HJ, Duggal M, Kloukos D. (2021) Vital Pulp Therapy in Primary Teeth with Deep Caries: An Umbrella Review. *Pediatr Dent*, 43, 426-437.

Gupta A, Aneja K, Wadhwa J, Aggarwal V, Sidhu S, Mehta N. (2023) Preoperative nonsteroidal anti-inflammatory drugs on the success of inferior alveolar nerve block in irreversible pulpitis: An overview of systematic reviews. *Saudi Endod J*, 13, 9-21.

Hoffmann F, Allers K, Rombey T, Helbach J, Hoffmann A, Mathes T, Pieper D. (2021) Nearly 80 systematic reviews were published each day: observational study on trends in epidemiology and reporting over the years 2000-2019. *J Clin Epidemiol*, 138, 1-1.

Jakovljevic A, Duncan HF, Nagendrababu V, Jacimovic J, Milasin J, Dummer PMH. (2020) Association between cardiovascular diseases and apical periodontitis: an umbrella review. *Int Endod J*, 53,1374-1386. doi: 10.1111/iej.13364.

Jakovljevic A, Jacimovic J, Georgiou AC, Nikolic N, Aminoshariae A, van der Waal SV, Nagendrababu V. (2022) Single nucleotide polymorphisms as a predisposing factor for the development of apical periodontitis-An umbrella review. *Int Endod J*, 55, 700-713. doi: 10.1111/iej.13756.

Kattan S, Lee SM, Kohli MR, Setzer FC, Karabucak B. (2018) Methodological Quality Assessment of Meta-analyses in Endodontics. *J Endod*, 44 , 22-31

Khademi A, Iranmanesh P, Mosayebi N, Heydari M, Bagherieh S. (2023) Effect of premedication on the success of inferior alveolar nerve block in patients diagnosed with irreversible pulpitis: An umbrella review. *Dent Res J (Isfahan)*, 20,75.

Lundh A, Sismondo S, Lexchin J, Busuioc OA, Bero L. (2017) Industry sponsorship and research outcome. *Cochrane Database Syst Rev*, 12, MR000033. doi: 10.1002/14651858.MR000033.pub2.

Leong DJX, Yap AU. (2021) Vital pulp therapy in carious pulp-exposed permanent teeth: an umbrella review. *Clin Oral Investig*, 25, 6743-6756. doi: 10.1007/s00784-021-03960-2.

Lopes LB, Neves JA, Botelho J, Machado V, Mendes JJ. (2021a) Regenerative Endodontic Procedures: An Umbrella Review. *Int J Environ Res Public Health*, 18, 754. doi: 10.3390/ijerph18020754.

Lopes LB, Calvão C, Vieira FS, Neves JA, Mendes JJ, Machado V, Botelho J. (2021b) Vital and Nonvital Pulp Therapy in Primary Dentition: An Umbrella Review. *J Clin Med*, 11, 85. doi: 10.3390/jcm11010085.

Lin GSS, Yew YQ, Lee HY, Low T, Pillai MPM, Laer TS, Wafa SWWSST. (2022) Is pulpotomy a promising modality in treating permanent teeth? An umbrella review. *Odontology*, 110, 393-409. doi: 10.1007/s10266-021-00661-w.

Lalfakawmi S, Gupta A, Bukhari S, Abraham D, Singh A, Mrinalini. (2023) Efficacy of corticosteroids on postoperative pain levels after nonsurgical endodontic treatment: An overview of systematic reviews. *Saudi Endod J*, 13, 217–24.

Moreira MS, Anuar ASN, Tedesco TK, Dos Santos M, Morimoto S. (2017) Endodontic Treatment in Single and Multiple Visits: An Overview of Systematic Reviews. *J Endod*, 43,864-870. doi: 10.1016/j.joen.2017.01.021.

Moore PA, Ziegler KM, Lipman RD, Aminoshariae A, Carrasco-Labra A, Mariotti A. (2020) Benefits and harms associated with analgesic medications used in the management of acute dental pain: An overview of systematic reviews. *J Am Dent Assoc*, 149,256-265.e3. doi: 10.1016/j.adaj.2018.02.012.

Nagendrababu V, Segura-Egea JJ, Fouad AF, Pulikkotil SJ, Dummer PMH. (2020a) Association between diabetes and the outcome of root canal treatment in adults: an umbrella review. *Int Endod J*, 53:455-466. doi: 10.1111/iej.13253.

Nagendrababu V, Duncan HF, Whitworth J, Nekoofar MH, Pulikkotil SJ, Veettil SK, Dummer PMH. (2020b) Is articaine more effective than lidocaine in patients with irreversible pulpitis? An umbrella review. *Int Endod J*, 53,200-213. doi: 10.1111/iej.13215.

Nagendrababu V, Pulikkotil SJ, Sultan OS, Jayaraman J, Peters OA. (2018) Methodological and reporting quality of systematic reviews and meta-analyses in endodontics. *J Endod*, 44, 903-913

Nagendrababu V, Jakovljevic A, Jacimovic J, Duncan HF, Jayaraman J, Dummer PM. (2021a) Critical analysis of the reporting quality of randomized trials within Endodontics using the Preferred Reporting Items for RAndomized Trials in Endodontics (PRIRATE) 2020 quality standard checklist. *Int Endod J*, 54, 1083-1104

Nagendrababu V, Duncan HF, Dummer PMH. (2021b) International Endodontic Journal policy on mandatory prospective (a priori) protocol registration for clinical trials and systematic reviews. *Int Endod J*, 54, 1685-1686. doi:10.1111/iej.13581

Nagendrababu V, Faggion CM Jr, Pulikkotil SJ, Alatta A, Dummer PM. (2022) Methodological assessment and overall confidence in the results of systematic reviews with network meta-analyses in Endodontics. *Int Endod J*, 55, 393-404.

Nagendrababu V, Faggion CM Jr, Gopinath VK, Narasimhan S, Duncan HF, Levin L, Abbott PV, Dummer PM. (2023) Methodological assessment and overall confidence in the results of systematic reviews with meta-analyses focusing on traumatic dental injuries: A cross-sectional study. *Dent Traumatol*, 39, 637-646.

Pussegoda K, Turner L, Garritty C, Mayhew A, Skidmore B, Stevens A, Boutron I, Sarkis-Onofre R, Bjerre LM, Hróbjartsson A, Altman DG, Moher D. (2017) Systematic review adherence to methodological or reporting quality. *Syst Rev*, 6, 131. [https://doi:10.1186/s13643-017-0527-2](https://doi.org/10.1186/s13643-017-0527-2).

Pollock M, Fernandes RM, Becker LA, Pieper D, Hartling L (2023). Chapter V: Overviews of Reviews. In: Higgins JPT, Thomas J, Chandler J, Cumpston M, Li T, Page MJ, Welch VA (Eds.). *Cochrane Handbook for Systematic Reviews of Interventions* version 6.4 (updated August 2023). Cochrane, Available from <http://www.training.cochrane.org/handbook>.

Page M, Shamseer L, Altman D, Tetzlaff J, Sampson M, Tricco A, Catalá-López F, Li L, Reid E, Sarkis-Onofre R. (2016) Epidemiology and reporting characteristics of systematic reviews of biomedical research: a cross-sectional study. *PLoS Medicine*, 13, 30.

PLoS Medicine Editors. (2011) Best practice in systematic reviews: the importance of protocols and registration. *PLoS Med*, 8, e1001009. doi:10.1371/journal.pmed.1001009.

Perry R, Whitmarsh A, Leach V, Davies P. (2021) A comparison of two assessment tools used in overviews of systematic reviews: ROBIS versus AMSTAR-2. *Syst Rev*, 10, 1-20.

Pinto KP, Serrão G, Alves Ferreira CM, Sassone LM, Fidalgo TKDS, Silva EJNL. (2023) Association between Apical Periodontitis and Chronic Diseases: An Umbrella Review. *Iran Endod J*, 18, 134-144. doi: 10.22037/iej.v18i3.42560.

Rojas-Gutiérrez WJ, Pineda-Vélez E, Agudelo-Suárez AA. (2022) Regenerative Endodontics Success Factors and their Overall Effectiveness: An Umbrella Review. *Iran Endod J*, 17,90-105. doi: 10.22037/iej.v17i3.32703.

Suebnuakarn S, Ngamboonsirisingh S, Rattanabanlang A. (2010) A systematic evaluation of the quality of meta-analyses in endodontics. *J Endod*, 36, 602-608.

Shea BJ, Reeves BC, Wells G, Thuku M, Hamel C, Moran J, Moher D, Tugwell P, Welch V, Kristjansson E, Henry DA. (2017) AMSTAR 2: a critical appraisal tool for systematic reviews that include randomised or non-randomised studies of healthcare interventions, or both. *BMJ*, 358, j4008.

Schiavo JH. (2019) PROSPERO: an international register of systematic review protocols. *Medical reference services quarterly*, 38, 171-180.

Schiavo JH. (2019) PROSPERO: an international register of systematic review protocols. *Medical reference services quarterly*, 38, 171-180.

Singh AK, Khanal N, Acharya N, Hasan MR, Saito T. (2022) What Are the Complications, Success and Survival Rates for Autotransplanted Teeth? An Overview of Systematic Reviews and Metanalyses. *Healthcare (Basel)*, 10, 835. doi:10.3390/healthcare10050835.

Só GB, Silva IA, Weissheimer T, Lenzi TL, Só MVR, da Rosa RA. (2023) Do NSAIDs used prior to standard inferior alveolar nerve blocks improve the analgesia of mandibular molars with irreversible pulpitis? An umbrella review. *Clin Oral Investig*, 27,1885-1897. doi: 10.1007/s00784-023-04979-3.

Tewari N, Goel S, Mathur VP, O'Connell AC, Johnson RM, Rahul M, Sultan F, Goswami M, Srivastav S, Ritwik P. (2022) Success of medicaments and techniques for pulpotomy of primary teeth: An overview of systematic reviews. *Int J Paediatr Dent*, 32, 828-842. doi: 10.1111/ipd.12963.

Tan BL, Tong HJ, Narashimhan S, Banihani A, Nazzal H, Duggal MS. (2023) Tooth autotransplantation: An umbrella review. *Dent Traumatol*, 39, 2-29. doi: 10.1111/edt.12836.

Whiting P, Savović J, Higgins J, Caldwell D, Reeves B, Shea B, Davies P, Kleijnen J, Churchill R. (2016) ROBIS: a new tool to assess risk of bias in systematic reviews was developed. *J Clin Epidemiol*, 69, 9.

Table 1: Characteristics of included umbrella reviews.

No	Name/Year	Number of authors	Country of the first author/ corresponding author	Journal Name	Impact factor* (IF) JCR 2022	Instrument used to appraise the methodological quality or risk of bias	Protocol registered	Name of registry	Methodological quality scores
1	Moreira et al. 2017	5	Brazil / Brazil	JOE	2.886	AMSTAR	NO	NR	5.5
2	Moore et al. 2018	6	USA/USA	JADA	2.572	AMSTAR 2	YES	PROSPERO	7
3	Jakovljevic et al. 2020	6	Serbia/ Serbia	IEJ	5.264	AMSTAR 2	YES	PROSPERO	9.5
4	Nagendrababu, Segura-Egea et al. 2020	5	Malaysia / Malaysia	IEJ	5.264	AMSTAR	YES	PROSPERO	8.5
5	Nagendrababu, Duncan et al. 2020	7	Malaysia / Malaysia	IEJ	5.264	AMSTAR	YES	PROSPERO	8.5
6	Gizani et al. 2021	6	Greece/ Switzerland and Singapore	PD	2.378	ROBIS	YES	PROSPERO	8.5
7	Leong and Yap 2021	2	Singapore / Singapore	COI	3.607	AMSTAR 2	YES	PROSPERO	10.5
8	Lopes, Neves et al.2021	5	Portugal / Portugal	IJERPH	4.614	AMSTAR 2	NO	NR	8.5
9	Lopes, Calvao et al. 2021	7	Portugal / Portugal	JCM	4.964	AMSTAR2	NO	NR	9
10	Barbosa et al. 2022	6	Brazil/ Brazil	LMS	2.1	AMSTAR 2	YES	PROSPERO	9.5
11	Caviedes-Bucheli et al.2022	9	Colombia / Colombia	IEJ	5	AMSTAR-2 and ROBIS	YES	PROSPERO	7.5
12	Di Spirito et al.2022	6	Italy/ Italy	HC	2.8	AMSTAR 2	NO	NR	8.5
13	Dotto et al.2022	6	Brazil/ Brazil	JPD	4.6	AMSTAR 2	YES	PROSPERO	10
14	Fathi et al. 2022	7	Iran/ Iran	IJD	2.1	AMSTAR 2	NO	NR	7
15	Jakovljevic et al. 2022	7	Serbia/ Serbia	IEJ	5	AMSTAR 2	YES	PROSPERO	10.5
16	Lin et al.2022	7	Malaysia / Malaysia	OD	2.5	AMSTAR 2	YES	PROSPERO	9.5
17	Ahmad et al. 2022	3	Saudi Arabia/ UK	EBD	NA	AMSTAR 2	YES	PROSPERO	8.5
18	Rojas-Gutiérrez et al.2022	3	Colombia/ Colombia	IREJ	NA	AMSTAR-2	YES	PROSPERO	7.5

19	Singh et al. 2022	5	Nepal/ Japan	HC	2.8	ROBIS	YES	PROSPERO	9.5
20	Tewari et al 2022	10	India / India	IJPD	3.8	AMSTAR-2 and ROBIS tool.	YES	PROSPERO	11
21	Gupta et al. 2023	6	India/ India	SEJ	NA	AMSTAR	YES	PROSPERO	8.5
22	So et al. 2023	6	Brazil/ Brazil	COI	3.4	AMSTAR 2	YES	PROSPERO	9.5
23	Khademi et.al 2023	5	Iran/ Iran	DRJ	NA	AMSTAR 2	YES	PROSPERO	9.5
24	Pinto et al. 2023	6	Brazil/ Brazil	IREJ	NA	AMSTAR-2	YES	PROSPERO	9.5
25	Asgary and Eghbal 2023	2	Iran / Iran	IREJ	NA	NR	NO	NR	2.5
26	Lalfakawmi et.al 2023	6	India / India	SEJ	NA	AMSTAR	YES	PROSPERO	6.5
27	Tan et al.2023	6	Singapor e/ Qatar	DT	2.5	AMSTAR 2	YES	PROSPERO	11

Note: JOE- Journal of Endodontics, JADA- Journal of the American Dental Association, IEJ-International Endodontic Journal, PD- Pediatric Dentistry, COI-Clinical Oral Investigations, IJERPH-International Journal of Environmental Research and Public Health, JCM-Journal of Clinical Medicine, LMS-Lasers in Medical Science, HC- Healthcare, JPD- The Journal of Prosthetic Dentistry, IDJ-International Journal of Dentistry, OD- Odontology, EBD-Evidence-Based Dentistry, IREJ-Iranian Endodontic Journal, IJPD-International Journal of Paediatric Dentistry, SEJ-Saudi Endodontic Journal, DRJ-Dental Research Journal, DT- Dental Traumatology. *Impact factor for the year 2023 is not available so the 2022 IF was used; NR: Not reported; NA: Not available

Table 2: Summary of methodological quality assessment

No	Checklist Items	Adequately reported n(%)	Partially reported n(%)	Not reported n(%)
1	Did the umbrella review include the eligibility criteria for selecting the systematic reviews?	26 (96.3)	0 (0)	1 (3.7)
2	Did the report of the umbrella review contain an explicit statement that the review methods were established prior to the conduct of the review and did the report justify any significant deviations from the protocol?	2 (7.4)	22 (81.5)	3 (11.1)
3	Did the umbrella review authors use a comprehensive literature search strategy?	23 (85.2)	2 (7.4)	2 (7.4)
4	Did the umbrella review authors perform study selection in duplicate?	23 (85.2)	0 (0)	4 (14.8)
5	Did the umbrella review authors perform data extraction in duplicate?	23 (85.2)	0 (0)	4 (14.8)
6	Did the umbrella review authors provide a list of excluded studies and justify the exclusions?	18 (66.7)	1 (3.7)	8 (29.6)
7	Did the umbrella review authors describe the included systematic reviews in adequate detail?	26 (96.3)	0 (0)	1 (3.7)
8	Did the umbrella review authors use a satisfactory technique for assessing the risk of bias (RoB) or methodological quality in systematic reviews that were included in the umbrella review?	26 (96.3)	0 (0)	1 (3.7)
9	Did the umbrella review authors report on the sources of funding for the systematic reviews included in the umbrella review?	20 (74.1)	0 (0)	7 (25.9)
10	Did the umbrella review authors report any potential sources of conflict of interest, including any funding they received for conducting the umbrella review?	24 (88.9)	0 (0)	3 (3.7)
11	Did umbrella review authors manage overlapping systematic reviews? (The degree of overlap in primary studies included in the SRs)	8 (29.6)	0 (0)	19 (70.4)

Table 3: Multiple Linear regression results for variables influencing total methodological quality scores

Predictor	Estimate	SE	95% Confidence Interval		t	p
			Lower	Upper		
Intercept	-826.4799	412.473	-1686.8831	33.923	-2.004	0.059
Protocol registered [#] (Reference: Not registered)	2.5716	0.654	1.2083	3.935	3.935	<.001
Impact factor [#] (Reference: Non-Impact factor Journal)	2.0377	0.760	0.4514	3.624	2.680	0.014
Year	0.4111	0.204	-0.0147	0.837	2.014	0.058
Continent: (Reference – America)						
Europe – Americas	1.2642	0.755	-0.3114	2.840	1.674	0.110
Asia – Americas	0.2870	0.599	-0.9626	1.537	0.479	0.637
Number of authors	0.0236	0.166	-0.3217	0.369	0.142	0.888

- Predictors had significantly association with higher methodological quality scores.

Table 4 - Bootstrapped Coefficient Estimates for Multiple Linear Regression Model

	Bias	SE	p-value	BCa 95% Confidence Interval	
				Lower	Upper
Intercept	-49.267	383.439	.052	-1372.934	-308.161
Protocol registered [#]	-.072	1.016	.031	.850	4.264
Impact Factor [#]	-.036	.795	.040	.476	3.569
Year	.024	.190	.051	-.185	.891
Europe – Americas	.013	.879	.132	-.063	3.114
Asia – Americas	-.004	.570	.626	-.892	1.472
Number of authors	-.026	.225	.898	-.366	.376

BCa- Bias Corrected and Accelerated method; # - Predictors had significantly association with higher methodological quality scores.

Supplementary Table 1: Checklist used to appraise the methodological quality of umbrella reviews in endodontics

No	Items	YES/ PARTIAL YES/ NO
1	Did the umbrella review include the eligibility criteria for selecting the systematic reviews?	YES/NO
2	Did the report of the umbrella review contain an explicit statement that the review methods were established prior to the conduct of the review and did the report justify any significant deviations from the protocol? For PARTIAL YES: The authors stated that they had a written protocol or guide that included ALL the following: a) a search strategy b) inclusion/exclusion criteria c) a risk of bias assessment For YES: As for PARTIAL YES, plus the protocol was registered and should also have specified: d) a plan to assess overlapping of systematic reviews or primary studies included in the systematic reviews	YES/ PARTIAL YES/ NO
3	Did the umbrella review authors use a comprehensive literature search strategy? For PARTIAL YES (all the following): a) searched at least 2 databases (relevant to research question) b) provided key words and/or search strategy For YES (ab+cd): c) searched the reference lists / bibliographies of included reviews d) conducted search within 24 months of completion of the review	YES/ PARTIAL YES/ NO
4	Did the umbrella review authors perform study selection in duplicate? For YES, either ONE of the following: at least two reviewers independently agreed on selection of eligible studies and achieved consensus on which studies to include OR two reviewers selected a sample of eligible studies and achieved good agreement (at least 80 percent), with the remainder selected by one reviewer	YES/ NO

5	Did the umbrella review authors perform data extraction in duplicate? For YES, either ONE of the following: at least two reviewers achieved consensus on which data to extract from included studies OR two reviewers extracted data from a sample of eligible studies and achieved good agreement (at least 80 percent), with the remainder extracted by one reviewer	YES/ NO
6	Did the umbrella review authors provide a list of excluded studies and justify the exclusions? For PARTIAL YES: provided a list of all potentially relevant studies that were read in full-text form but excluded from the review For YES, must also have: Provide reasons for exclusion after reading full-text	YES/ PARTIAL YES/ No
7	Did the umbrella review authors describe the included systematic reviews in adequate detail? • Country or continent • Year of publication • Journal name or type of journal or journal IF • Topic • Funding • Type of overview (interventions or other) • Number of included studies • Design of included studies • Intervention/control • Search period • Tools used to assess RoB • Finding of the review For YES - the review reported 5-12 characteristics For PARTIAL YES - the review reported 3-4 characteristics For NO - the review reported 1-2 characteristics	YES/ PARTIAL YES/ NO
8	Did the umbrella review authors use a satisfactory technique for assessing the risk of bias (RoB) or methodological quality of the systematic reviews that were included in the umbrella review? For YES- used tools such as AMSTAR-2 or ROBIS For NO - used reporting tools (such as PRISMA) or used no tool	YES/NO

9	Did the authors of the umbrella review report the sources of funding for the systematic reviews included in the umbrella review? For YES - the sources of funding for systematic reviews included in the umbrella review were reported Note: Reporting that the umbrella review authors looked for this information, but it was not reported by the authors of the included systematic review also qualifies	YES/NO
10	Did the authors of the umbrella review report any potential sources of conflict of interest, including any funding they received for conducting the umbrella review? For YES: the authors reported no competing interests. OR The authors described their funding sources and how they managed potential conflicts of interest.	YES/NO
11	Did the authors of the umbrella review manage overlapping systematic reviews? (The degree of overlap in primary studies included in the SRs) For YES - any information on overlapping reported, For NO - no information on overlapping reported	YES/NO

Note: Items 1 to 10 are derived from the AMSTAR-2 checklist and Item 11 is derived from the Cochrane overview of reviews

Figure 1: Literature search process

