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Outcome measures for randomized controlled trials on carious lesion management in children and adolescents (CARPED-COS): protocol for developing a Core Outcome Set

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Study protocol

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Abstract

Background: This study aims to develop a core outcome set (COS) for randomized controlled trials (RCTs) evaluating strategies for managing carious lesions in primary teeth and permanent molars in patients up to 19 years of age.

Methods: The research will consist of three phases. Phases 1 and 2 will focus on mapping the outcomes used in RCTs involving deciduous teeth and permanent molars, respectively. Two independent examiners will perform studies selection and data extraction in duplicate. Searches will be conducted in electronic databases, including MEDLINE/PubMed, Scopus, Web of Science, Embase, and the Cochrane Library. Extracted outcomes will be categorized into domains. Phase 3 will focus on the development of the COS and will involve qualitative interviews, a two-round Delphi survey, and consensus meetings. Participants will be selected to ensure representation across different areas of expertise, experiences, roles, and geographic regions, including patients, dentists, and researchers.

Discussion: This study addresses an important gap in cariology research by proposing a COS for clinical trials on the management of carious lesions in children and adolescents. Standardizing outcomes is expected to improve consistency and comparability across studies, facilitate evidence synthesis, and support the development of clearer and more clinically applicable recommendations.

Background

The generation of evidence in health research ideally follows a continuum from primary studies to the development of clinical guidelines and their implementation in practice. However, this process involves several distinct stages at which research may fail to effectively inform patient care. One key barrier arises when results from randomized controlled trials (RCTs) cannot be compared or combined due to heterogeneity in reported outcomes. [1]

Outcome heterogeneity in primary studies limits the synthesis of evidence in systematic reviews and meta-analyses, which are essential to increase statistical power and support evidence-based clinical decision-making. [2] When outcomes differ substantially across studies, it becomes difficult to determine the relative benefits of interventions, potentially delaying the adoption of effective treatments or the discontinuation of ineffective ones. [1]

Traditionally, outcomes in clinical research have been selected by researchers based on their own perspectives, often without the involvement of other stakeholders. As a result, outcomes that are important to patients may be overlooked, while others may be overemphasized or selectively reported. [3–5] This practice can compromise the relevance, transparency, and applicability of research findings.

Patient-reported outcomes (PROs) have gained increasing attention because they capture patients' perceptions of their health status and treatment effects without interpretation by clinicians or

researchers. [6] Incorporating patient perspectives in outcome selection can improve the relevance of research and contribute to more patient-centred healthcare decisions. [7]

To address these challenges, Core Outcome Sets (COS) have been proposed. A COS is an agreed minimum set of outcomes that should be measured and reported in all clinical trials for a specific health condition. The use of COS can reduce outcome heterogeneity, minimize selective reporting, and improve the comparability and synthesis of research findings. [8, 9] Several organizations, including the GRADE Working Group, Cochrane, and the World Health Organization, recognize the importance of COS in strengthening the evidence base for clinical guidelines. The Core Outcome Measures in Effectiveness Trials (COMET) Initiative was established to support the development and implementation of COS and provides resources and a database of ongoing and completed COS studies. [8]

In pediatric dentistry, however, COS development remains limited. A systematic review identified only one COS in this field, focused on pulp treatment in primary teeth. [10, 11] Meanwhile, meta-research has shown a high prevalence of selective outcome reporting in cariology trials, particularly those evaluating restorative treatments in children and adolescents. [5, 12] Dental caries remains one of the most prevalent diseases worldwide and significantly affects children's oral health-related quality of life, causing pain, infections, and impacts on daily activities and school performance. [13] Despite its clinical and public health relevance, COS initiatives in cariology are still scarce.

Therefore, the aim of this study is to develop a Core Outcome Set for randomized controlled trials evaluating strategies for the management of carious lesions in primary and permanent molars in patients up to 19 years of age - CARPED-COS.

Methods

Study design

This study was registered in the Core Outcome Measures in Effectiveness Trials (COMET) Initiative database (comet-initiative.org/Studies/Details/3439) and in the Open Science Framework (OSF) (doi: 10.17605/OSF.IO/XW8E2), where study materials and data will be made publicly available . The protocol was developed in accordance with the Core Outcome Set-STAndardised Protocol Items (COS-STAP) statement and the COMET Handbook [14,8].

The project will be conducted in three sequential phases. Phases 1 and 2 are meta-research studies designed to identify and map outcomes reported in randomized controlled trials (RCTs) evaluating management strategies for carious lesions in primary teeth (Phase 1) and posterior permanent teeth (Phase 2). Phase 3 will involve the development of a Core Outcome Set (COS) in this field through qualitative interviews, a two-round Delphi survey, and a consensus meeting.

Phases 1 and 2: Identification and mapping of outcomes through meta-research studies

Phases 1 and 2 will be reported according to the Guidelines for Reporting Meta-Epidemiological Methodology Research. [15]

Information sources

Systematic searches will be conducted in MEDLINE/PubMed, Scopus, Web of Science, Embase, Cochrane Library, and ProQuest for grey literature, without restrictions on language or year of publication. Reference lists of potentially eligible studies will also be screened.

Search strategy

To guide the development of search strategies for each meta-research study, specific PICOS questions were defined based on the scope of the review. The following elements were considered:

Health condition: carious lesions in primary teeth and permanent molars.
Target population: children and adolescents with carious lesions.
Intervention: all strategies used for the management of carious lesions.
Study design: randomized controlled trials (RCTs).

Search strategies will be developed for MEDLINE/PubMed and adapted for the other databases. Records will be imported into Rayyan, and duplicates will be removed.

Study selection process

The study selection process will be conducted using the Rayyan software by two reviewers independently, in duplicate, and blinded. [16] One researcher will be involved in all stages of the process. Two additional reviewers will also perform checks of the selected studies, both for eligibility criteria and data extraction, resulting in two designated reviewers for each meta-research study.

Initially, both reviewers will assess titles and abstracts according to the inclusion criteria. In cases of insufficient information for decision-making, absence of an abstract, or lack of clarity in the abstract, the study will be carried forward to the next stage. Subsequently, the same two reviewers will independently, in duplicate, and blinded, assess the full texts of eligible articles according to the exclusion criteria.

A third researcher, experienced in research on the management of carious lesions, will resolve any disagreements or uncertainties.

Eligibility criteria

Initially, the titles and abstracts of potentially relevant studies identified through the database searches will be assessed by two reviewers based on the following inclusion criteria: (1) randomized controlled

trials (RCTs); and (2) studies evaluating management strategies for carious lesions in primary teeth (Phase 1) or posterior permanent teeth (Phase 2).

Following the initial screening, articles meeting the inclusion criteria will be assessed in full text. Studies will then be considered ineligible if they meet at least one of the following exclusion criteria: (1) lack of clarity in outcome measures or methods of measurement; (2) studies conducted in specific patient groups (e.g., individuals undergoing medication or with special healthcare needs); and (3) insufficient description of the intervention or comparator. When multiple reports describe the same sample, the most complete report will be included.

Data extraction

The same two reviewers will independently and in duplicate extract data from the eligible articles. For each included study, the following information will be systematically collected: publication details (authors, year of publication, country, journal, and trial registration), sample characteristics (number and age of participants, year of participant recruitment), study methodology (type of randomized controlled trial, study setting, sample size calculation [yes/no], compared interventions, follow-up period, list of reported primary and secondary outcomes, and indices/measures used to assess outcomes), as well as conflict of interest and funding.

An outcome will be considered primary if it is explicitly defined as such or if the study clearly focuses on a single outcome. If no primary outcome is identified or if multiple outcomes are reported, these will be classified as secondary. [4]

Data analysis

Initially, a list of extracted outcomes will be developed, grouping those described using different terms but with similar meanings under a single, previously agreed term. Thus, outcomes will be grouped by similarity and categorized under predefined terms. Outcome categorization will be performed independently and in duplicate by two reviewers. In cases of disagreement, a third reviewer will be consulted. Similarly, the inclusion of new categories will be determined through consensus among the researchers involved in the study. A descriptive analysis will be conducted to illustrate the distribution of outcomes across the RCTs.

Phase 3: Core Outcome Set Development

The COS will be developed based on outcomes identified in Phases 1 and 2, as well as additional outcomes generated from stakeholder input. Its development will involve qualitative interviews, a two-round Delphi process, and a consensus meeting.

Participants

Patients and/or their caregivers, dentists, and researchers will be recruited according to the eligibility criteria described below. This approach aims to ensure a diverse and representative sample, allowing for a comprehensive understanding of the perspectives of different stakeholder groups involved in the management of cavitated carious lesions.

Accordingly, the following participants will be included:

- Patients up to 19 years of age with experience of carious lesions in primary or permanent molars, and/or their parents or caregivers, will be eligible to participate.

- Dental professionals with experience in managing carious lesions in children and adolescents;

- Researchers working in the field of cariology.

The following participants will be excluded:

- Patients with special healthcare needs and/or their caregivers;
- Dentists who are also researchers;
- Researchers who do not conduct studies on the treatment of carious lesions.

Participants will be recruited as follows:
For the qualitative phase, an initial search will be conducted in the Scopus database using the terms (caries) AND (“management” OR “treat*”), with filtering by institutional affiliation in Brazil to identify those with the highest scientific output in the field of carious lesion management. Based on this mapping, purposive sampling will be adopted to recruit researchers from the five regions of Brazil, aiming to capture diverse regional contexts. The two researchers with the highest number of publications in each region will be invited by email to participate. Following consent and completion of the interviews, participants will be asked to indicate potential participants from their professional contexts, including dentists and patients and/or parents or caregivers who meet the study eligibility criteria. This stage will follow a snowball sampling strategy to enhance the diversity of perspectives and experiences related to caries management. For the Delphi survey, the same recruitment strategy will be applied; however, no country filter will be used in the Scopus search. Therefore, participants’ countries will correspond to the institutional affiliations identified in the database. For the consensus meeting, participants who complete both rounds of the Delphi survey will be invited.

Qualitative interviews

Qualitative interviews will be conducted to identify outcomes considered important by stakeholders. Initially, 30 participants will be recruited, evenly distributed among patients and/or caregivers, dentists, and researchers in the field of cariology. Interviews will continue until data saturation is reached, with two additional interviews conducted to confirm saturation.

A semi-structured interview guide will be developed and pilot-tested. Interviews will be conducted individually, either face-to-face or remotely, by a trained researcher. Audio recordings will be transcribed verbatim and anonymized. Content analysis will be used to identify outcomes raised by participants. Outcomes mentioned by at least two participants will be considered for inclusion in the Delphi survey. [17] These outcomes will be combined with those identified in Phases 1 and 2 to generate the initial outcome list.

Delphi survey

A two-round online Delphi survey will be undertaken to prioritize outcomes. Participants from the three stakeholder groups will be recruited internationally using purposive sampling to ensure diversity in background, expertise, and geographical location. The survey will be available in Portuguese, English, and Spanish. Approximately 300 participants will be invited at this stage, with an expected sample of around 70 respondents completing the Delphi survey rounds.

A personalized email invitation will be sent to potential participants, outlining the study objectives and inviting their participation. Only individuals who consent to participate in both rounds will be included; those who do not complete the first round will not be invited to the second round.

Two rounds of the Delphi survey will be conducted. During each round, reminder emails will be sent at two-week intervals to non-respondents. Each round will remain open for four weeks. If response rates in the second round are lower than anticipated, the survey period will be extended by an additional two weeks, with further reminders issued to maximize retention and minimize attrition bias. [8]

In round 1, participants will be presented with the initial outcome list and asked to rate the importance of each outcome. Participants will score each outcome on a 9-point Likert scale recommended by the GRADE approach, where 1–3 indicates limited importance, 4–6 important but not critical, and 7–9 critical importance. Participants will also be able to suggest additional outcomes. Suggested outcomes will be reviewed independently by two researchers, and outcomes proposed by at least two participants will be considered for inclusion in round 2.

To reduce participant burden, only outcomes rated 7–9 by more than 50% of respondents and 1–3 by fewer than 15% will be retained for round 2, together with newly suggested eligible outcomes. In round 2, participants will be shown their previous scores and the distribution of scores from each stakeholder group before rescoring the outcomes. Participants will also be asked to rank their 10 most important outcomes.

For consensus assessment, participants will be grouped into two panels: (1) patients/parents/caregivers and (2) professionals/researchers. “Consensus in” will be defined as at least 70% of participants in each panel rating an outcome as 7–9 and fewer than 15% rating it as 1–3. “Consensus out” will be defined as at least 70% rating an outcome as 1–3 and fewer than 15% rating it as 7–9. All other outcomes will be classified as having no consensus and will be taken forward to the consensus meeting.

Consensus meeting

A final online consensus meeting will be held after completion of the Delphi survey. Representatives from all stakeholder groups who completed both Delphi rounds will be invited to participate, with approximately 60% expected to take part. [2] The meeting will be conducted in English, with language support available when needed.

During the meeting, outcomes that reached consensus and those that remained without consensus after the Delphi process will be presented. Participants will discuss each outcome and vote anonymously on whether it should be included in the final COS. Outcomes receiving more than 70% of votes for inclusion or exclusion will be considered as having reached consensus. Up to three rounds of discussion and voting will be conducted. Outcomes that do not reach consensus after three rounds will not be included in the final COS.

Analysis

A list of outcomes will be compiled by grouping equivalent terms under a single agreed term. These terms will be defined prior to the first Delphi round and refined through group consensus, after which all outcomes will be re-categorized using the final agreed terms. Descriptive statistics, including absolute numbers and percentages, will be used to present the frequency of each outcome within each meta-research study and across the stages of COS development. No inferential statistical tests will be performed.

Discussion

This study addresses an important gap in cariology research by proposing a Core Outcome Set (COS) for clinical trials evaluating the management of carious lesions in children and adolescents (CARPED-COS). By integrating evidence from existing studies with input from multiple stakeholder groups, including patients, clinicians, and researchers, it is expected to enhance the relevance, consistency, and transparency of reported outcomes. The development of this COS may facilitate more robust evidence synthesis, reduce research waste associated with outcome heterogeneity and selective reporting, and support the development of more consistent and clinically applicable recommendations.

The definition of outcomes in clinical research has traditionally been driven by researchers, often without the involvement of other key stakeholders. This approach may lead to the prioritization of outcomes with limited relevance to patients and clinical practice, as well as increase the risk of selective outcome reporting. In contrast, COS initiatives promote a more inclusive and structured process for outcome selection, ensuring that the perspectives of patients, caregivers, and healthcare professionals are incorporated. [3-5] This is particularly relevant in pediatric dentistry, where treatment decisions may directly impact not only clinical parameters but also quality of life, behavior, and long-term oral health trajectories.

In the field of cariology, particularly in pediatric populations, there remains a lack of standardized outcome reporting in randomized controlled trials. Previous evidence has demonstrated considerable heterogeneity and incomplete reporting of outcomes, limiting comparability across studies and weakening the strength of systematic reviews and meta-analyses. [5, 12] By establishing a COS for the management of cavitated carious lesions in individuals up to 19 years of age, this study aims to address these limitations and provide a foundation for more consistent and meaningful outcome reporting.

From a scientific perspective, the implementation of a COS is expected to improve the quality and reproducibility of research and support the development of more robust clinical guidelines. From a clinical and societal standpoint, the inclusion of multiple stakeholders ensures that selected outcomes reflect what is most relevant to patients and practitioners, potentially improving treatment adherence, clinical decision-making, and patient-centered care. This inclusive approach is also expected to promote greater alignment between research outputs and population needs, while fostering more collaborative and context-sensitive research practices. Finally, the development and implementation of a COS represent an important methodological advancement, contributing to innovation in clinical research design and supporting the generation of more useful and impactful evidence.

Abbreviations

CARPED-COS: Outcome measures for randomized controlled trials on carious lesion management in children and adolescents
COS: Core Outcome Set

RCTs: Randomized Controlled Trials

PROs: Patient-Reported Outcomes

COMET: Core Outcome Measures in Effectiveness Trials

COS-STAP: Core Outcome Set–STAndardised Protocol Items

OSF: Open Science Framework

GRADE: Grading of Recommendations Assessment, Development and Evaluation

Declarations

Ethics approval and consent to participate

Ethical approval was obtained from the Research Ethics Committee of the School of Dentistry, University of São Paulo (approval no. 8,255,642). Written informed consent will be obtained from participants aged 18 years or older. For participants younger than 18 years, parental or guardian consent, as well as participant assent, will be required.

Consent for publication

Not applicable.

Availability of data and materials

Findings will be disseminated through peer-reviewed publications, conference presentations, and public sharing of study materials and datasets in the Open Science Framework (OSF) repository (https://osf.io/).

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

E.M.S., D.P.R., and T.K.T. contributed to the conception and design of the study; E.M.S., A.M.P.C., J.P.F.C., J.S.L., L.P.C.M., F.S.M., R.D.F., and M.C.R. contributed to data acquisition; A.F.M., F.M.M., M.M.B., and T.G. contributed to data analysis and interpretation; E.M.S. and T.K.T. drafted the manuscript; A.M.P.C., A.F.M., D.P.R., F.M.M., F.S.M., J.P.F.C., J.C.P.I., J.S.L., L.P.C.M., M.C.R., M.M.B., T.G. critically revised the manuscript for important intellectual content.

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