

Overview of evidence-based clinical practice guidelines for preoperative care: a systematic review.

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Research

Keywords: Perioperative Care, Clinical Practice Guidelines, Systematic review, GRADE, AGREE-II

Posted Date: January 28th, 2020

DOI: <https://doi.org/10.21203/rs.2.22002/v1>

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Version of Record: A version of this preprint was published on July 13th, 2020. See the published version at <https://doi.org/10.1186/s13643-020-01404-8>.

Abstract

Background Our aim was to summarize and compare relevant recommendations from evidence-based CPGs (EB-CPGs).

Methods Systematic review of clinical practice guidelines. Data sources: PubMed, EMBase, Cochrane Library, LILACS, Tripdatabase and additional sources. In July 2017, we searched CPGs that were published in the last 10 years, without language restrictions, in electronic databases, and also searched specific CPG sources, reference lists and consulted experts. Pairs of independent reviewers selected EB-CPGs and rated their methodological quality using the AGREE-II instrument. We summarized recommendations, its supporting evidence and strength of recommendations according to the GRADE methodology.

Results We included 16 EB-CPGs out of 2262 references identified. Only nine of them had searches within the last five years and seven used GRADE. The median (percentile 25-75) AGREE-II scores for rigor of development was 49% (35-76%) and the domain 'applicability' obtained the worst score: 16% (9-31%). We summarized 31 risk stratification recommendations, 21.6% of which were supported by high/moderate quality of evidence (41% of them were strong recommendations), and 16 therapeutic/preventive recommendations, 59% of which were supported by high/moderate quality of evidence (75.7% strong). We found inconsistency in ratings of evidence level. 'Guidelines' applicability' and 'monitoring' were the most deficient domains. Only half of the EB-CPGs were updated in the past five years.

Conclusions We present many strong recommendations that are ready to be considered for implementation as well as others to be interrupted, and we reveal opportunities to improve guidelines' quality.

Background

An estimated **313** million major surgical procedures are undertaken every year worldwide.[1] Low- and high-income countries show an estimated rate of major surgery of 295 and 11,110 procedures per 100,000 population per year respectively[1], an enormous disparity for the recommended minimum threshold of 5000 operations per 100,000 people. At current rates of surgical and population growth, 6.2 billion people (73% of the world's population) will be living in countries below the minimum recommended rate of surgical care in 2035.[2] However, the crude number of patients who receive surgery is increasing, as well as their mean age and the occurrence of comorbidities.[3] Because of the inherent risks of death and complications, surgical safety is a significant public-health concern. As an example, more than 2% of patients undergoing surgery will suffer major cardiac complications.[4] In this context, to provide adequate preoperative care is truly mandatory. The first routine preoperative tests started 50 years ago with only a handful of actions, and have nowadays expanded to a large set of **risk stratification** and preventive interventions. Lately, efforts to standardize care have been made, specially through the implementation of clinical practice guidelines (CPGs) with recommendations useful both for

health providers and patients.[5] These recommendations usually consider all risks and benefits for a **risk stratification** or therapeutic procedure to be undertaken, sometimes even including algorithm pathways. The potential benefits, like the safety of care and standardization of procedures are only as good as the quality of the practice guidelines implemented. Unfortunately, those CPGs not supported by the best evidence might promote inappropriate preoperative testing behaviors, negative both for patients and health systems. For example, false positive results, coming from inappropriate testing, may delay or prevent surgery, thus creating unnecessary stress or harm to patients.

Multiple medical societies and organizations around the world have published preoperative evaluation CPGs; however, many of them are not even based on solid scientific evidence. Additionally, not all of them harness methods like the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach, which is **one of** the soundest system for rating the quality of a body of evidence in systematic reviews and CPGs.[6] GRADE offers a transparent and structured process for developing and presenting evidence summaries and making recommendations.[6]

A systematic review found no evidence from high quality studies to support routine preoperative tests in healthy adults undergoing non-cardiac surgery.[7] **Risk stratification** testing based on the problems identified during the preoperative assessment seems justified, but there is still little evidence supporting it. [7] In this way, the implementation of EB-CPGs may lead to a reduction in the number of unnecessary preoperative tests, without affecting patient safety.[8-12] The first health technology assessment (HTA) on the topic published in 1989 by the Swedish Council on Technology Assessment in Health Care (SBU) [13], showed healthcare quality improvements and cost savings using an evidence-based approach. The findings of this report have been confirmed by nine other subsequent studies from five countries, collected in another HTA document.[14]

For this reason, through an overview of clinical practice guidelines we aimed to identify and synthesize EB-CPGs on preoperative care that were published worldwide in the last 10 years, in order to help prioritization processes. We also rated CPGs' quality and summarized recommendations describing their level of evidence and the strength of recommendations according to the GRADE approach.[6]

Methods

Study design: Systematic review (overview) of EB-CPGs following Cochrane methods[15] and the Argentinean Academy of Medicine's Guide for the adaptation of CPGs when searching for and selecting CPGs.[16] For reporting, we followed the PRISMA statement [17] and a specific guideline for overviews of systematic reviews (**Online supplemental material. Appendix 1. PRISMA checklist**).[18] The protocol available in Spanish including a summary in English.[1]

Inclusion criteria of EB-CPGs[19] on preoperative care were as follows: a) description of the guideline's development expert panel; b) use of standard methods for identification, data collection and study risk of

bias assessment; c) report of the level of evidence that supports each recommendation. Guidelines were excluded if they were limited to single specific conditions since we focus more general recommendations. **If guidelines referred only for preoperative care for neurosurgery or colorectal surgery then we excluded them.**

Search strategy: In July 2017, we searched CPGs published in the last 10 years without language limitations in main electronic databases, metasearch engines, specific CPG sources, reference lists and consultation of experts, and the main scientific societies related to preoperative evaluation. The sources included PubMed, EMBase, Cochrane Library, LILACS, [Tripdatabase](#) and additional sources: National Guideline Clearinghouse, NeLH Guidelines Finder, Guía Salud GPCs en España, GAC guidelines, CMA Infobase: Clinical Practice Guidelines Database (CPGs), New Zealand Guidelines, Scottish Clinical Guidelines, EBM Guidelines, Health Services/Technology Assessment Text (HSTAT), National Institute for Health and Clinical Excellence (NICE) and Institute for Clinical Systems Improvement (ICSI). See **Online supplemental material. Appendix 2. Search strategy** for details of these sources and our search strategy for preoperative care.

Selection and Data Extraction: Pair of reviewers **independent** selected (by title and abstract, first, and full text eligible studies, afterwards) the articles retrieved, with a specific software to facilitate the initial phases of systematic reviews called EROS.[20] One reviewer extracted them while the other verified the data in a previously piloted form (which included variables such as search date, objective, setting, target population, target professionals, recommendations, classification system of the quality of evidence and of the strength of the recommendation, quality of evidence by recommendation, and the strength of each recommendation) and preoperative clinical risk criteria and categories (See **Online supplemental material 3. Preoperative clinical risk criteria and categories**). Discrepancies were resolved by a consensus of the whole team.

Guideline quality appraisal and classification: Independent pairs of reviewers rated each EB-CPGs using the AGREE-II tool consisting of 23 key items organized in six domains: scope and purpose, stakeholder involvement, rigor of development, clarity of presentation, applicability, editorial independence and two overall evaluation items.[21] Each item were graded using a scale of 7 points: from 1, meaning "Strongly disagree", to 7, meaning "Strongly agree". Each domain was graded by summing up all the item scores in a domain and showing the total as a percentage of the maximum possible score for that domain (from 0 to 100%). We present the AGREE-II domain scores expressed as a percentage across CPGs. (**Online Supplemental material. Appendix 5 with the explanation of each items of the AGREE-II domains**)

We also categorized each EB-CPGs according to the extent to which they successfully addressed AGREE-II criteria as: [16]

Strongly recommended (++): CPG whose standardized score exceeds 60% in ≥ 4 AGREE-II domains. The scores of the remaining domains must be $\geq 30\%$ and $>60\%$ for the domain rigor of development.

Recommended (+): CPG whose standardized score range from 30 to 60% in ≥ 4 AGREE-II domains. The rigor of development score must be between 30% and 60%.

Not recommended (-): CPG whose standardized score is $< 30\%$ in ≥ 4 AGREE-II domains or if rigor of development score is less than 30%.

To deal with discrepancies between the direction and strength of the CPG recommendations, we applied a rule to decide “doing or not doing the recommendation”:

Yes (Y) - No (N) do it. $\geq 2/3$ recommendations in the same direction (for/against) and $\geq 2/3$ strong recommendations.

Probably yes (PY) - Probably no (PN) do it. $\geq 2/3$ recommendations in the same direction (for/against) and $< 2/3$ strong recommendations.

Uncertainty (?) to do it. $< 2/3$ recommendations in the same direction (for/against).

Synthesis of results: We conducted a tabular synthesis of the recommendations to describe their strength and the level of evidence supporting them according to the current GRADE methodology,⁶ and transforming the original grading system when necessary, to compare and integrate the results for each recommendation in a unified manner. Simply put, the GRADE quality of evidence can be HIGH, MODERATE, LOW and VERY LOW. The Randomized Clinical Trials (RCTs) start from HIGH quality of evidence and the non-randomized studies start from a LOW quality of evidence. Five criteria can downgrade one or two levels: methodological quality (study limitations), inconsistency of results, indirectness, imprecision and publication bias. In cases where there are no methodological limitations, there are three criteria that can upgrade one or two levels: magnitude of effect, dose-response effect, and confounders underestimating the effect. **For the mapping the level of evidence to a common grading system (GRADE), we re-assessed all evidence when the translation was not obvious.** Regarding the strength of a recommendation, which is defined as the extent to which one can be confident that the desirable consequences of an intervention outweigh its undesirable consequences, GRADE uses four simple categories to classify them. The categories are ‘strong’ or ‘weak’, and ‘for’ or ‘against’ a certain **risk stratification** or therapeutic approach. We presented descriptive statistics as percentages or means with standard deviations.

[1] <https://www.iecs.org.ar/wp-content/uploads/Protocolo-de-Overview-y-adaptaci%C3%B3n-de-GPC-prequir%C3%BAgicas-1.pdf>

Results

The search strategy identified 2262 references after the elimination of duplicates. After the selection process we identified 23 references corresponding to 16 EB-CPGs published in the last 10 years (**Figure 1:**

Flowchart). Two references were examined in depth and eventually excluded since they only transcribed pre-existing CPGs, already included in our selection.[22, 23]

Table 1 provides a general description of the included EB-CPGs. Seven were developed in America (4 in the United States, 1 in Argentina, 1 in Brazil and 1 in Canada), seven in Europe (2 continental, 2 from Italy, 1 in Belgium, 1 in Scotland and 1 in United Kingdom) and two were global collaborations. Only 8/16 (50 %) of the EB-CPGs that reported their search date, conducted their searches within the last five years. Out of the EB-CPGs, ten addressed multiple practices, five focused on unique practices, one referred to perioperative fasting, and the remaining four were about antimicrobial prophylaxis. Furthermore, four were risk stratification recommendations, five were therapeutic or preventive interventions, and six considered both aspects.

Each guideline reports the levels of evidence and the recommendation grading systems used by their authors. The grading system used were GRADE (7 EB-CPGs), SIGN [24] (2 EB-CPGs) and the other utilized their own or modified systems. (**Online supplemental material Appendix 4**).

We presented the scores as a percentage per each AGREE-II domain. The domains with the best median score (percentile 25-75) were editorial independence 91% (81-100), clarity of presentation 85% (69-97) and scope and objective 80% (65-89). Stakeholder involvement 53% (44-62) and rigor of development 49% (35-76) had an intermediate performance while 'applicability' was the most deficient 16% (9-31). Regarding the guideline recommendation category, 6/16 (37%) were classified as highly recommended and the rest as recommended (**Online supplemental material Appendix 5**). An overall AGREE-II score was also presented in **Table 1**.

Table 2 shows the **risk stratification recommendations** presenting the level of evidence and recommendation strength of the EB-CPG with the highest overall and methodological rigor AGREE-II score. The 31 **risk stratification** recommendations included 102 specific recommendations according to the population/problem or the type of surgery. Out of the 102 recommendations, 5 (4.9%) had a high level of evidence, 17 (16.7%) had a moderate level, 45 (44.1%) had a low level, and 35 (34.3%) had a very low/insufficient level. Regarding recommendation strength, 24 (23.5%) were strong for, 26 (25.5%) were strong against, 37 (36.3%) weak for, and 15 (14.7%) were weak against.

We found discrepancies among EB-CPG in 10 out of 102 (10%) **risk stratification recommendations** After applying the rule "doing or not doing the recommendation", 31 (60 specific) "doing" and 31 (39 specific) "not doing" diagnostic evaluations (See **Online supplemental material Appendix 6. Table 1 GRADE level of evidence and strength of recommendations by CPG; Table 2 Recommended risk stratification evaluations only** and **Table 3 Not recommended risk stratification evaluations** to facilitate the finding of relevant recommendation by different point of access).

Table 3 shows the **therapeutic/preventive recommendations** using the same presenting criterion than Table 2. The 16 therapeutic/preventive recommendations included 78 specific recommendations according to the population or the type of surgery. Out of these recommendations, there were 28 (35.9%)

with a high evidence level, 18 (23.1%) with a moderate level, 24 (30.8%) with a low level, and 8 (10.2%) with a very low level. Regarding their recommendation strengths: 41 (52.6%) were strong for, 18 (23.1%) were strong against, 14 (17.9%) weak for, and 5 (6.4%) weak against. In **Online supplemental material Appendix 7** we present an additional table concerning antimicrobial prophylaxis recommendations for each surgical site.

We found discrepancies among EB-CPG in 3 out of 78 (4%) of the **therapeutic/preventive care recommendations**. After applying the direction and strength of recommendations rule to decide doing or not doing the CPG, 15 (55 specific) recommended and 10 (23 specific) did not recommended therapeutic/preventive interventions (See **Online supplemental material Appendix 8**).

(See **Online supplemental material Appendix 6 – Table 1 GRADE level of evidence and strength of recommendations by CPG; Table 2 Recommended therapeutic/preventive care only** and **Table 3 Not recommended therapeutic/preventive care**).

Discussion

To our best knowledge the present study is the first overview of guidelines encompassing a broad spectrum of preoperative care recommendations.

We observed higher level of evidence supporting therapeutic than **risk stratification** recommendations (high/moderate quality of evidence 59 vs 22%, respectively). It is not surprising, because cross sectional or cohort studies can provide high quality evidence for test accuracy but indirect evidence for patient-important outcomes. Furthermore, high level of heterogeneity is almost the rule in **risk stratifications test**, downgrading even more the level of evidence because inconsistency.[25-27]

The strength of a recommendation is defined as the extent to which one can be confident that the desirable effects of an intervention outweigh its undesirable ones. We found only 12/53 (23%) 'strong' **risk stratification** recommendations statements (for and against) based on high/moderate level of evidence and 43/78 (55%) for therapeutic/preventive care recommendation. Although it would be desirable higher proportions of high-quality supporting evidence a guide panel must consider additional factors. In order to assess competing management alternatives, GRADE proposes to consider four domains: estimates of effect for desirable and undesirable outcomes, confidence in the estimates of effect, values and preferences, and resource use. Guideline panels must integrate these factors to make a strong or weak recommendation for or against an intervention.[28]

After our search date, the updated guideline from the European Society of Anesthesiology (ESA) was published, using GRADE and searching until May 2016.[29] This CPG addressed two main clinical questions in order to help each anesthesiologists in their daily practice: 1. how should a pre-operative consultation clinic be organized and 2. How should pre-operative assessment of a patient be performed.

As in our present work, this guideline covered specific conditions that might adversely interfere with anesthesia and surgery, including cardiovascular disease, respiratory disease, smoking, obstructive sleep apnea syndrome, renal disease, diabetes, obesity, coagulation disorders, anemia and pre-operative blood conservation strategies, the geriatric patient, alcohol and drug misuse and addiction and currently also neuromuscular disease. We are hereby presenting a preoperative clinical risk criteria and categories that was complemented with established risk factors for postoperative pulmonary complications (See **Online supplemental material Appendix 3**).[29] The 2018 ESA guidelines also provided independent predictors for difficult mask ventilation, a topic not specifically addressed in previous CPGs.[29]

As described, RCTs are still few and therefore many preoperative interventions rely to a large extent on expert opinion, which in turn requires to be adapted to the reality of nations' healthcare systems.

Studies on prognostic or diagnostic accuracy tests, including scoring of severity of illness, usually provide low quality of evidence, even when scores such as ASA-PS, RCRI, NSQIP-MICA, POSSUM and others have been extensively validated.[29]

Our updated overview of EB-CPGs, conducted under the rigorous Cochrane methods, may be a useful resource for the professionals involved in preoperative care to consult during decision-making. We present many strong recommendations with sufficient evidence to be routinely implemented in clinical practice. However, any decision should be taken considering local contextual factors.

In addition, cost reductions were identified at the clinical level as well as at the health system level in another study.[9-11,30] Two guidelines also suggested strong costs benefits both for patients and society.[34,35] Another study showed that the application of EB-CPGs significantly improved the efficiency of the preoperative evaluation without negatively affecting the quality of care.[31] These findings were consistent across different settings, like in a hospital in Barbados where the introduction of guidelines reduced the burden of presurgical tests and costs with not hampering patient's safety.[32] In the same way, a recent study in a hospital in New Jersey, USA, found that approximately 25% of tests were not justifiable and could be thus eliminated by complying with NICE/ASA guidelines. The evaluation of applying these changes in practice showed significant savings without altering clinical outcomes.[33]

Recommendations can be adopted, modified or even not implemented, depending on institutional or national requirements and legislation and local availability of devices, drugs and resources.[34] Decision-makers at the national and subnational levels should be provided with the information they need to apply the evidence and recommendations in their setting.[35] As a limitation, including only EB-CPGs could have resulted in omitting some information, but we prioritized summarizing the highest quality evidence. Our exclusion criteria for CPGs, limiting the scope to specific conditions, may represent an additional caveat since some particular **risk stratification** or therapeutic interventions could have been also excluded. Nevertheless, the high number of recommendations summarized in our study suggest that this could have been only a minor limitation.

Our study will be useful for future preoperative care guideline developers or adapters. Consistently with other overviews of clinical guidelines, the domain that received the lowest mean score was the 'applicability' domain of the AGREE-II tool. Similarly, the heterogeneity of evidence and the strength of recommendations grading systems in this overview echo that of other clinical guideline overviews.[36-38] Low scores in the applicability domain result in inadequate adoption rates of guidelines, particularly for preoperative care where 'defensive medicine' (i.e. prescribing more tests than necessary just to prevent litigation) is very common. We also found some discrepancies, mainly in the evidence level, in each recommendation that did not always discriminate between universal interventions and those suitable only for special target groups or specific surgeries.

Guideline developers should ensure rigorous methodological processes and should also make recommendations that are formulated and disseminated in ways that facilitate understanding and application by end-users. For example, the DECIDE Collaboration conducted research and developed tools to improve implementation of evidence-based recommendations by different target audiences, including providers, policy makers, and the public.[39] In that sense, GRADE provides guideline developers with a comprehensive and transparent framework for grading quality of evidence and of strength of recommendations.

Our overview identified several controversies, evidence gaps and issues regarding preoperative care guidelines that warrant future research and reveal opportunities to improve the guidelines quality.

For example, we found many discrepancies about **risk stratification** recommendations like electrocardiography and Chest X-ray, polysomnography, assessment of left ventricular function, stress testing and coronary angiography in certain populations. We found less discrepancies for therapeutic/preventive care mainly because antimicrobial prophylaxis, use of beta-blockers (Find these discrepancies in the **Online supplemental material Appendix 6 and Appendix 8**).

From the perspective of the anesthesiologist practice there still remain many unanswered questions. For example, in the patient with significant medical, surgical or obstetrical history, it would be useful to understand how early the pre-anesthetic evaluation should be performed, considering the time required to optimize the patient's status. There are also uncertainties for the recommendation of fasting for solids in adults and children since many factors can delay gastric emptying, and no fixed rules apply. Fasting should be individualized in some patients, and depending on the characteristics of the fat intake. Regarding prokinetics and antacids, patients' comorbidities like esophageal pathology, bariatric surgery history or obesity, should be considered in the decision, but there is no formal recommendation. In the same way, suspending or not suspending aspirin should be evaluated according to the patient's history and risk of bleeding of the surgery that could be catastrophic in neurosurgery, spinal surgery or ophthalmologic surgery. It is also strange that informed consent only has a 'weak for', recommendation from a unique CPGs since there is enough background of litigation due to the lack of consent.

We encourage guideline developers to adopt GRADE and AGREE-II tools to elaborate future sound preoperative care guidelines.[6,21]

The huge amount of resources involving preoperative care warrants high-quality nationwide EB-CPGs supported by all relevant stakeholders to improve the chances of a successful implementation. This probably includes the involvement of the Ministry of Health, scientific societies, and consumers working together through a formal process of implementation and monitoring.[16, 40]

Although standardization of preoperative care may be desirable, differences in recommendations could reflect differences in contextual factors such as organizational or financial arrangements, legal framework, varied values and preferences, and the acceptability and feasibility of using different interventions. Research exploring reasons for conflicting recommendations in different countries or settings could also drive overall improvements in guideline quality. The key findings are described in **Box 1**.

Box 1 Key points

- The included evidence-based clinical practice guidelines (EB-CPGs) showed significant heterogeneity both of evidence and recommendation grading systems; GRADE was the most commonly used.
- About half of the included EB-CPGs were updated in the last five years and one third of them were rated as strongly recommended based in their high AGREE-II performance.
- They were generally deficient in applicability and in providing monitoring tools.
- We summarized 31 **risk stratification** and 16 therapeutic/preventive recommendations.
- We found 93 strong for and 46 strong against recommendations, all which were ready to be considered to be implemented or to be interrupted, respectively.
- The level of evidence and strength of recommendation was higher for therapeutic/preventive recommendation than for **risk stratification**
- We only found 12/53 (55%) strong **risk stratification** recommendations based on high/moderate level of evidence and 43/78 (55%) for therapeutic/preventive care recommendations.

In conclusion we found significant heterogeneity of guidelines' quality and rating systems, as well as deficiencies in several guideline quality domains, which reveal opportunities for quality improvement which deserve careful consideration by future guideline developers. Nevertheless, we present many strong recommendations ready to be at present considered for implementation or discontinuation.

Abbreviations

- CPG: Clinical Practice Guidelines.
- GRADE: Grading of Recommendations Assessment, Development, and Evaluation.
- HTA: Health Technology Assessment.
- EB-CPG: Evidence Based- Clinical Practice Guidelines.
- RCT: Randomized Clinical Trials.
- Y: Yes.
- N: No.
- PY: Probably Yes.
- Probably No.
- HSTAT: Health Services/Technology Assessment Text.
- NICE: National Institute for Health and Clinical Excellence.
- ICSI: Institute for Clinical Systems Improvement.
- ESA: European Society of Anesthesiology.
- ESC/ESA: European Society of Cardiology / European Society of Anesthesia.
- SBC: Brazilian Society of Cardiology.
- ACC/AHA: American College of Cardiology/American Heart Association.
- CCSG: Canadian Cardiovascular Society.
- SARNePI: Italian Society of Anesthesia and Intensive Pediatric Therapy and Neonatology.
- ICSI: Institute for the Improvement of Clinical Systems.
- BARA: Regional Anesthesia Associations of Belgium.
- ASHP: American Society of Health-System Pharmacists.
- SIGN: Scottish Intercollegiate Guidelines Network.
- SAC: Argentine Society of Cardiology.

Declarations

Ethics approval and consent to participate: Not applicable.

Consent for publication: Not applicable.

Availability of data and materials: Not applicable.

Funding: Independent grant of the Argentine Federation of Associations of Anesthesia, Analgesia and Resuscitation (FAAAAR).

Conflicts of interest

None.

Authors' contributions

A.C and A.B. provided substantial contribution to conception and design, E.T.L and S.A.V undertook the acquisition of data. All authors contributed to the analysis and interpretation of data; drafting the article or revising it critically for important intellectual content and provided final approval of the final version submitted.

Acknowledgements

Dr. Claudio Isod, Anesthesiologist and member of the Sociedad Platense de Anestesiología, for his valuable feedback.

Dr. Juan Manuel Rey, Anesthesiologist, for his valuable feedback.

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Tables

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Figures

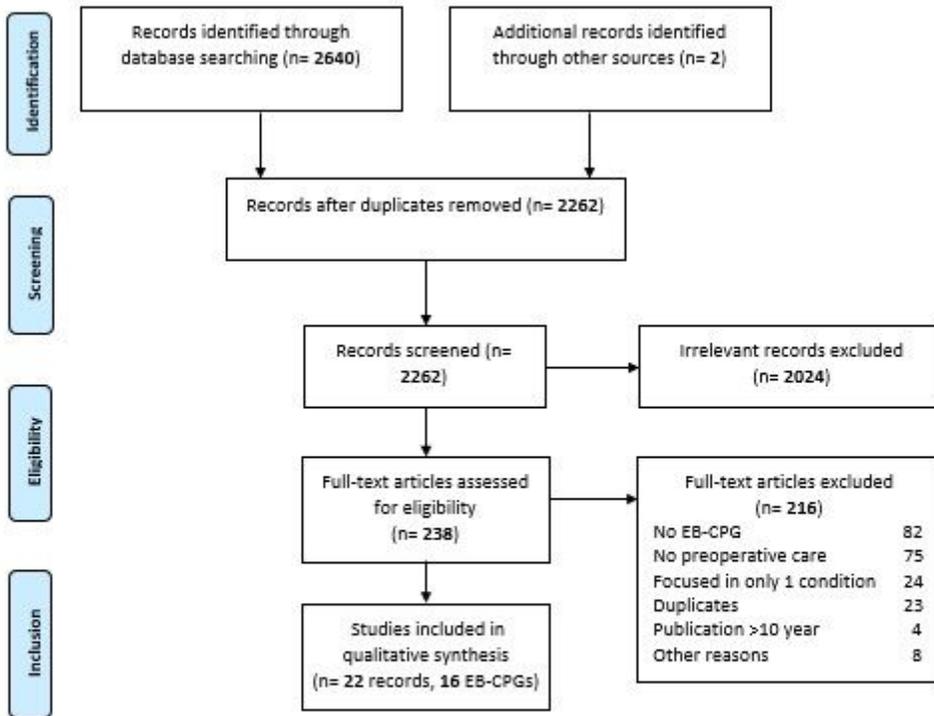


Figure 1

Study flowchart

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