

Dentists' awareness and knowledge of evidence-based dentistry principles, methods and practices: a systematic review

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Key points

- Dentists seem to be aware of evidence-based dentistry, the PubMed/Medline database, evidence-based dentistry scientific journals and clinical practice guidelines.
- Variable proportions of dentists claim to have knowledge about evidence-based dentistry, and most reported an understanding of systematic reviews and randomised clinical trials.
- Actual knowledge is scarcely assessed, and few dentists seem to really understand evidence-based dentistry principles, methods and practices.

Abstract

Introduction As an attempt to provide supporting evidence for the formulation of future educational strategies on knowledge translation, this systematic review assessed and synthesised the available evidence related to the dentists' awareness, perceived and actual knowledge of evidence-based dentistry (EBD) principles, methods and practices.

Methods Primary studies that considered dentists' reports collected from interviews, questionnaires, or conversation sessions were selected. Studies enrolling students, dental hygienists, or other health professionals were not included. Reviews, editorials, letters, study protocols, articles presenting knowledge translation strategies and initiatives, examples of EBD approaches to specific clinical questions, and guidelines focused on EBD implementation were also excluded. Cochrane, Embase, PubMed, Scopus and Web of Science databases were searched. Grey literature was partially covered by the Google Scholar search and the reference lists of the pre-selected studies. The study search was concluded in February 2021. Descriptive data of the selected studies were synthesised, and the risk of bias was assessed according to the National Institutes of Health Quality Assessment Tool for observational cohort and cross-sectional studies.

Results Twenty-one articles were included. High percentages of dentists were aware of EBD. Variable proportions of professionals declared to have some understanding of EBD, although few presented actual knowledge of principles, methods and practices.

Discussion Methodologically, most studies presented limitations regarding sample representativity, participation rates, detailing of the outcome measures, and validation of the assessment tools. Additionally, extensive overall ranges of responses were often observed across the studies, possibly as a result of heterogeneity across samples and assessment tools. The authors thus suggest developing valid questionnaires including all dimensions (awareness, perceived knowledge and actual knowledge) within an assessment tool. This would contribute to establishing knowledge translation strategies to overcome specific gaps in EBD knowledge.

Introduction

Evidence-based practice is defined as 'the conscientious, explicit and judicious use of the best current evidence in making decisions about the care of patients'.¹ With

the increasing number of patient care-related articles being published and accessed by dental professionals, clinicians are likely to achieve an increased level of confidence during clinical decision-making.² Still, many dentists tend to rely solely on what they have learned during their training or personal experience.^{3,4} Moreover, obstacles to implementing evidence-based dentistry (EBD) have also been reported,⁵ including not only those that are self-related, but also evidence-, context- and patient-related barriers.

Recent studies have shown that a high percentage of dentists are aware of EBD principles, methods and practices.^{2,6,7,8,9,10,11,12} Dentists have also demonstrated enthusiasm,

willingness and desire to implement EBD into daily clinical practice.^{2,12} However, although dentists have expressed positive attitudes towards EBD, they apparently lack knowledge about EBD.^{9,12} In the health research literature, an overlap of meanings between awareness and knowledge is often seen.¹³ Hence, a clear definition appears to be necessary, since it is the translation of knowledge into practice that might positively impact health care.¹⁴

To accurately incorporate evidence-based concepts into clinical practice, a clear understanding is required, including an awareness of the basic terminology and principles.¹⁵ Therefore, a systematic review (SR) of this topic should help

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establish knowledge translation strategies to overcome specific and pre-identified gaps in dentists' understanding of the main concepts involved in EBD. The purpose of this SR was to assess and synthesise the available evidence related to the dentists' awareness of, and perceived and actual knowledge of, EBD principles, methods and practices.

Methods

Protocol and registration

This manuscript presents information about dentists' awareness of EBD and their perceived and actual knowledge of EBD principles, methods and practices. The SR protocol has been registered in the PROSPERO database (CRD42017056298).

We considered 'awareness' to be a state of consciousness about the existence of any given information. To confirm or refute awareness of a term or a subject, the respondents should have answered questions such as 'Are you aware of...?' or 'Have you ever heard/read about...?' Awareness of a term/subject could also be confirmed/refuted whenever the response alternatives included terms such as 'aware'/'unaware' or '(not) heard/read about'.

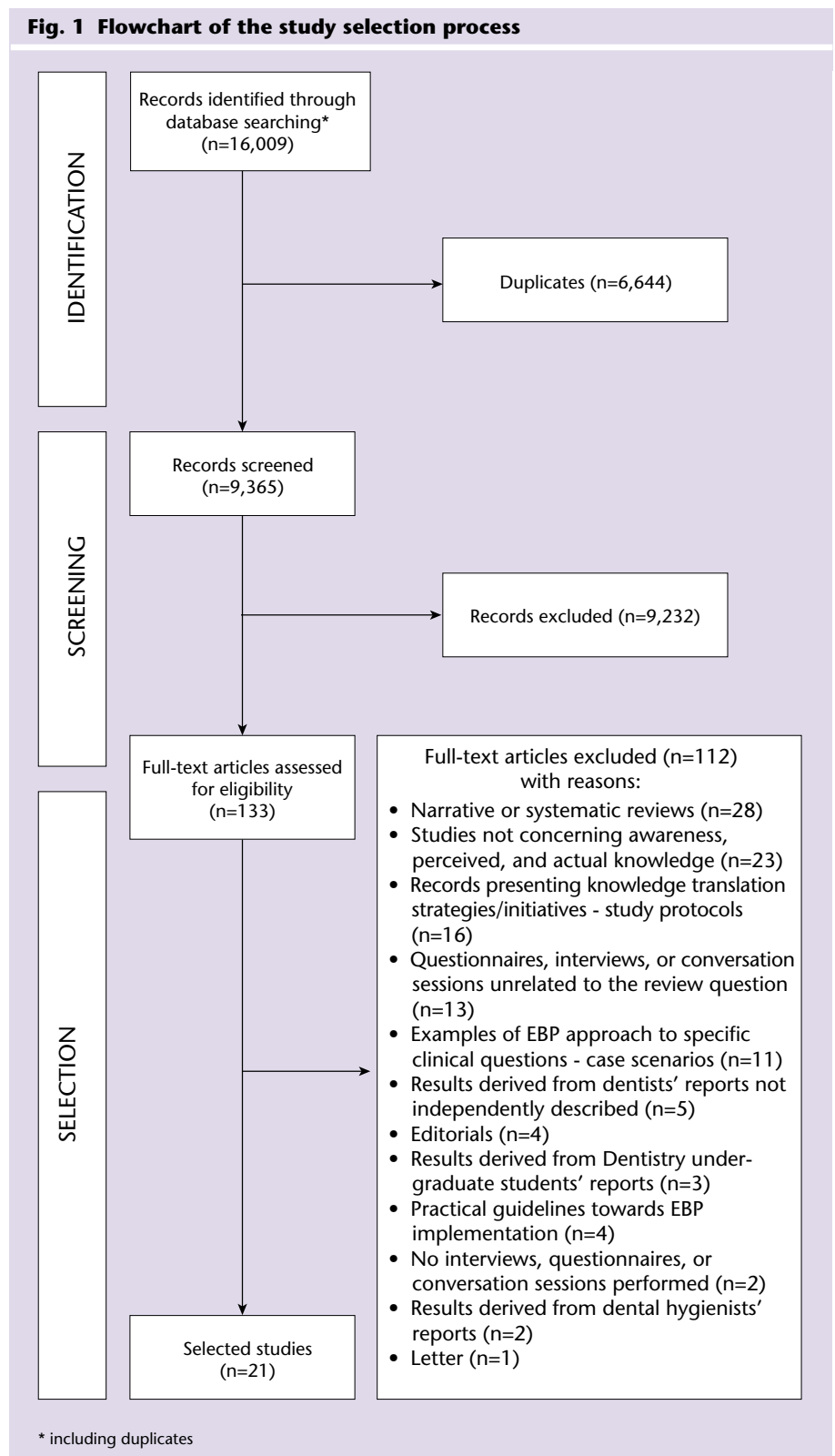
'Awareness' must be differentiated from 'knowledge', which might instead be acquired from experience and/or previous learning. We thus considered 'knowledge' to be a more advanced state of realisation than 'awareness', in which dentists claim to (that is, possess perceived knowledge) or understand (that is, possess actual knowledge as certified by experts) a specific term/subject.

We used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement checklist to report this review.¹⁶

Information sources and search

We performed a search up to February 2021 of the following sources: Cochrane Central Register of Controlled Trials, Embase, PubMed, Scopus and Web of Science. Grey literature was partially covered by the Google Scholar search (first 100 hits) and the reference lists of the pre-selected studies. There were no restrictions concerning the year or language. Initially, we developed a search strategy for the PubMed database (online Supplementary Appendix 1), which was later adapted to the other search sources.

Fig. 1 Flowchart of the study selection process



Eligibility criteria

We included primary quantitative and qualitative studies in which the investigators presented information collected from interviews, questionnaires, or conversation sessions with dentists. Exclusion criteria were as follows:

- Studies enrolling dentists along with other professionals, but in which the

investigators failed to report the results separately for the various professions

- Studies in which the investigators exclusively enrolled dentistry students, dental hygienists, or other health care professionals
- Studies that did not concern awareness of EBD and perceived and actual knowledge of EBD

Table 1 Summary of the results of studies concerning awareness of EBD principles, methods and practices (cont. on page 4)

Reference	EBD, in general	PubMed/Medline	Cochrane	EBD journals	Other EBD sources
Iqbal and Glenny ²	EBD: Unaware: 7.0% Know little: 19.0% Understand: 19.0% Understand/use/cannot define: 28.0% Understand/define: 28.0%		Collaboration: Unaware: 73.0% Know little: 15.0% Understand: 5.0% Understand/use/cannot define: 3.0% Understand/define: 4.0%		SR: Unaware: 7.0% Know little: 22.0% Understand: 31.0% Understand/use/cannot define: 21.0% Understand/define: 18.0%
Rabe <i>et al.</i> ⁹	EBD: Previously heard: 80.4% Other responses: NM	Database: Unaware: 28.9% Aware: 68.1%	Collaboration: Unaware: 61.5% Aware of name: 13.0% Aware of activities: 22.4%	<i>Evidence-Based Dentistry</i> : Unaware: 65.9% Aware: 31.8%	
Yusof <i>et al.</i> ¹²	EBD: Yes: 69.9% No: 30.0%		Collaboration: Unaware: 58.5% Know little: 23.0% Understand: 16.3%		SR: Unaware: 4.4% Know little: 24.4% Understand: 71.1%
Madhavji <i>et al.</i> ¹⁵			Database: Unaware: 55.0% Some awareness: 20.0% Fully aware: 25.0%		
Haron <i>et al.</i> ²⁰					CPG: Always: 35.0% Sometimes: 55.0% Never: 10.0%
Gupta <i>et al.</i> ⁸	EBD: Yes: 70.5% No: 29.5%				
Qureshi <i>et al.</i> ²¹		Database: 4.4 + 1.0 (mean score) (5-point scale)			
Yamalik <i>et al.</i> ¹¹	EBD: No idea: 13.9% Know what it is: 32.8% Practice: 32.1% Dentists should practice it: 21.2%				
Ahad and Sukumaran ⁶	EBD: Yes: 80.0% No: 20.0%				
Al-Ansari and El-Tantawi ⁷	EBD: Heard about: 78.6% Other responses: NM	Database: I know and I use: ~77.1% I know and I never use: ~8.6% I do not know: ~11.8%	Database: I know and I use: ~34.6% I know and I never use: ~26.7% I do not know: ~37.0%	<i>Evidence-Based Dentistry</i> : I know and I use: ~40.9% I know and I never use: ~37.7% I do not know: ~19.6% <i>Journal of Evidence-Based Dental Practice</i> : I know and I use: ~37.0% I know and I never use: ~35.4% I do not know: ~25.9%	CATs: I know and I use: ~15.7% I know and I never use: ~25.9% I do not know: ~56.6% TRIP: I know and I use: ~11.8% I know and I never use: ~23.6% I do not know: ~61.4% Dental Elf: I know and I use: ~9.4% I know and I never use: ~26.7% I do not know: ~62.2%

- Articles presenting knowledge translation strategies and initiatives (study protocols), examples of EBD approaches to specific clinical questions (case scenarios), and practical guidelines focused on EBD

implementation

- Narrative reviews or SRs, meta-analyses (MAs), editorials, letters, study protocols
- Duplicate results/samples.

Study selection

Two researchers (MFNE, MGR) independently reviewed titles and abstracts, pre-selecting studies that apparently presented information on awareness of EBD and

Table 1 Summary of the results of studies concerning awareness of EBD principles, methods and practices (cont. from page 3)

Reference	EBD, in general	PubMed/Medline	Cochrane	EBD journals	Other EBD sources
Afrashtehf <i>et al.</i> ¹⁸			Database: I know and I use: ~14.0% I know and I never use: 42.2% I do not know: ~42.2%	<i>Journal of Evidence-Based Dental Practice:</i> I know and I use: ~42.2% I know and I never use: 28,1% I do not know: ~28.1% <i>Evidence-Based Dentistry:</i> I know and I use: ~56.3% I know and I never use: 28.1% I do not know: ~14.0%	TRIP: I know and I use: ~14.0% I know and I never use: 0.0% I do not know: ~85.9% Dental Elf: I know and I use: ~14.0% I know and I never use: 0.0% I do not know: ~85.9% CDA Oasis: I know and I use: ~14.0% I know and I never use: ~28.1% I do not know: ~56.3% ADA Critical Summaries: I know and I use: ~28.1% I know and I never use: ~28.1% I do not know: ~42.2%
Guncu <i>et al.</i> ¹⁹					CPG: Yes: 68.0% No: 32.0%
Rawat <i>et al.</i> ²³	EBD: Unaware: 62.0% Aware/did not use: 28.25% Unable to help in clinical decision-making: 9.1%		Database: Unaware: 55.0% Aware/did not use: 18.3% Read: 15.4% Unable to help in clinical decision-making: 10.4%		DARE: Unaware: 50.8% Aware/did not use: 21.6% Read: 15.0% Unable to help in clinical decision-making: 12.5%
Almalki <i>et al.</i> ¹⁰	EBD: Yes: 91.8% Other responses: NM				

Key:
SR = systematic review; EBD = evidence-based dentistry (the terms ‘evidence-based practice’, ‘evidence-based medicine’ and ‘evidence-based dental medicine’ were considered as synonyms of EBD, for analyses purposes); CPG = Clinical Practice Guideline; NM = not mentioned; TRIP = Turning Research Into Practice; CDA = Canadian Dental Association; ADA = American Dental Association; CATs = Critically Appraised Topics; DARE = Database of Abstracts and Systematic Reviews.

perceived and actual knowledge of EBD principles, methods and practices. In case of disagreement, we retrieved the full-text documents and discussed them until reaching a consensus.

Data items and collection

Two researchers (MFNF, MLA) independently extracted the included studies’ characteristics and results and recorded them with standardised tables. Then, another researcher (CFM) reviewed the extracted information. Disagreements were resolved by re-examining the original documents. Whenever necessary, we contacted the authors of the selected studies to inquire about missing or incomplete data.

Summary measures and synthesis of the results

The study outcomes were dentists’ awareness of EBD and their perceived and actual

knowledge of EBD principles, methods and practices. Descriptive data were collected from the results of the included studies and synthesised descriptively, since we did not consider them adequate to be merged in an MA because of the large degree of methodological and clinical (sample origin) heterogeneity.

Risk of bias in individual studies

Two examiners (RPACS, LAAJ) used the National Institutes of Health Quality Assessment Tool for observational cohort and cross-sectional studies¹⁷ to assess the quantitative studies, because all of them were observational. A third reviewer (CFM) was involved in case of disagreement.

Results

Study selection and characteristics

The selection process resulted in a final list of 21 included studies, which covered either ‘awareness’,^{2,6,7,8,9,10,11,12,15,18,19,20,21,22,23} ‘perceived

knowledge’^{2,6,7,8,9,12,15,20,21,22,23,24,25,26,27,28} and/or ‘actual knowledge’^{2,10,12,20,21,22,25,29} (Fig. 1). All of the included studies were cross-sectional quantitative studies, and their detailed characteristics are provided in online Supplementary Table 1. Online Supplementary Appendix 2 indicates the specific reasons for exclusions after full-text readings.

Summary of the results

The results of the included studies were organised into three domains (awareness, perceived knowledge and actual knowledge), and they are presented in the following sections.

Awareness of EBD principles, methods and practices

In several studies,^{2,6,7,8,9,10,11,12} most respondents declared that they were aware of EBD-related terms, with frequencies ranging from 69.9%¹² to 93.0%.² Only

Table 2 Summary of the results of studies concerning actual knowledge of EBD principles, methods and practices (cont. on page 6)

Reference	Definitions	Scores	Skills	Statements
Iqbal and Glenny ²	<p>EBD: Correct: 29.4% Incorrect: 70.5%</p> <p>SR: Correct: 49.0% Incorrect: 51.0%</p> <p>Critical appraisal: Correct: 68.1% Incorrect: 31.8%</p>		<p>Identifying important factors in a RCT: Sample size: 75.0% Randomisation: 49.0% Blinding: 47.0% Placebo: 38.0%</p> <p>Appropriate statistics: 26.0%</p> <p>Relevant outcomes: 23.0%</p> <p>Follow-up: 18.0% Study population: 12.0% Intention to treat: 2.0%</p>	
Yusof et al. ¹²				<p>EBD is a process of making decisions based on scientifically proven evidence (Answer: yes) Correct: 94.2% Incorrect: 4.4% Don't know: 1.5% Out of the ones that have heard about EBD (n = 135)</p> <p>EBD involves a series of steps from identifying the clinical question, finding the answer/evidence, assessing the validity of evidence, to applying it if clinically suitable (Answer: yes) Correct: 95.6% Incorrect: 3.7% Don't know: 0.7% Out of the ones that have heard about EBD (n = 135)</p> <p>Evidence from all published articles in scientific journals can be used in EBD (Answer: no) Correct: 48.9% Incorrect: 43.7% Don't know: 6.7% Out of the ones that have heard about EBD (n = 135)</p> <p>The best and quickest way to find evidence is by reading textbooks or asking experienced colleagues (Answer: no) Correct: 53.3% Incorrect: 42.2% Don't know: 3.7% Out of the ones that have heard about EBD (n = 135)</p> <p>EBD benefits patients by improving quality and effectiveness of clinical treatments (Answer: yes) Correct: 97.8% Incorrect: 1.5% Don't know: 0.7% Out of the ones that have heard about EBD (n = 135)</p> <p>EBD allows dentists to improve their knowledge and clinical skills (Answer: yes) Correct: 97.8% Incorrect: 1.5% Don't know: 0.7% Out of the ones that have heard about EBD (n = 135)</p>

one study presented a relatively lower frequency (38.0%),²³ which the authors attributed to a potential gap in the local EBD education.²³

A minority of the interviewees were unaware of the PubMed/Medline database (28.9%⁹ and 11.8%).⁷ Additionally, according to the results of another

study,²¹ PubMed was reported as highly acknowledged by the respondents (4.4/5.0). In contrast, several studies,^{2,7,9,12,15,18,23} found low percentages of participant awareness.

Table 2 Summary of the results of studies concerning actual knowledge of EBD principles, methods and practices (cont. from page 5)

Reference	Definitions	Scores	Skills	Statements
Haron <i>et al.</i> ²⁰		Mean score: 9.0 (0–21) Percentage above the mean: 40.8%	Ranking evidence pyramid: Correct: ~19.2% Incorrect: ~80.7%	EBD includes accurate diagnosis and selection of optimal treatments for individual patients (Answer: yes) Correct: ~75.2% Incorrect: ~24.8% Out of the ones with higher knowledge scores (n = 49) Correct: ~88.9% Incorrect: ~11.1% EBD practice ignores experience (Answer: no) Correct: ~71.5% Incorrect: ~28.5% Out of the ones with higher knowledge scores (n = 49) Correct: ~88.0% Incorrect: ~22.0% EBD is based on expert opinion (Answer: no) Correct: ~53.2% Incorrect: ~46.8% Out of the ones with higher knowledge scores (n = 49) Correct: ~88.9% Incorrect: ~11.1%
Sabounchi <i>et al.</i> ²⁵		Mean score: 7.9 + 2.0 (0–11) Percentage above mean score: 88.6%		
Hinton <i>et al.</i> ²⁹		Percentage of correct answers: ~19.0%		
Qureshi <i>et al.</i> ²¹			Formulating a PICO question: 0.1 + 0.3 (0–3) Finding evidence: 1.2 + 1.5 (0–6) Searching on PubMed: 0.2 + 0.8 (0–8)	
Almalki <i>et al.</i> ¹⁰			Identifying which studies form the base and the apex of the evidence pyramid: Correct: 24.8% Incorrect: NR%	
Vahabi <i>et al.</i> ²²		Mean score: 9.9 + 3.6 (4–18) Percentage above mean score: 52.1%		

Key:
EBD = evidence-based dentistry (the terms 'evidence-based practice', 'evidence-based medicine' and 'evidence-based dental medicine' were considered as synonyms of EBD, for analyses purposes); SR = systematic review; RCT = randomised clinical trial; PICO = population, intervention, comparison, outcome (acronym).

In contrast, several studies,^{2,7,9,12,15,18,23} found low percentages of participant awareness the Cochrane Database/Collaboration (27.0%² to 61.3%⁷).

The included studies also asked participants questions about their awareness of specific scientific journals. According to these investigations, 70.3%¹⁸ and 72.4%⁷

of the dentists indicated that they were aware of the *Journal of Evidence-Based Dental Practice*. In other studies, 31.8%,⁹ 78.6%⁷ and 84.4%¹⁸ of the respondents confirmed

their awareness of the journal *Evidence-Based Dentistry*. A high frequency of non-specialist respondents⁹ and the recruitment of graduate students sited in university environments¹⁸ might explain this wide data range in the results of different studies. Additionally, higher awareness rates were observed in more recent studies,^{7,18} as opposed to the former.⁹ This might explain the variability observed for the response ranges and the potential increase in EBD focus in our practice over time. Respondents indicated relatively lower rates of awareness of other sources of critical summaries, such as the American Dental Association (ADA) Critical Summaries and the Database of Abstracts of Reviews of Effects (DARE) (56.2%¹⁸ and 36.6%,²³ respectively).

Two investigations assessed respondents' awareness of the Turning Research Into Practice (TRIP) database.^{7,18} While 35.4%⁷ of graduate students indicated that they were aware of this source, only 14.0%¹⁸ of dental practitioners reported awareness. As for other EBD sources, one study reported that 90.0%²⁰ of the interviewed dentists claimed to be aware of Clinical Practice Guidelines (CPGs), but only 68.0% claimed to 'know about' them.¹⁹ In contrast, several other studies reported lower rates of unawareness concerning SRs (7.0%² and 4.4%¹²). The rates of reported awareness regarding other EBD sources were also collected and are shown in Table 1.

Perceived knowledge of EBD principles, methods and practices

According to four studies, high proportions of dentists reported having at least some understanding of EBD^{2,9,12,26} (80.8%²⁶ to 97.8%¹²). The relatively lower frequencies observed in two other studies (44.7%⁸ and 47.3%²⁵) could be related to the respondents' shorter-term professional experience.

Except for one study, which documented a relatively lower rate of perceived knowledge about SRs (42.4%),²³ several others^{2,7,8,9,12,15} found that a high proportion of dental professionals claimed to know about SRs (70.5%⁸ to 95.5%¹²). This discrepancy might be because most of the respondents from the former study²³ did not have an internet connection in their workplaces. This could have reduced their opportunities to access information and obtain knowledge about SRs or other related subjects. Two studies

found that most respondents reported a certain level of knowledge about randomised clinical trials (RCTs) (70.9%⁹ and 98.0%¹⁵). In contrast, other studies^{7,9,15,20,23} found that respondents presented relatively lower rates of perceived knowledge of MAs (31.7%⁹ to 68.0%¹⁵).

The selected studies presented high frequencies of perceived knowledge about RCT-related topics, such as 'clinical effectiveness' (82.0%² and 97.7%¹²), 'randomisation' (96.2%⁷) and 'blinding' (80.0%¹⁵ and 86.9%⁷). Other studies found that moderate numbers of respondents reported understanding on topics related to observational studies, such as 'absolute risk' (64.0%⁷ and 46.2%²³), 'relative risk' (64.2%,²⁰ 88.0%⁷ and 43.7%²³) and 'odds ratio' (61.0%,¹⁵ 48.4%²⁰ and 29.6%²³). As for terms related to diagnostic studies, such as 'sensitivity'^{7,20} and 'specificity',^{7,15} the respondents reported possessing perceived knowledge at relatively higher rates (63.4%²⁰ to 89.0%⁷).

In the selected studies, most respondents reported some understanding of 'confidence interval' (70.0%,¹⁵ 56.7%,²⁰ 68.5%⁷). The proportion of interviewees that reported some understanding of 'heterogeneity' varied from 35.4%²³ to 76.0%;⁷ but in the former study,²³ an additional response alternative was available, in which the respondents were able to acknowledge their lack of knowledge, in addition to reporting their willingness to obtain knowledge. This added alternative ('do not understand, but would like to') was strongly preferred among respondents.²³ Of the general dental practitioners surveyed, 58.6%⁹ claimed to know about 'strength of evidence', while a relatively higher percentage of orthodontics specialists (92.0%) claimed to have this knowledge.¹⁵

In several studies,^{2,12,22,24,27} most respondents (60.5%²⁴ to 93.0%²) claimed to know about 'critical appraisal of the literature'. The only study that reported a relatively lower rate (23.1%) also observed an overall low rate of knowledge perception among the respondents concerning other subjects, illustrating that the respondents had an insufficient basic understanding and knowledge of the definitions and procedures in statistics and epidemiology.²⁵ Frequencies related to the knowledge perception of other topics are shown in online Supplementary Table 2.

Actual knowledge of EBD principles, methods and practices

In one study,¹² a high percentage of respondents correctly identified the definition of EBD (94.2%), the steps involved in EBD (95.6%), the benefits of EBD for patients (97.8%) and the advantages for those who practise EBD (97.8%). However, when asked to describe the EBD concept with their own words, another study² found that only a few respondents (29.4%) could correctly define EBD.

When asked about the factors that should be considered during the clinical decision-making process, most professionals agreed with statements that included diagnosis and the selection of optimal treatments for individual patients (75.2% and 88.9%) and the practitioners' experience (71.5% and 88.0%).²⁰ However, in another study, when asked if evidence from all published articles can be used in EBD, nearly half of the sample (43.7%) answered positively,¹² which was also the case (46.8%) when respondents were asked if EBD is based on expert opinion²⁰ and if the best and quickest way to find the evidence was by reading textbooks or asking experienced colleagues (42.2%).¹²

Tests were also developed in four studies to measure the professionals' overall knowledge of EBD. The percentages of correct answers were variable (19.0%,²⁹ 43.0%,²⁰ 55.0%²² and 71.8%²⁵). In another study,²¹ when specific skills were evaluated, poor performances were observed for formulating PICO questions (0.1/3.0), searching PubMed (0.2/8.0) and finding evidence (1.2/6.0). When asked to identify the most important factors in an RCT, respondents most often indicated sample size (75.0%), randomisation (49.0%) and blinding (47.0%).² Further details about the dentists' actual knowledge are provided in Table 2.

Risk of bias within studies

Most of the included studies presented issues regarding participation rates,^{6,7,11,15,19,20,26,27} or in detailing of the outcome measures.^{6,7,8,10,11,12,15,18,19,20,21,26} A full appraisal of the studies is provided in Table 3.

Discussion

Summary of evidence

According to several studies,^{2,6,7,8,9,10,11,12} most professionals seemed to be aware of EBD. Despite these results, one may

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Table 3 Quality assessment of the studies according to the NIH Quality Assessment Tool for observational cohort and cross-sectional studies (cont. on page 9)

Question	Reference									
	Iqbal and Glenn ²	Rabe <i>et al.</i> ⁹	Yusof <i>et al.</i> ¹²	Madhavji <i>et al.</i> ¹⁵	Haron <i>et al.</i> ²⁰	Sabounchi <i>et al.</i> ²⁵	Straub-Morarend <i>et al.</i> ²⁶	Gupta <i>et al.</i> ⁸	Hinton <i>et al.</i> ²⁹	Qureshi <i>et al.</i> ²¹
1. Research question	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Study population	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3. Participant rate of eligible persons	Yes	Yes	Yes	No	No	CD	No	CD	Yes	Yes
4. Eligibility criteria	Yes	Yes	NR	NR	Yes	Yes	NR	Yes	Yes	Yes
5. Sample size	NR	NR	NR	NR	Yes	NR	NR	NR	NR	NR
6. Exposure assessment	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. Timeframe	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8. Exposure levels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9. Exposure measures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10. Repeated exposure assessment	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
11. Outcomes measures	Yes	Yes	No	CD	CD	Yes	CD	CD	Yes	CD
12. Assessors' blinding	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13. Follow-up rate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
14. Relationship between exposure and the outcome	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Question	Reference									
	Yamalik <i>et al.</i> ¹¹	Ahad and Sukumaran ⁶	Al-Ansari and El-Tantawi ⁷	Afrashtehf <i>et al.</i> ¹⁸	Ciancio <i>et al.</i> ²⁴	Pau <i>et al.</i> ²⁸	Guncu <i>et al.</i> ¹⁹	Rawat <i>et al.</i> ²³	Almalki <i>et al.</i> ¹⁰	Vahabi <i>et al.</i> ²²
1. Research question	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Study population	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
3. Participant rate of eligible persons	No	No	No	Yes	Yes	Yes	No	Yes	NR	Yes
4. Eligibility criteria	NR	NR	NR	Yes	Yes	Yes	NR	NR	Yes	No
5. Sample size	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
6. Exposure assessment	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7. Timeframe	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
8. Exposure levels	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9. Exposure measures	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
10. Repeated exposure assessment	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 3 Quality assessment of the studies according to the NIH Quality Assessment Tool for observational cohort and cross-sectional studies (cont. from page 8)

11. Outcomes measures	No	No	CD	CD	Yes	Yes	No	Yes	No	Yes	Yes
12. Assessors blinding	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
13. Follow-up rate	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
14. Relationship between exposure and the outcome	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Key:
CD = cannot determine; NR = not reported; NA = not applicable.

easily argue that EBD awareness might not necessarily reflect actual knowledge, as the difference in meaning between the terms ‘awareness’ and ‘knowledge’ is somewhat blurred.¹³ According to McCallum *et al.*,³⁰ although awareness and knowledge are not qualitatively different, they occupy opposite positions on a knowledge continuum spectrum. Given this, variable percentages of dentists claimed to have some knowledge about EBD.^{2,6,8,9,12,21,25,26} While many dentists could identify the correct definition of EBD,¹² only a few could correctly define it themselves.² Even though professionals were frequently able to accurately recognise the steps involved in EBD, the potential benefits and advantages of EBD in clinical practice,^{12,20} significant proportions of dentists still showed fundamental misconceptions regarding the components that, according to their perception, should comprise EBD; for example, the opinions of experienced peers,²⁰ textbooks, or any published article.¹² Hence, it can be inferred that, even though many dentists are aware of EBD, we cannot assume that they understand the meaning of EBD, considering the information we were able to retrieve.

Although the PubMed/Medline database appears to be frequently used by,^{7,9} and is well-known²¹ to, most dentists, the Cochrane database is less so.^{2,7,9,12,15,18,23} We deduce that this might be attributed to the latter’s restricted access. Even though we have observed overall poor performances for formulating proper PICO questions, searching, and finding evidence,²¹ the PubMed/Medline database might still be considered an important resource for clinicians and researchers due to its accessibility.³¹

The application of the knowledge derived from full articles accessed via PubMed, or any other database, requires several abilities on the part of their readers. Besides formulating answerable PICO questions, searching, and finding studies, another essential skill is critically evaluating the selected literature. Even though the critical thinking ability seems to have a close relationship with working competence,^{32,33} the results collected here in this regard revealed variable rates of perceived knowledge,^{2,12,22,24,25,27} which indicates another possible gap to be addressed by dental professionals.

Concerning knowledge of particular study designs, most dentists reported some understanding of RCTs in general^{9,15} or more specifically.^{2,7,12,15} As for the SR study design, the studies revealed high rates of awareness^{2,12} and perception of knowledge.^{2,7,8,9,12,15} Even though we identified an overall perception of adequate knowledge concerning RCTs, SRs and related terms among respondents, none of the included studies could certify actual knowledge. Furthermore, only moderate percentages of respondents claimed to have perceived knowledge of observational or diagnostic studies.^{7,15,20,23} While most of the interviewed professionals declared to have perceived knowledge of ‘confidence interval’^{7,15,20} and ‘heterogeneity’,^{9,15} variable percentages of respondents claimed to have perceived knowledge of the term ‘strength of evidence’.^{7,23} This may indicate that professionals might be more familiar with study designs that investigate therapeutic interventions (RCT and SR). Nevertheless, a dentist’s ability to critically assess clinical evidence should ideally include understanding other methodological concepts and general statistical notions.

In addition to limited EBD training/skills, practical issues, such as shortage of time, have been indicated as a significant barrier to EBD practice.⁵ To overcome this obstacle, critical summaries and evidence-based treatment recommendations – or CPGs – have emerged as highly condensed, easily accessible vehicles for staying current with research findings.^{34,35} Recommendations have already been made for authors to produce summarised versions of their research,^{36,37} and although most of the interviewees seem to be aware of specific journals that are often dedicated to disseminating critical summaries,^{7,18} other databases, such as ADA Critical Summaries and DARE, seem to be less familiar to them.^{18,23} Although the number of critical summaries available may be limited in these electronic sources, they are fully accessible to unsubscribed users, and they provide content that was previously synthesised considering the risk of bias.

The frequency of awareness of TRIP, a database that includes a wide range of CPGs, was also low,^{7,18} even though more significant numbers of practitioners reported being aware of this type of document.^{19,20} CPGs are systematically developed recommendations to assist the practitioner and the patient with appropriate health care for specific clinical circumstances.³⁸ Unfortunately, dental CPGs are still insufficient, and many are still of low quality, are unclear, or do not consult reliable information sources.^{39,40,41} Therefore, practitioners should become familiar with the use of objective parameters when critically consulting CPGs.⁴²

Limitations

In terms of dentists’ actual knowledge, the selected studies’ data is quite

limited, controversial and arguable. The application of general tests of knowledge disclosed variable percentages of correct answers.^{20,25,29} This discrepancy might be related to the different assessment tools used to elicit the responses. The only study that found a high level of actual knowledge about EBD was the one that used multiple-choice options to collect the respondents' answers.²⁵ Therefore, these results seem to be inherently biased. Furthermore, even if some of the studies included here apparently confirmed actual knowledge of EBD,^{2,12,20,25} this does not necessarily mean that dentists are implementing EBD principles during their professionals' routine practice.

Methodologically, the quantitative results summarised here must be considered cautiously. Most studies presented limitations regarding sample representativity,^{6,7,8,10,11,15,18,19,20,21,22,23,24,25,27,29,30} participation rates,^{6,7,11,15,19,20,26,27} detailing of the outcome measures^{6,7,8,10,11,12,15,18,19,20,21,26} and validation of the assessment tools.^{2,6,7,8,9,11,15,18,19,20,21,22,24,26,30} Additionally, extensive overall ranges of responses were often observed for similar questions across the studies. This might be related to the significant heterogeneity identified across samples, as the assessment tools or investigation methods were rarely uniform, and the wide time range throughout which the included studies were conducted (from 2002² to 2020^{22,27}). Due to the clear heterogeneity among studies, the conduction of any MA was not justified.

Hence, the quantitative results of the selected studies should not be extrapolated globally. Since there seems to be scarce information derived from properly validated assessment tools, educators or policymakers might still be provided with reliable information before designing potentially effective educational strategies. Therefore, future research in the EBD field should develop questionnaires that combine all dimensions (awareness of EBD, perceived knowledge of EBD and actual knowledge of EBD) within a single assessment tool. In addition, a validation process would also be warranted, with EBD actual practice as a reference. This would thus help establish future knowledge translation strategies to overcome specific and pre-identified gaps in dentists' knowledge of the main principles, methods and practices involved in EBD.

This SR was not aimed at evaluating the effectiveness of educational interventions related to EBD on dental practitioners, and the results collected here are not sufficient to support their recommendation. Therefore, we believe that future syntheses should be performed with this specific purpose. Nevertheless, we assume that continuing education initiatives covering EBD principles and the development of critical appraisal skills for multiple study designs and documents, such as CPGs, would be somewhat beneficial for clinicians interested in improving their practice. Although there have been important incentives for dental practitioners to adopt EBD habits, it seems clear that improving our understanding on the fundamentals and skills is an essential pre-condition.

Based on low certainty of the evidence, dentists seem to be aware of EBD in general, the PubMed/Medline database, EBD scientific journals and CPGs. Concerning perceived knowledge, variable proportions of dentists claimed to know about EBD, and most reported a certain level of understanding of SRs and RCTs. However, actual knowledge has scarcely been assessed, and few dentists seem to really understand EBD principles, methods and practices.

Ethics declaration

The authors deny any conflicts of interest.

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Author contributions

Murilo Fernando Neuppmann Feres: conception of the work, acquisition of data, data analysis, interpretation of data, drafting the work, critical review for intellectual content, final approval of the submitted version. Maxwell Lopes Albuini: acquisition of data, drafting the work, final approval of the submitted version. Renata Pires de Araújo Castro Santos: acquisition of data, drafting the work, final approval of the submitted version. Luciano Aparecido de Almeida-Junior: acquisition of data, data analysis, drafting the work, final approval of the submitted version. Carlos Flores-Mir: conception of the work, acquisition of data, data analysis, interpretation of data, drafting the work, critical review for intellectual content, final approval of the submitted version. Marina Guimarães Roscoe: conception of the work, acquisition of data, data analysis, interpretation of data, drafting the work, critical review for intellectual content, final approval of the submitted version.

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