

Assessment of Pediatricians' Knowledge, Practices, and Attitudes on Oral Health/Care in Children in the Last Decade: A Systematic Scoping Review and Critical Reflection

Arturo Garrocho-Rangel* / María Elena López-Torre** / Miguel Ángel Santos-Díaz *** / Gabriela Torre-Delgadillo**** / Juan Carlos Flores-Arriaga***** / Marc Saadia *****/ Amaury Pozos-Guillén *****

Pediatricians are primary health care professionals who supervise the growth and development and treat infants and children during the first years of life. Thus, they should possess knowledge regarding oral health care, to provide anticipatory guidance, as well as dental education to parents in order to make appropriate clinical decisions. For many years, several surveys have been performed worldwide to assess the pediatricians' knowledge, awareness, and experience regarding oral health care and prevention. This work aimed to scope the existing literature and summarize the most relevant evidence about knowledge, practices, and attitudes on oral health/care among pediatricians worldwide. PubMed, Cochrane Library, Google Scholar, and Dentistry & Oral Sciences Source were explored. Under a structured PCC question and eligibility criteria, for relevant clinical trials and observational studies, published during the last decade. Titles and abstracts were screened. Full-text articles were critically reviewed for bias risk and a data charting table was constructed. A total of 44 references were initially identified, and 37 titles remained for abstract screening after removing duplicates; then, 27 potential full-text articles were carefully reviewed. Finally, 25 relevant and most informative studies were included. The selected studies were conducted in India, Lebanon, Saudi Arabia, and Paraguay, Europe, Australia, Qatar, Iran, Turkey, United Arab Emirates, Nigeria, Brazil, Chile, Germany, Taiwan, Canada, and the USA. Through included surveys, researchers have reported different levels of knowledge, practice involvement, and attitude on children's oral health among pediatricians. In general, unsatisfactory knowledge of oral health was reported. The main impediments for a better professional involvement or practice include inappropriate education, poor auto-confidence, and lack of time. So, it has been suggested that some oral health training or clinical guidelines should be included in the current medical curricula.

Keywords: Pediatricians; Knowledge; Practice; Attitude; Children's Oral Health.

*Arturo Garrocho-Rangel, DDS, PhD, Associate Professor, Pediatric Dentistry Postgraduate Program, Faculty of Dentistry, San Luis Potosí University, San Luis Potosí, SLP, México.

**María Elena López-Torre, DDS, Resident, Pediatric Dentistry Postgraduate Program, Faculty of Dentistry, San Luis Potosí University, San Luis Potosí, SLP, México.

***Miguel Ángel Santos-Díaz, MD, MS, Associate Professor, Pediatric Dentistry Postgraduate Program, Faculty of Dentistry, San Luis Potosí University, San Luis Potosí, SLP, México.

****Gabriela Torre-Delgadillo, DDS, MS, Associate Professor, Pediatric Dentistry Postgraduate Program, Faculty of Dentistry, San Luis Potosí University, San Luis Potosí, SLP, México.

*****Juan Carlos Flores-Arriaga, DDS, PhD, Associate Professor, Pediatric Dentistry Postgraduate Program, Faculty of Dentistry, San Luis Potosí University, San Luis Potosí, SLP, México.

*****Marc Saadia, DDS, MS, Private practice, Mexico City, México.

*****Amaury Pozos-Guillén, DDS, PhD, Associate Professor, Pediatric Dentistry Postgraduate Program, Faculty of Dentistry, San Luis Potosí University, San Luis Potosí, SLP, México.

Corresponding author:

Amaury Pozos-Guillén

Faculty of Dentistry, San Luis Potosí University, Av. Dr. Manuel Nava # 2, Zona Universitaria, C.P. 78290; San Luis Potosí, SLP, México.

Phone: 52 4448262300 X 5134

E-mail: apozos@uaslp.mx

INTRODUCTION

Dental caries comprises the single most frequent chronic disease among children worldwide today, especially in those individuals of low-income and minority status. It has been established that certain factors, such as the limited knowledge on adequate oral hygiene and the difficulties for accessing preventive oral care services, contribute to untreated dental caries in many children.¹ This can lead to complications with chewing and eating, speaking, and attending to learning at school.² Therefore, comprehensive oral care must be considered as an integral part of the overall health of children.³ In this regard, the American Academy of Pediatric Dentistry⁴ (AAPD) has historically recognized that oral health care and preventive education can enhance the opportunity for children to have a life free of oral disease. General dentists, physicians, nurses, health providers, and community organizations must be involved to achieve this purpose. Primary care physicians and pediatricians examine infants and young children during the first and second year of life (“well-baby” or “check-up” visits) to evaluate the developmental progress and give the parents opportune nutrition or immunization guidance.⁵ So, they are in a distinctive position to play an invaluable role in guaranteeing that parents receive relevant and reliable oral information on the optimal prevention of dental caries and other oral diseases (e.g. gingivitis and malocclusions).⁶ These health professionals commonly confront the morbidity associated with dental caries, so, they have the great opportunity to early intervene, in collaboration with dental colleagues, to prevent or control this disease and improve the oral health outcomes.³ Working together, pediatric dentists and pediatricians should reinforce coordinated efforts to provide education, guidance, and counseling to parents, guardians, and caregivers pretending in this way to achieve a high-quality oral preventive and opportune restorative management to affected infants and young children.⁷

According to Soares and coworkers, most parents systematically visit and consult pediatricians (public or private) throughout the first year of life, which does not occur concerning pediatric dentistry practitioners or general dentists.⁸ Therefore, and as primary health providers, pediatricians must possess knowledge of pediatricians and educate parents on common oral diseases and associated risk factors, basic preventive oral measurements (e.g. brushing, breastfeeding, night bottle-feeding, fluoride varnishes), dietary recommendations, early diagnosis of dental caries, dento-facial injury prevention, the establishment of a dental home, and timely referral to the dental specialist for the child's first dental visit. On the other hand, many parents are unaware of the consequences of poor oral health for their pregnancy and/or their children (newborn, infant, or young child).⁴ Further, most children do not visit a dentist to control dental disease until after 2 or 3 years of age and many poor and minority parents are unable to access pediatric dental care at all for them.^{2,9,10}

By increasing the pediatrician's role and involvement in their patients' oral health during the regular medical visits, especially in those who are deprived to obtain access to qualified professional dental attention. This clinician-patient-parents interaction allows routinely discussing age-appropriate anticipatory guidance on a variety of oral topics.² So, it is necessary to periodically evaluate to what degree pediatricians are knowledgeable about oral and dental health

care and prevention, their behaviors or practices regarding oral diseases, and their corresponding incidence in the professional clinical practice.¹¹ Also, little has been recognized about the potential barriers to patients' oral care among pediatricians, how they value the promotion of oral health, and the extent to which they are willing to take on additional actions for this.^{2,5,12} To address these questions, international and regional cross-sectional surveys have been performed worldwide to assess or screen the pediatricians' knowledge or literacy, current practice, and experience regarding oral care and prevention.^{10,12,13}

Hence, the aims of the present study were to systematically scope the most relevant and reliable evidence published during the last decade and map the recent information regarding pediatricians' awareness, views, and attitudes on oral health about their patients, in order to identify potential gaps in knowledge that need to be addressed in the near future.

METHODS

Study design. The present scoping review was carried out according to the methodology stated by Arksey and O'Malley,¹⁴ Levac and co-workers,¹⁵ and the Preferred Reporting Item for Systematic Reviews and Meta-analysis extension for scoping reviews guidelines (PRISMA-ScR)¹⁶ for transparent reporting.

Study hypothesis

We believe that, in general, pediatricians exhibit a low level of knowledge, attitude, or professional capability concerning essential children and infants' oral-related pieces of evidence and practices.

Research question and eligibility criteria

The study followed a PCC format scoping review question, where *the population* (P) was “pediatricians”; *concept* (C) was “knowledge about children oral health”; and *context* (C) was “clinical trials/ observational studies/ narrative review articles/ on pediatric oral health/care”. The following focused research question was constructed: among the pediatricians, what is the average level of knowledge about children's oral health and care? To address this question and other related interrogates, only electronic available cross-sectional survey designs), written in the English and Spanish languages, and published between 2011 and 2021, were eligible. Studies performed in teenagers, letters to the editor, and gray literature were excluded. Reasons for exclusion after full-text reading were recorded.

Search strategy and screening process

An electronic search from the period from September to November 2021 was performed in the following four databases: PubMed, Cochrane Library, Google Scholar, and Dentistry & Oral Sciences Source (EBSCO) for cross-sectional surveys. A search strategy was conducted, employing different combinations of keywords (and synonyms), MeSH terms, and Boolean operators. The main five key search terms were “oral health”, “children”, “pediatricians”, “knowledge”, and “practice”. We adapted this strategy for use in all electronic databases. For instance, in PubMed, the next search algorithm was employed:

(“oral health”[MeSH Terms] OR (“oral”[All Fields] AND “health”[All Fields]) OR “oral health”[All Fields]) AND

("child"[MeSH Terms] OR "child"[All Fields] OR "children"[All Fields] OR "child s"[All Fields] OR "children s"[All Fields] OR "childrens"[All Fields] OR "childs"[All Fields]) AND ("paediatrician s"[All Fields] OR "paediatricians"[All Fields] OR "pediatrician s"[All Fields] OR "pediatricians"[MeSH Terms] OR "pediatricians"[All Fields] OR "paediatrician"[All Fields] OR "pediatrician"[All Fields]) AND ("knowledge"[MeSH Terms] OR "knowledge"[All Fields] OR "knowledge s"[All Fields] OR "knowledgeability"[All Fields] OR "knowledgeable"[All Fields] OR "knowledgeably"[All Fields] OR "knowledges"[All Fields]) AND "practice"[All Fields] OR "practices"[All Fields]

The complete searching process was carefully carried out by two independent, blinded, and pre-calibrated authors (MELT and GTD), according to the inclusion and exclusion criteria. The levels of inter- and intra-reviewer of these authors were calculated using Cohen's kappa coefficient,¹⁷ using the SPSS statistical software (v. 25). Any discrepancy or conflict of opinion was resolved through discussion and consensus by consulting other authors (MASD and JCFA) or the full author team.

Data charting and result synthesis

A special tabular form for data charting was constructed and piloted with relevant information entries, and approved by authors' consensus. From each selected article, the following items were summarized and recorded: publication's first author, and country; population (studied sample), questionnaire characteristics, main outcomes/findings/conclusions. All items were collected independently by two blinded authors (AJPG and JAGR).

Bias risk

The methodological quality of included pediatrician surveys was evaluated through the Center for Evidence-Based Management's (CEBM) appraisal tool—adapted from Crombie, *The Pocket Guide to Critical Appraisal*; the critical appraisal approach used by the Oxford Centre for Evidence Medicine; checklists of the Dutch Cochrane Centre; BMJ editor's checklists; and the checklists of the EPPI Centre—¹⁸ integrated by twelve issues/items and three different answer options: "Yes", "Can't tell", and "No". The answer "Yes" had a value of 1 point, "Can't tell" 0.5 points, and "No" 0 points; however, the items 4 and 11 were rated inversely ("Yes" = 0 pt, "Can't tell" = 0.5 pts, and "No" = 1 pt). So, the maximum total score was 12 points. Only those studies with moderate (5-8 pts) to high quality (9-12 pts) were included in the final list of the present scoping review.

RESULTS

We initially identified a total of 41 references from the different electronic databases and the subsequent manual searching, after which 37 titles remained after removing duplicates. After the article title and abstract screening, 27 potential full-text articles were carefully reviewed for eligibility. Finally, 25 relevant, representative, and most informative studies were included, according to the critical appraisal performed. The selection process was according to the PRISMA-ScR statement flowchart, as can be outlined in Figure 1. On the other hand, a very good intra- and inter-reviewer agreement levels were found for the search strategy and screening processes, according to the calculated kappa coefficients (0.87 and 0.94, respectively). The results of the survey risk of the bias assessment

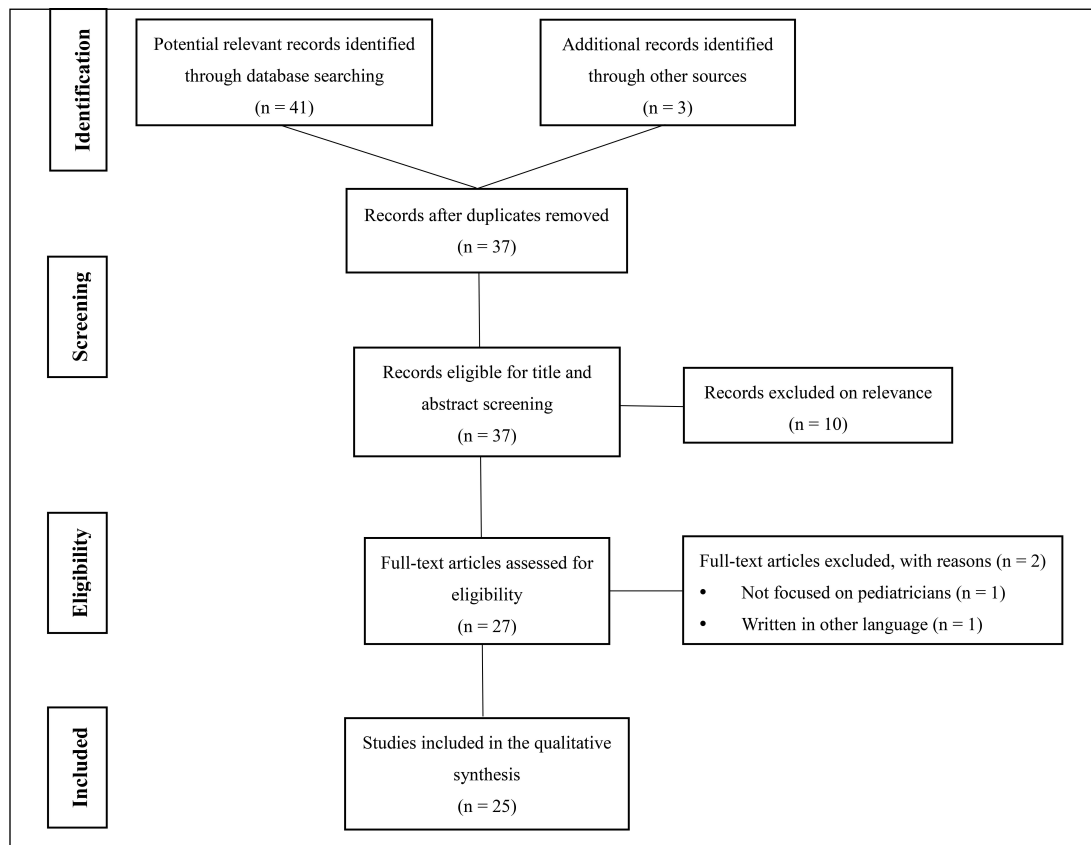


Figure 1. Prisma flow chart for literature search.

process are described in Table 1;^{6,8-13,19-36} the total score for risk of bias of the included studies, according to the CEBM's scale, ranged from 6.5 to 10.5 (moderate to high quality).

Considering the inclusion criteria, all the studies were cross-sectional questionnaires (mostly self-reported surveys). Regarding the country, most surveys were conducted in India (5), Lebanon (2), Saudi Arabia (2), and Paraguay (2); the rest were from Europe, Australia, Qatar, Iran, Turkey, United Arab Emirates, Nigeria, Brazil, Chile, Germany, Taiwan, Canada, and the USA. All studies

presented any type of descriptive or inferential statistical analysis (with p values and/or 95% confidence intervals). The publication dates ranged from 2011 to 2020. Principal characteristics, numerical data, and findings/conclusions from each article were summarized in Table 2.^{6,8-13,19-36} The approximate total sample size of the included studies was 4,750 pediatricians, residents, family physicians, and other primary health care providers (range per study: 60 to more than 400). Regarding this, only a few studies included a clear sample size calculation process (e.g. based on statistical power).

Table 1. Risk of bias assessment of each included study.

Author	Did the study address a clearly focused question / issue?	Was the research method (study design) appropriate for answering the research question?	Was the method of selection of the study subjects clearly described?	Could the way the sample was obtained introduce selection bias?	Was the sample of subjects representative with regard to the population to which the findings would be referred?	Was the sample size based on pre-study considerations of statistical power?	Was a satisfactory response achieved?	Are the measurements (questionnaires) likely to be valid and reliable?	Was the statistical significance assessed?	Are confidence intervals given for the main results?	Could there be confounding factors that have not been accounted for?	Can the results be applied to your organization?	Total score
Sabbagh et al. ¹⁹	0.5	1	1	0.5	1	0	1	1	1	1	0.5	1	9.5
Raghavendra et al. ²⁰	1	1	1	0.5	1	0	0.5	1	1	1	0.5	1	9.5
Bozorgmehr et al. ¹²	0	0.5	1	0.5	1	0	1	1	0.5	0	0.5	1	7
Nammalwar et al. ²¹	1	1	1	0.5	1	0	0	1	1	0	0.5	1	8
Soares et al. ⁸	0	0.5	0.5	1	1	1	1	1	0.5	0.5	0	1	8
Hope-López et al. ²²	0	1	1	0	1	1	1	1	1	0.5	0	1	8.5
Gonul-Sezer et al. ¹¹	1	1	1	0.5	1	0	1	1	1	1	1	1	10.5
Quinonez et al. ²³	1	1	1	0.5	0.5	0.5	1	1	1	0	0	1	8.5
Rolón-Lara et al. ²⁴	0.5	1	1	0	0.5	1	1	1	0.5	1	0	1	8.5
Wagner et al. ²⁵	0.5	1	1	0.5	1	0	1	1	1	0	0	1	8
Lochib et al. ²⁶	1	1	1	0.5	1	0.5	0.5	1	0	0	0.5	1	7.5
Bismarck et al. ⁶	1	1	1	0.5	1	0	1	1	1	1	1	1	10.5
Indira et al. ⁹	0.5	1	1	0.5	1	0	1	1	1	0	0.5	1	8.5
Nassif et al. ²⁷	1	1	1	0.5	1	0	1	1	1	0	1	1	9.5
Díaz-Reissner et al. ²⁸	1	1	1	0	1	1	1	1	1	0.5	0.5	1	10
Noueiri et al. ²⁹	0.5	1	1	0.5	1	0	1	1	1	0	0.5	1	8.5
Singhal et al. ³⁰	0.5	1	1	0.5	1	0	1	1	0	0	0.5	1	7.5
Hadjipanayis et al. ¹⁰	0.5	1	0.5	0	1	0	1	1	0	0	0.5	1	6.5
Dima et al. ³¹	0	1	1	0	1	0	1	1	1	1	1	1	9
Koirala et al. ³²	0.5	1	1	0	1	0.5	1	1	1	1	0	1	9
Alshunaiber et al. ³³	0.5	1	1	0	1	0	1	1	1	0	0.5	1	8
Gupta et al. ³⁴	1	1	1	0	1	0	0.5	1	0	0	0.5	1	7
Goyal et al. ³⁵	0.5	1	1	0.5	1	0	1	1	0	0	0.5	1	7
Alkhtib et al. ³⁶	1	1	1	0.5	1	0	0.5	1	1	0	0.5	1	8.5
Aburahima et al. ¹³	1	1	1	0.5	1	0	1	1	1	0	0.5	1	9

In general, the included questions for the professional knowledge issue were: age for the first child dental visit, oral disease, and dental caries risk factors, oral disease prevention and hygiene measures, and fluoride treatments or supplementations; for the practice at the medical office, the associated questions were: routine oral clinical examinations, risk factor assessment, guidance/counseling

to parents (e.g. cariogenic diet or dental trauma), referral to pediatric dentists, and fluoride applications; and, for the attitude issue: professional involvement or role in oral disease prevention and oral health promotion, personal interest on oral health training, and related current barriers.

Table 2. Characteristics of the included studies.

Author and Country	Study sample characteristics	Questionnaire characteristics	Main outcomes/ findings/conclusions
Sabbagh et al. ¹⁹ , Saudi Arabia	- 605 pediatricians (51% female, 49% male) from the city of Jeddah (Saudi Arabia).	- A questionnaire was structured to assess dental knowledge, attitude, and behavior after a thorough literature review. - Open-ended and close-ended items. - 40 questions about general dental knowledge, preventive dental measures, the timing for referral, diet counseling, parafunctional habits, and handling of dental trauma.	- RR = 60% - Mean age = 39.57 yrs. - In general, pediatricians' knowledge, attitudes, and behavior regarding oral health and prevention were not satisfactory. - The concept of oral health prevention was deficient. Awareness of fissure sealants, fluoride, dietary counseling, time of first dental visits, and thumb sucking were quite limited.
Raghavendra et al. ²⁰ , India	- 84 randomly selected pediatricians (76% males and 24% females) from four cities of North Karnataka (India).	- The questionnaire was divided into several sections: (1) personal information, (2) dental knowledge, (3) treatment performed in primary teeth, (4) age until primary teeth are retained, (5) cariogenic food, (6) recommended age of weaning, and (7) tooth brushing and preventive. - 25 close-ended items.	- RR = 100% - Mean age = 41.5 yrs. - Pediatricians had poor knowledge regarding dental and oral health, and treatment needs in children. - Although pediatricians are aware that they play an important role in the prevention and early diagnosis of oral diseases, they generally do not possess enough knowledge to do it.
Bozorgmehr et al. ¹² , Iran	- 60 pediatricians and 15 residents (55% females and 45% males) from Kerman (Iran).	- The questionnaire comprised five sections with a series of questions, including sociodemographic and practice characteristics, knowledge about the risk factors for oral diseases, attitude toward oral disease prevention, practicing oral preventive care, information about oral diseases.	- RR = 80% - Mean age = 40 yrs. - Less than 50% of the respondents knew all the main risk factors of dental caries, gingivitis, and malocclusions. - Less than 10% of pediatricians prescribed dietary fluoride supplements in their professional practices.
Nammalwar et al. ²¹ , India	- 400 pediatricians and 400 family physicians from the city of Chennai (India).	- The self-administered questionnaire involved four sections: personal details, approach toward pediatric dentistry, knowledge level, and received training on oral health. - Only Yes/No items.	- RR = 87% - Most respondents were less aware of the first dental visit. - Only a few acknowledged the cariogenicity of medicated syrup. - A few physicians underwent dental training.
Soares et al. ⁸ , Brazil	- 130 Brazilian pediatricians (69% females and 31% males) recruited by the census, enrolled in the Regional Council of Medicine, Section Piauí (city of Teresina).	- The questionnaire contained demographic data and issues concerning the guidance given to parents and caregivers about oral health.	- RR = 77% - Mean age = 48 yrs. - 92% of the pediatricians always performed an oral examination during routine consultations. - Regarding the indication of cleaning the baby's mouth, 94% indicated the procedure. - 59% indicated cleaning with water or saline applied with gauze, cotton, or by ingestion using a water bottle after a milk bottle; 26% did not respond; 15% used other materials.
Hope-López et al. ²² , Chile	- 164 pediatricians (69.5% females and 30.5% males) who attended a Pediatrics congress in Pucón (Chile).	- The questionnaire was translated and adapted from the University of Washington's national survey for pediatricians. The survey included demographic data, knowledge about preventive therapies in oral health, opinion on their role in oral health promotion, experience in detecting oral problems, and existing barriers when referring patients to the dentist. - Likert-type items (5 options).	- RR = 100% - Mean age = 44.3 yrs. - 64% of respondents reported diagnosing cavities in preschoolers at least once a month. - 51.1% referred the child to the dentist at 1 year of age. - 3% of them correctly answered all knowledge questions. - 66.8% never received oral health training during their formation.

Table 2. Characteristics of the included studies (continued).

Author and Country	Study sample characteristics	Questionnaire characteristics	Main outcomes/ findings/conclusions
Gonul-Sezer et al. ¹¹ , Turkey	- 350 Turkish practicing pediatricians, members of two medical associations, who attended a Pediatrics Congress in Istanbul in 2010.	- The questionnaire was designed based on a literature review and consisted of five sections: (1) demographic data; (2) 28 questions assessing knowledge about oral health risk factors, pathology, dentition, nutrition, and caries prevention; (3) oral health-related clinical practices; (4) self-reported and their own children dental problems; and (5) oral health education and training.	- RR = 40% - Median age = 37 yrs. - 13.9% of pediatricians referred children younger than one year of age to the dentist. But, after adjusting for the level of oral health education and training, sex, and having children, only the knowledge was significantly associated with referring patients younger than one year of age (p = 0.01).
Quinonez et al. ²³ , USA	- A random sample of AAP members (2008/2012 Periodic Survey of Fellows). - 57% female, 43% male.	- Two surveys to examine pediatricians' participation in oral health activities, attitudes, practices, and barriers regarding screening and risk assessment, counseling, and topical fluoride applications in children from birth to 3 years of age. - Yes/no and Likert-type questions.	- RR = 48% - The majority of respondents provide oral health activities in medical offices. Most respondents agree they should apply fluoride varnish, but only 7% report doing this. Many respondents reported receiving oral health training; but, limited time, lack of training, and billing remain as barriers to delivering these services.
Rolón-Lara et al. ²⁴ , Paraguay	- A sample of 92 pediatricians and residents (62% female, 38 male) practicing in the city of Asunción and the department Central.	- A self-administered questionnaire (developed and validated by Di Giuseppe et al.) to determine the level of knowledge, attitudes, and practices in oral health prevention. - 34 closed, multiple-choice items.	- RR = 100% - Mean age = 29 yrs. - 74% of pediatricians exhibited inadequate practice regarding oral examination and fluoride prescription. - 49% had enough knowledge about risk factors for main oral diseases. - 100% had a favorable attitude toward their role in the prevention of oral diseases.
Wagner et al. ²⁵ , Germany	- 167 practicing pediatricians (76.7% female and 23.3% male) in the state of Thuringia (Germany).	- A questionnaire with 33 standardized items to be answered in around 10 minutes, to assess the current oral health-related preventive recommendations. - Divided into four sections: (1) vitamin supplements, (2) recommended oral hygiene measures, (3) counseling of parents and referrals to the dentist, and (4) personal and professional information. - Closed and open questions.	- RR = 52% - Mean age = 43.5 yrs. - More than 9.0% of the pediatricians advise parents about diet, use of baby bottles, oral hygiene, and dental visits. - 23.3% prescribe solely vitamin D, and 20.9% prescribe vitamin D combined with fluoride. - Fluoride supplements are given as required by 37.2%. The simultaneous use of fluoride supplements and fluoride toothpaste in the first three years was recommended by 45.9% of the pediatricians.
Lochib et al. ²⁶ , India	- 71 pediatricians, members of the Pediatrician Association from the city of Faridabad (India).	- A 13-item questionnaire covering professional and personal information, knowledge (dental caries, fluoride supplement, spread of caries, and dental home), attitudes, and their role toward infant oral health care. - Yes/No and multiple-choice questions.	- RR = 90% - 12% routinely performed an oral examination of infants. - 4% counseled the parents regarding caries risk. - 26% recommended fluoride for the prevention of caries. - 86% referred the child to a general dentist.
Bismarck et al. ⁶ , Nigeria	- 121 pediatricians (54.5% female and 44.5% male) who attended the Annual General Meeting (Pediatric Association of Nigeria) in 2015.	- The questionnaire was designed according to the AAPD clinical guidelines and similar previous studies. - It included personal/professional information, knowledge of basic children's oral health care, and recommendations for expanding the knowledge among pediatricians.	- RR = 89.3% - 89.3% reported that children should be referred to dental health care. - 53.7% felt that examination of the oral cavity should be routine. - 50.4% reported that health education should be given to caregivers/mothers about nursing caries. - 89.3% recommended that the current postgraduate curriculum should incorporate knowledge of basic oral health care in children.

Author and Country	Study sample characteristics	Questionnaire characteristics	Main outcomes/ findings/conclusions
Indira et al. ⁹ , India	- 120 pediatricians from the city of Mysore, listed in the Indian Academy of Pediatrics (IAP).	<ul style="list-style-type: none"> - A survey questionnaire (based on studies by Tegwyn et al., Prakash et al., and Murthy et al.). - 27 questions regarding personal and professional details, knowledge level, and approach toward infant oral healthcare. - Cronbach alpha value: 0.84. 	<ul style="list-style-type: none"> - RR = 80.8% - Pediatricians agree that it is important to do the first dental examination before 1 year. - The importance of initiating oral hygiene practice before the eruption of first teeth was uncommon among pediatricians. - Most of the respondents were less aware of the first dental visit, including early childhood caries.
Nassif et al. ²⁷ , Lebanon	- 100 Lebanese pediatricians from five governorates, members of the Lebanese Society of Pediatricians.	<ul style="list-style-type: none"> - A 21-item questionnaire to evaluate the knowledge and attitudes regarding children's oral health. - It included two sections: (1) pediatrician's general information (years, place, and type of practice); and (2) knowledge and attitude regarding several oral health issues (9 questions). 	<ul style="list-style-type: none"> - RR = 100% - 65% to 75% of pediatricians believe that a child can brush properly his teeth before the age of 5 years. - 13% to 28% of respondents declare that white and black spots are signs of affected teeth.
Díaz-Reissner et al. ²⁸ , Paraguay	- 98 pediatric interns (68.4% female, 31.6% male) from Central and Asunción Departments.	<ul style="list-style-type: none"> - A 16-item questionnaire (adapted from Rojas-Mayhure's Peruvian study) requesting: (1) demographic and academic information; and (2) dental caries knowledge and attitude. - Multiple-choice and Likert questions. 	<ul style="list-style-type: none"> - RR = 100% - Mean age = 27 yrs. - Insufficient knowledge regarding dental caries prevention was found in 83.67%, 16.33% had fair knowledge, and none had thorough knowledge. - A positive attitude was shown by 96.94%, indifferent attitude in 3.16%, and none showed a negative attitude about the role of the pediatrician in preventing dental caries.
Noueiri et al. ²⁹ , Lebanon	- 100 members of the Lebanese Society of Pediatricians, selected for five governorates.	<ul style="list-style-type: none"> - An 11-item questionnaire, divided into two sections: (1) general information and (2) behavior regarding children's oral health, according to several variables. 	<ul style="list-style-type: none"> - RR = 100% - 97.7% of pediatricians with more than 5 years of practice reported inquiring about whether a child is taking a milk/juice bottle overnight, as compared to 76.9% of pediatricians who have been practicing for less than five years. - Most pediatricians working in cities/big villages (98.9%) and 76.9% in small villages examine for cavities during the oral examination.
Singhal et al. ³⁰ , Canada	- Pediatricians and Family Physicians from the Niagara region (Canada).	<ul style="list-style-type: none"> - A self-administered postal survey questionnaire, based on a conducted comprehensive literature review on different electronic databases and previous similar studies. - 22 items for evaluating (1) practice characteristics; and (2) knowledge, attitude, willingness, and readiness about oral healthcare in children. - The questionnaire was piloted for content validity, face validity, relevance, and clarity. 	<ul style="list-style-type: none"> - RR = 68.3% - More than 90% knew that untreated tooth decay could affect the general health of a child. - More than 80% examine the oral cavity. - More than 50% are not aware that white spots/lines on the enamel are the first signs of tooth decay. - Lack of clinical time was the top reason for not performing oral disease prevention measures.
Hadjipanayis et al. ¹⁰ , Cyprus, Israel, Italy, Spain, Belgium	- 939 pediatricians from diverse European countries.	<ul style="list-style-type: none"> - A questionnaire was developed to assess the knowledge, attitudes, and practices on oral health. - Sections: (1) demographic characteristics, (2) oral health education and training received, (3) knowledge, and (4) attitude and practices about oral health. 	<ul style="list-style-type: none"> - RR = 54.3% - Mean age = 52.8 yrs. - Oral health education was received mainly through continuing medical education and practical experience (51%) rather than in medical school or residency (33%). - 24% did not know that the first signs of caries were white spots on the enamel. - Although 98.8% of pediatricians check the oral health status of children, only 52% feel confident enough to identify dental caries. - 43% recommended a first dental visit for children above the age of 3 years and 7% under 1 year of age.

Table 2. Characteristics of the included studies (continued).

Author and Country	Study sample characteristics	Questionnaire characteristics	Main outcomes/ findings/conclusions
Dima et al. ³¹ , Taiwan	- 301 participants; 105 pediatricians (62.9% male, 37.1% female) of Taipei City (Taiwan). The rest were general and pediatric dentists.	- A standardized self-administered questionnaire consisting of five parts: (1) demographic and occupational characteristics; (2) knowledge related to early childhood caries (ECC) and its prevention; (3) practices regarding caries prevention; (4) fluoride varnishes program in Taiwan; and (5) attitude toward potential barriers in the medical office (knowledge, confidence, learning, and time). - 52 to 54 items. - Cronbach's alpha coefficients were: knowledge = 0.57, attitude = 0.76, and practice = 0.89.	- RR (pediatricians) = 100%. - The correlation between knowledge and attitude among the pediatricians was significantly positive. - Attitude and practice among the pediatricians were significantly positively correlated. - Pediatricians lacked ECC-related knowledge.
Koirala et al. ³² , Australia	- A sample of pediatricians (51.7% females, 48.3% male), members of the Australian Pediatric Research Network.	- An annual multi-topic survey (2013), designed to assess children's oral health knowledge, current practice, barriers to oral health-related discussions, and demographic measures. - Likert-scale questions adapted from the AAP Survey of Fellows.	- RR = 41%. - Few pediatricians reported very good/excellent ability to assess plaque presence and dental caries. - 10% reported proposing the issue of oral health with all patients. - Lack of professional training was reported as the principal barrier for adequate oral health supervision.
Alshunaiber et al. ³³ , Saudi Arabia	- 202 pediatricians and family physicians in Riyadh city (40.1% female, 59.9% male).	- A self-administered, close-ended questionnaire adapted from a literature review, with the following sections: (1) sociodemographic data; (2) knowledge assessment; (3) attitude assessment; (4) practice; (5) barriers preventing the performance of children's oral health activities; and (6) desire of receiving dental training and education.	- RR = 100% - The participants' practice was lower (42.6%) compared with their attitude (86.1%) and knowledge (65.3%). - Most of the participants (52.5%) indicated lack of clinical time as the main barrier for performing oral health activities. - Majority of the participants (76.7%) indicated that they need more dental training and education. - Dental caries preventive methods (44.6%) were the most requested topic, of which workshops and seminars were the main preferred method (39.6%).
Gupta et al. ³⁴ , India	- 65 randomly selected pediatricians (75.3% male, 24.7% female) practicing in Varanasi (India).	- A comprehensive questionnaire based on several previous studies, divided into four sections: (1) demographic characteristics; (2) knowledge on pediatric dentistry; (3) practice and opinions about dental caries and oral health; and (4) attitude of the pediatrician toward early childhood caries (ECC) and oral health.	- RR = 100% - 58.5% acknowledged the importance of pediatric dentistry. - 72.7% perform any type of oral examination regularly. - 17% knew ECC. - 32.3% acknowledged the cariogenicity of medicated syrups.
Goyal et al. ³⁵ , India	- 102 young pediatricians (Junior and Senior residents) from Chandigarh (India).	- A self-administered questionnaire about pediatric oral diseases, reviewed by experts (content validity). - It consisted of two sections: (1) open-ended questions on basic demographic information, and (2) close-ended questions to assess the knowledge regarding oral diseases, hygiene measures, topical fluoride applications, and attitude and related practices.	- Majority knew dental caries, bottle feeding, tongue cleaning, and medication causing gum inflammation. - Few knew recommended age to start tooth brushing and recommended adequate sugar exposures per day. - Although the majority had correct knowledge about fluoride and its role in caries prevention, very few knew the recommended fluoride concentration in toothpaste for children.

Author and Country	Study sample characteristics	Questionnaire characteristics	Main outcomes/ findings/conclusions
Aburahima et al. ¹³ , United Arab Emirates	- A random sample of 176 pediatricians (55.1% males, 44.9% females) from the UAE.	- A 16-items questionnaire, adapted from Sabbagh et al. ¹⁹ and Weather-spoon et al., consisted of three parts: (1) demographic questions; (2) dental knowledge, behavior, and practices; and (3) dental attitude. - Yes/No and multiple-choice questions.	- RR = 100% - 51.4% identified the appropriate age for a child's first dental visit. - 47.6% believed that the appropriate age to start brushing was after the eruption of the primary molars. - 71.4% believed that the ideal time to give sugary snacks is in between meals. - 66.5% said that they would prescribe antibiotics to treat local dental sepsis without fever.
Alkhtib et al. ³⁶ , Qatar, Australia	- 168 pediatricians and other primary health providers practicing in Qatar.	- A 23-item questionnaire, distributed in 20 primary health care centers. - It was based on a comprehensive literature review and previous similar study (Lewis et al. ²); with three sections: (1) demographic data, experience, and training; (2) knowl-edge about pediatric oral diseases and oral health promotion; and (3) practices and attitudes toward oral health issues.	- RR = 67%. - 35.7% received some form of oral health training during their undergraduate formation. - The participants would assess the dental problem of the child and discuss the importance of tooth brushing with the mother. - A significant number of respondents were unlikely to assess the children's fluoride intake.

RR: Response Rate

DISCUSSION

The world incidence and prevalence of dental caries for youngest children has not decreased over the past decade, despite significant improvements in dental science. So, the American Academy of Pediatric Dentistry recommends the employment of diverse preventive measures and the early detection of oral disease, particularly ECC, as well as the opportune initiation of oral health care during the child's first months/years of life, including the pediatrician professional involvement.³³ According to this, recent information from the American Academy of Pediatrics³ revealed that more than 85% of infants and children aged 1 year had office-based pediatrician visits annually, compared with only around 1.5% who had attended dental offices or clinics; in other words, pediatrician visits outnumbered visits to dentists 250 to 1. These data show that pediatricians must be knowledgeable about different fundamental aspects related to children's oral care and prevention.

Another important obstacle to a major participation involvement in the oral health assessment and care by pediatricians and other primary health care providers is the perception that it is difficult to refer several subgroups of patients, as mentioned by Lewis and colleagues.² In their survey applied to 1,600 pediatricians registered in the American Medical Association, over one-half of the respondents reported difficulty referring uninsured pediatric patients, and more than one-third found trouble referring *Medicaid* patients in the USA. In this same regard, respondents mentioned that problems accessing dental care are increased in rural areas, where the availability of dental providers is limited. If pediatricians are to play a greater role in promoting oral health in their practices, confidence in their ability to refer patients to professional dental care should be ensured. On the other hand, some pediatricians did not share the same opinion as to the AAPD, about the concept that children have to be referred to the dentist by one year of age. Some of them still question whether dental care and preventive

education require a visit to the dentist because the AAP has identified that pediatricians should be capable of providing basic dental care for children under the age of three.³ Thus, pediatricians need to get adequate information to assume a greater involvement in their children's oral health-related activities. Some of them report only a brief time for oral attention and that their inadequate knowledge makes it difficult to provide the attention to appropriate oral health that all children deserve.²

Knowledge insufficiency and improper practice have been attributed to the lack of adequate oral education during medical school and residency training.²⁹ Therefore, they have frequently considered themselves lacking in confidence in their abilities to guide or advise families about oral health or think that this issue does not fall within their domain.³⁵ Thus, some authors have recommended integrating the teaching of pediatric oral health into medical formation for pediatricians, and reinforcing the involvement of them and other primary health professionals in oral disease prevention activities.^{31,32} In this same regard and despite the importance of pediatric oral health, periodical dental assessment and care for children is still unorganized in most low-income countries.^{36,37}

Although the present review is not the first one trying to map and synthesize the most relevant articles about pediatricians' awareness, practices, and attitudes regarding worldwide pediatric oral health and care (see *Dickson-Swift et al., 2020*),³⁸ we pretend to complement and enrich the current knowledge on this topic, focusing on the dental literature's evidence published in the last ten years. We also performed a critical review of the retrieved full-text articles with the aim to provide the best quality evidence, which might guide or contribute to future and more methodologically advanced research, such as meta-analysis studies or umbrella-type reviews.³⁹ In the present scoping review, only cross-sectional survey studies were included, and it is well-known that these methodological designs are prone to diverse bias and confounding. Despite this limitation, we

are confident that sufficient reliable and useful information could be collected and synthesized.

The results and findings obtained from the present study indicate, similarly to those by Dickson-Swift and colleagues, that pediatricians have a limited or unsatisfactory knowledge level on different pediatric dentistry critical issues; for example, the appropriate age for the first dental visit, identifying visible plaque or white spot lesions, topical fluoride varnishes, or pit-fissure sealants.³⁸ Regarding the referral of a child to the dentist, many pediatricians recommend a specialized oral assessment only when dental problems are reported by parents. Further, most reported barriers for an adequate oral health practice were little parental acceptance of oral advice, lack of auto-confidence, insufficient professional available time, the medical/insurance system, and, in a few cases, high dental treatment costs, and the low or non-existent extra remuneration for the pediatrician. According to this information, oral health screening, implementation of basic prevention measures—particularly during the first 24 months of age—, and related counseling/guidance to parents should be some predominant actions of pediatricians' practice in the medical office. Therefore, it becomes necessary the improvement of educational/training programs for reaching an increased involvement in children's oral health by pediatricians and other primary health care providers. In this regard, there are three excellent published clinical guidelines on children's oral health, especially focused on pediatricians.^{3,4,7}

Ethical approval, consent to participate or for publication.

Not applicable.

Conflict of interest.

The authors declare that they have no conflict of interest.

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