Submitted: 22 May, 2024 Accepted: 18 July, 2024 Published: 03 November, 2024 DOI:10.22514/jocpd.2024.134

ORIGINAL RESEARCH

Journal of Clinical Pediatric Dentistry

Prevalence and severity of dental caries using ICDAS in predicting treatment needs in Mexican school-age children

Arturo Emiliano Carrillo Ortiz[1], Cesar Abraham Olvera Fuentes[1], Alvaro García Pérez[2,*], Jacqueline Adelina Rodríguez Chávez[3], Teresa Villanueva Gutiérrez[4], Hugo Marcelo Flores Ruíz[5], Karen Angelina Mora Navarrete[2]

[1]Pediatric Stomatology Specialties, Faculty of Higher Studies (FES) Iztacala, National Autonomous University of Mexico (UNAM), 53000 Naucalpan, Mex, Mexico
[2]Laboratory of Public Health Research, Faculty of Higher Studies (FES) Iztacala, National Autonomous University of Mexico (UNAM), 54090 Tlalnepantla, Mex, Mexico
[3]Department of Comprehensive Dental Clinics, University Center for Health Sciences, University of Guadalajara, Guadalajara, 44340 Guadalajara, JAL, Mexico
[4]Health Care Department, Metropolitan Autonomous University-Xochimilco, 04960 Mexico City, CDMX, Mexico
[5]Department of Natural and Exact Sciences, University of Guadalajara, CUValles Campus, 46600 Guadalajara, JAL, Mexico

***Correspondence**
alvaro.garcia@unam.mx
(Alvaro García Pérez)

Abstract

Evaluate the prevalence and severity of caries in permanent teeth and their association with the treatment needs of 8–12-year-old Mexican schoolchildren. The cross-sectional study was conducted on 1139 8–12-year-old schoolchildren attending two public primary schools in State of Mexico. The study used the International Caries Detection and Assessment System (ICDAS) to examine the prevalence of caries and identify treatment needs in schoolchildren. Other variables considered were age, gender, oral hygiene, dental visits $\leq$6 months, toothbrushing frequency, and the mother's years of education. A logistic regression model was used to identify the association between independent variables and treatment needs. In all analyses, two-tailed p values $\leq$ 0.05 were considered statistically significant. The prevalence of caries lesions was 82.1% (82.2% boys *vs.* 81.9% girls) considering all lesion categories (ICDAS 1–6), while the distribution of the severity of caries was 17.9% (ICDAS 0), 13.9% (ICDAS 1–2), 28.3% (ICDAS 3–4) and 39.9% (ICDAS 5–6). The treatment needs index was 77.3%. The logistic regression model showed that the schoolchildren with moderate (ICDAS 3–4) and extensive carious (ICDAS 5–6) lesions were, respectively, 61% Odds Ratio ((OR) = 1.61; p = 0.036) and 77% (OR = 1.77; p = 0.013) more likely to present treatment needs. Other variables, such as poor oral hygiene (OR = 1.52; p = 0.009), the mother's low level of education (OR = 1.53; p = 0.007), and a lack of dental visits (OR = 1.42; p = 0.030) were associated with dental treatment needs. The results obtained show that the 8–12-year-old Mexican schoolchildren presented a high level of treatment needs for moderate and extensive carious lesions (ICDAS 3–6). These findings reiterate the importance of implementing oral health prevention, promotion, and intervention programs to help protect the oral health of school-age children.

Keywords

Dental caries; Treatment needs; Oral health; Schoolchildren; Oral health literacy

1. Introduction

On a global level, oral diseases are among the most prevalent health conditions, presenting financial and health consequences and having a negative impact on the quality of life for the affected populations [1]. Caries continues to be a public health problem, with the 2019 Global Burden of Disease Study reporting, globally, 62.9 to 64.6 million prevalent cases of caries in primary and permanent teeth [2]. Moreover, dental caries is present in both developed and developing countries, affecting both rural and urban populations [3–5]. This multifactorial disease begins with the demineralization of the enamel and is accompanied by the rapid loss of calcium and phosphate ions and can progress until producing a cavitated lesion involving all the tissues of the tooth, culminating in its destruction [6]. This process may result in a considerable reduction in quality of life in the child and adolescent population due to pain, discomfort when chewing, difficulty in sleeping, fracture and premature tooth loss [7, 8]. On a global level, various indices, such as dmft (decayed, missing, and filled teeth), DMFT (Decayed, Missing, and Filled Teeth), and the Significant Caries Index (SiC), are currently used to evaluate the distribution pattern and management of caries lesions [9]. One drawback of these indices is that they are unable to evaluate the initial or moderate stages of carious lesions, leading to the underestimation of their prevalence, which helps to explain the complications observed in the use of dmft and DMFT to measure the increased presence of caries in the same individuals over the long term [10]. These challenges led to the development of ICDAS (International

Caries Detection and Assessment System) [11], a caries lesion detection system which enables the visual identification of the lesion, taking into account its degree of progression and classifying the presence of coronal caries as the following: healthy surfaces (ICDAS 0); initial carious lesions (ICDAS 1–2); moderate carious lesions (ICDAS 3–4); and extensive carious lesions (ICDAS 5–6) [12].

Studies conducted in Mexico on child populations aged between 4 and 12 years have reported an approximate 80% prevalence when considering all carious lesions (ICDAS 1–6) in primary dentition and an approximate 40% prevalence of dentine carious lesions (ICDAS 4–6) in permanent dentition [13, 14]. Additionally, this disease results in a high level of invasive treatment needs in both primary and permanent dentition, furthering the adverse effects of caries on the child and adolescent population [15]. An important aspect in the planning of healthcare services is the identification of deficiencies requiring treatment, with these healthcare needs influenced and defined by the social determinants corresponding to each population [16]. Research has reported varying outcomes for dental treatment needs in children, with, for example, 45% of subjects in India requiring restorative procedures [17], 71.4% in Qatar presenting dental caries lesions [18], and 78.0% in Nicaragua requiring dental caries treatment [19], while a 91.3% treatment needs index was found for permanent dentition in Mexico [20]. Data obtained from one specific study shows that 55% of the school-age population of interest had not seen a dentist in the last six months [14].

Despite the significant progress seen in Mexico with the emergence of the Instituto de Salud para el Bienestar (INSABI or Institute of Health for Welfare) as part of the System for Social Protection in Health, the system does not provide coverage for the majority of the specialized dental care required and solely provides services considered basic (prophylaxis, fillings and extractions) [21]. The large part of dental care provision in Mexico is private, with Moreno-Barrera *et al.* [22], in an analysis conducted on the Mexican child population, finding that approximately more than 50% of their sample used private dental services.

Clinical evaluation using ICDAS can directly assist in the diagnosis and management of carious lesions, from their initial appearance to their nonsurgical or surgical management and the necessary clinical follow-up. Furthermore, once the initial lesions have been identified, nonsurgical lesion management can be provided through the use of preventive interventions that aim to avoid costly impacts on oral healthcare services. Therefore, the present study aimed to evaluate the prevalence and severity of caries in permanent dentition and their association with the treatment needs observed in 8–12-year-old schoolchildren in Mexico. The hypothesis proposed by the present study is that schoolchildren with moderate and extensive carious lesions (ICDAS 3–6) experience a greater need for surgical and non-surgical dental treatment.

2. Material and methods

The present study was done in adherence to the guidelines set out by the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement.

2.1 Data collection

The treatment needs of the 8–12-year-old schoolchildren who participated in the present study were evaluated via a cross-sectional study conducted on data obtained from two public primary schools in a community in Naucalpan de Juárez, State of Mexico, in 2019. According to the Instituto Nacional de Estadística y Geografía (INEGI or National Institute for Statistics and Geography), the municipality has 93,823 inhabitants (45,449 men and 48,374 women), of whom 30.9% are not covered by one of the country's healthcare services. Data from INEGI shows that the average number of years of education in the community was 10.7, while approximately 86.2% of inhabitants can read and write and 56.6% are living in poverty (46.5% moderate and 10.1% extreme) [23]. The inclusion criteria for the present study were the following: children aged 8 to 12 years old; children of any gender; and children for whom a signed authorization to participate in the research had been provided. The exclusion criteria were as follows: schoolchildren suffering from any disease or condition that would impede the completion of the clinical oral examination; children who had refused to be clinically examined; children with fixed orthodontic appliances; and children without the signed consent of their parent/guardian. Based on the exclusion criteria, 25 schoolchildren chose not to participate in the study and 20 were eliminated from participating. A total of 1200 parents were asked to consent to their children participating in the study, with 1139 accepting and signing an informed consent form (a 94.9% response rate). Of the 1139 schoolchildren, 78.5% (894) had permanent dentition and 21.5% (245) had primary dentition.

2.2 Independent variable: caries lesions

Caries was evaluated in the permanent dentition of the participating schoolchildren using the ICDAS criteria. The detection codes for coronal caries used by ICDAS range from 0 to 6, depending on the severity of the lesion. The highest ICDAS scores, ICDAS 5 and 6 indicate active cavitated lesions that go into the dentin and have significant enamel destruction [11]. The determination of the ICDAS code for each tooth first required the evaluation of the surface of the tooth under wet and then dry conditions, after which, in order to differentiate between ICDAS codes 1 and 2, the teeth were then dried with compressed air for five seconds and re-examined in order to evaluate ICDAS Code 1. The cut-off points for the ICDAS were the following: caries free (ICDAS 0); initial lesions (ICDAS 1–2); moderate lesions (ICDAS 3–4); and extensive carious lesions (ICDAS 5–6) in permanent dentition [12].

2.3 Dependent variable: dental treatment needs index (TNI)

Finally, we assessed the treatment needs index using the following formula [20]:

$$TNI = \frac{decayed\ teeth\ (ICDAS\ 4-6)}{decayed\ teeth\ (ICDAS\ 4-6) + filled\ teeth}\ (100)$$

The application of the formula obtained results in the form

of quantitative values. If the result was 0, the child entered the group (0 = without treatment needs), while, if the result of the formula was greater than or equal to one, the child entered the group (1 = with treatment needs). The TNI was categorized into two groups (0 = without treatment needs and 1 = with treatment needs) [20].

2.4 Covariables

The following sociodemographic variables were used as potential confounders and fit to the model: age (in years); gender (boy/girl); toothbrushing frequency (number of times a day) dichotomized into <2 or ≥2 times a day; dental visits ≤6 months (yes/no); soda consumption (seldom/sometimes each week/>once per day); consumption of candy (seldom/a few times per week/at least once per day); and oral hygiene, which was evaluated via the Simplified Oral Hygiene Index (OHI-S). Oral hygiene was classified as poor (OHI-S score ≥2) and good (OHI-S score <2) [24]. The variable of the mother's years of education was used to distinguish those adults who had completed nine years of formal education or less from those who had completed more than nine years (which, in Mexico corresponds to primary and secondary school combined), as dichotomized into ≤9 years and >9 years.

2.5 Clinical oral examination

The oral examinations were conducted by two experienced dentists, using a mouth mirror and a World Health Organization (WHO) probe (11.5 mm, Hu-Friedy©), in the two public primary schools selected. The examination of the oral cavity of the children participating in the research adhered to infection control regulations. The child was asked to brush their teeth in order to eliminate any plaque or food remains prior to the oral examination. The two dentists had been previously trained and standardized in the application of the ICDAS oral examination process, which comprised two steps (theoretical and clinical), with intra and inter-examiner reliability for caries determined to be Kappa = 0.89.

2.6 Sample size

The sample size was calculated using the formula for the independent proportions with a power of 80%, to detect a 0.20 difference in proportions between the two groups, with a bilateral p value of 0.05. If 30% of the participants from the reference population present the factor of interest (extensive carious lesions), the present study required a sample size of 311 per group (namely, a total sample size of 622, assuming equal group sizes) [25].

2.7 Statistical analysis

All analyses were conducted using Stata 15 software (Stata Corp, College Station, TX, USA). Comparisons were made for age, gender, toothbrushing frequency, oral hygiene, soda consumption, candy consumption, mother's level of education, and the number of dental visits undertaken by those schoolchildren both with and without treatment needs. The Pearson Xi-square test was used for categorical variables, while the student's t-test was used for the discrete variable. The association between the dependent variable of treatment needs (0 = no treatment needs/1 = with treatment needs) and the independent variables was tested using the multiple logistic regression model adjusted for confounders, with the odds ratio (OR) calculated to a 95% confidence interval (95% CI). Model diagnostic tests were conducted using the Hosmer-Lemeshow goodness-of-fit test. A two-way interaction analysis was carried out between all the independent variables in the model, with no significant interaction found ($p > 0.05$). In all analyses, two-tailed p values ≤ 0.05 were considered statistically significant.

3. Results

3.1 Characteristics of the study population

The present study was conducted on 1139 schoolchildren aged 8 to 12 years old, 49.6% of whom were boys and 50.4% girls, and the mean age of whom was 9.57 (±1.18) years. The mean age of the schoolchildren was 9.57 (±1.18) years. There were no statistically significant differences between mean age by gender ($p = 0.422$). According to the OHI-S, 50.8% of the schoolchildren presented poor oral hygiene and 58.0% brushed their teeth less than twice a day. Regarding visits to the dentist, 64.9% of the schoolchildren had not visited the dentist in the last six months. In terms of the variable of the participant's mother's number of years of education, 63.4% had completed nine years or fewer of formal education.

The prevalence of caries lesions in the schoolchildren was 82.1% (82.2% boys *vs.* 81.9% girls) considering all lesion categories (ICDAS 1–6). By age group, the prevalence of caries lesions (ICDAS 1–6) was 72.6% (8 years), 81.5% (9 years), 87.9% (10 years), 79.3% (11 years) and 95.2% (12 years), with no statistically significant differences found for age ($p = 0.657$). The percentage of each lesion category was distributed as 17.9% (ICDAS 0), 13.9% (ICDAS 1–2), 28.3% (ICDAS 3–4) and 39.9% (ICDAS 5–6). No statistically significant differences were found for gender ($p = 0.283$). In terms of dental treatment needs, 77.3% had such needs and 22.7% did not. The distribution of existing restorations across the sample of schoolchildren revealed that the use of sealants was 1.4%, resins 34.1%, and amalgams 3.7%. None of the participants presented with restorations with glass ionomers or teeth missing due to caries.

The data showed that schoolchildren with poor oral hygiene present a higher percentage of treatment needs than those children with good oral hygiene (54.1% *vs.* 45.9%; $p < 0.001$), while those subjects whose mothers had a low level of education (≤9 years) presented a higher level of treatment needs than those with >9 years of education ($p < 0.001$), this data is shown in Table 1. Moreover, schoolchildren who had not visited the dentist (≤6 months) presented a higher percentage of treatment needs than those who had visited a dentist (>6 months) ($p < 0.001$). Fig. 1 presents the distribution of caries by age group, showing that the percentage of ICDAS 3–4 and ICDAS 5–6 scores was similar for both age groups.

TABLE 1. Distribution of variables by dental treatment needs among Mexican schoolchildren aged 8–12 years (n = 1139).

	Dental treatment needs index		*p*
	No treatment needs n = 259	With treatment needs n = 880	
Age mean (Standard deviation)	9.58 (±1.23)	9.56 (±1.17)	0.859
Gender			
Boys	119 (45.9)	446 (50.7)	0.180
Girls	140 (54.1)	434 (49.3)	
Toothbrushing frequency			
<2 times a day	116 (44.8)	397 (45.1)	0.926
≥2 times a day	143 (55.2)	483 (54.9)	
Oral hygiene (OHI-S)			
Good hygiene	157 (60.6)	404 (45.9)	<0.001
Poor hygiene	102 (39.4)	476 (54.1)	
Dental visits ≤6 months			
Yes	119 (45.9)	281 (31.9)	<0.001
No	140 (54.1)	599 (68.1)	
Consumption of soft drink			
Seldom	61 (23.5)	218 (24.8)	0.753
Sometimes per week	116 (44.8)	371 (42.2)	
>Once per day	82 (31.7)	291 (33.0)	
Consumption of sweets			
Seldom	88 (34.0)	271 (30.8)	0.523
Sometimes per week	125 (48.3)	459 (52.2)	
>Once per day	46 (17.7)	150 (17.0)	
Mother's level of education			
<9 yr	119 (46.0)	298 (33.9)	<0.001
>9 yr	140 (54.0)	582 (66.1)	

OHI-S: Simplified Oral Hygiene Index.

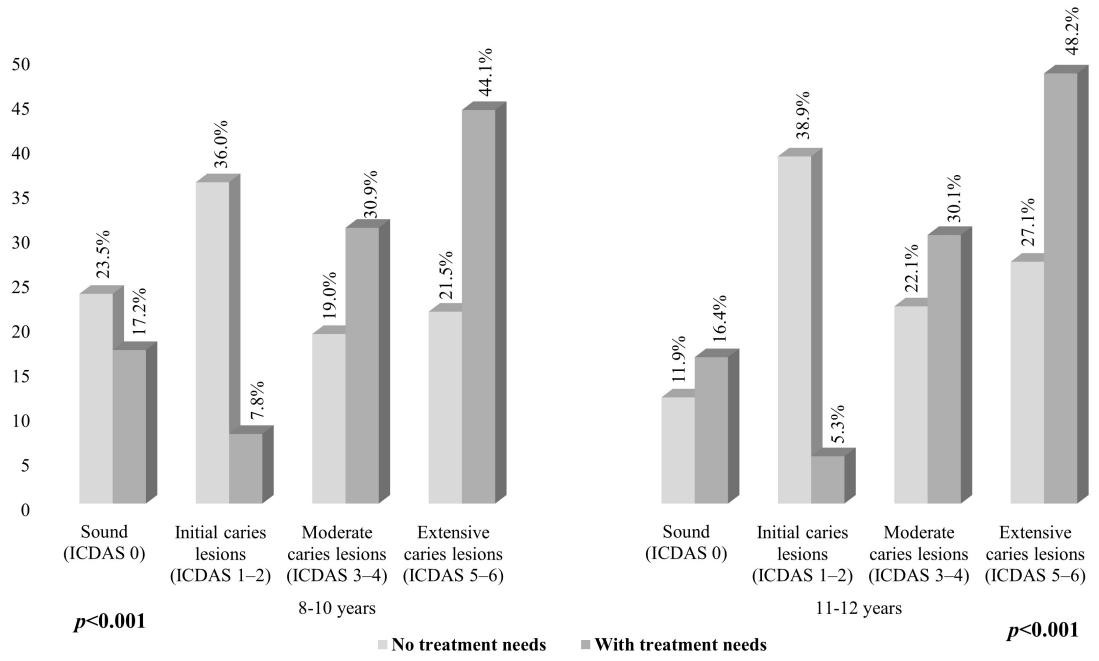

FIGURE 1. Percent distribution between of the dental treatment needs and the ICDAS by age groups among Mexican schoolchildren (n = 1139). ICDAS: International Caries Detection and Assessment System.

3.2 Multivariable analysis

A multiple logistic regression model was applied to identify the association between the severity of caries and the schoolchildren's dental treatment needs (Table 2). Seven variables were included in the multiple logistic regression analysis. The schoolchildren with moderate carious lesions (ICDAS 3–4) were 61% OR = 1.61 (95% CI [1.03–2.53]); $p = 0.036$ more likely to present treatment needs, while those schoolchildren with extensive carious lesions (ICDAS 5–6) were 77% more likely to present dental treatment needs OR = 1.77 (95% CI [1.12–2.78]); $p = 0.013$. Similarly, the schoolchildren with initial carious lesions (ICDAS 1–2) were 80% less likely to present surgical or nonsurgical treatment needs OR = 0.20 (95% CI [0.13–0.33]); $p < 0.001$. Other variables, such as poor oral hygiene OR = 1.52, (95% CI [1.11–2.08]); $p = 0.009$, the mother's low level of education OR = 1.53, (95% CI [1.12–2.09]); $p = 0.007$, and a lack of visits to the dentist OR = 1.42, (95% CI [1.03–1.95]); $p = 0.030$, were associated with treatment needs in the schoolchildren.

4. Discussion

The present study found that the schoolchildren with moderate and extensive carious lesions are more likely to present dental surgical and nonsurgical treatment needs than those with initial carious lesions after the regression model was fit for possible confounders. An important aspect to consider in the planning of healthcare services is the diagnosis and evaluation of the healthcare needs, which is a systematic method for identifying and reviewing the health care problems that present in any population [16]. Research has demonstrated that preventive programs may improve the health of the general population, when implemented adequately [26]. With regard to oral health needs, a sample of participants aged 6–11 years in India revealed that 70–90% of the population of interest required treatment; furthermore, it was also observed that treatment needs increased with age [27]. A study conducted on 6–12-year-old schoolchildren in Nicaragua found that approximately 50% of participants presented treatment needs and that the percentage was higher in boys than in girls (60.1% *vs.* 48.9%) [19]. The present study observed that 77.0% of the Mexican schoolchildren sampled presented treatment needs, a percentage that was similar for both boys and girls (50.7% *vs.* 49.3%). In order to determine healthcare needs, it is important to observe the distribution of the sociodemographic variables in a population in order to determine the epidemiological profile related to said needs in the population. Therefore, the profile of the disease could be used to adequately organize the corresponding healthcare responses and plan the corresponding healthcare services [28]. As the child population presents specific oral health characteristics and needs that require specific responses,

TABLE 2. Logistic regression model for the association between initial, moderate, and extensive caries lesions and treatment needs among Mexican schoolchildren aged 8–12 years (n = 1139).

Variables		Crude odds ratio (95% CI)	*p*	Adjust odds ratio (95% CI)	*p*
Age		0.98 (0.88–1.11)	0.860	0.98 (0.86–1.12)	0.805
Gender					
	Male	Reference		Reference	
	Female	0.82 (0.62–1.09)	0.181	0.87 (0.64–1.18)	0.395
Oral hygiene (OHI-S)					
	Good hygiene	Reference		Reference	
	Poor hygiene	1.81 (1.36–2.40)	<0.001	1.52 (1.11–2.08)	0.009
Toothbrushing frequency					
	≥2 times a day	Reference		Reference	
	<2 times a day	1.00 (0.75–1.32)	0.991	0.96 (0.70–1.32)	0.839
Dental visits ≤6 months					
	Yes	Reference		Reference	
	No	1.81 (1.36–2.40)	<0.001	1.42 (1.03–1.95)	0.030
Mother's level of education					
	>9 yr	Reference		Reference	
	≤9 yr	1.66 (1.25–2.19)	<0.001	1.53 (1.12–2.09)	0.007
ICDAS	Sound (ICDAS = 0)	Reference		Reference	
Initial caries lesions	(ICDAS 1–2)	0.23 (0.15–0.37)	<0.001	0.20 (0.13–0.33)	<0.001
Moderate caries lesions	(ICDAS 3–4)	1.91 (1.24–2.94)	0.003	1.61 (1.03–2.53)	0.036
Extensive caries lesions	(ICDAS 5–6)	2.41 (1.59–3.65)	<0.001	1.77 (1.12–2.78)	0.013

OR: Odds ratio; CI: Confidence Interval; ICDAS: International Caries Detection and Assessment System; OHI-S: Simplified Oral Hygiene Index. Hosmer-Lemeshow test = 0.783.

it is of great importance to generate more evidence for the analysis and implementation of strategies on a population level, with the objective of resolving the oral health problems and treatment needs that affect the pediatric population [29]. The strategies created may contribute to improving the state of oral health in children, thus exerting a positive impact on their quality of life.

Results reveal an 82% level of prevalence and severity of caries in the school-age population evaluated, further to the presence of moderate and extensive carious lesions increasing in line with the age of the participants. These findings coincided with previous studies conducted in India [30] and other populations, such as in Ecuador [31], where a 98.0% prevalence was reported in 2–11-year-old children. On the other hand, studies conducted in Mexico using ICDAS have reported a prevalence of 81.4% [14] in children aged 8–12 years and 82.2% in 3–5-year-old subjects [13]. Borges *et al*. [32], in a systematic review of the efficacy of current non-surgical treatments for non-cavitated carious lesions in permanent teeth, reported that the non-surgical approach has potential benefits that include the conservation of dental tissue by delaying intervention or minimizing the extent of the surgical procedure required, thus increasing the longevity of the teeth. Therefore, the clinical importance of identifying initial carious lesions during the clinical examination, may, together with the non-surgical approach, directly help in the management and clinical follow-up of caries, thus reducing the prevalence of caries in the child population affected.

Unfortunately, oral health care is one of the main requirements of oral health that is currently not met in children. The present study found that those schoolchildren with poor oral hygiene are 52% more likely to present dental treatment needs. During childhood, poor oral hygiene has been associated not only with the presence of caries and treatment needs but also poor academic performance, pain, and tooth loss, which compromise the viability of a normal diet and negatively affect nutrition, self-esteem, speech, socialization, and quality of life [33]. Khawaja *et al.* [34], in a study conducted on schoolchildren in Pakistan, found that the presence of caries was significantly higher in children with poor oral hygiene (OR = 2.40; p = 0.005) and that the treatment need levels in the subjects were over 90%. According to available evidence, oral hygiene measures, such as tooth brushing or the use of toothpaste together with dental floss and mouthwashes, are long-established practices in the majority of the population [35]. Therefore, it is important to highlight that the oral health of schoolchildren can be improved by teaching them better health practices via simple, cheap and easy-to-implement and evaluate oral health prevention, intervention, and promotion programs, which are fundamental elements for maintaining the oral health of the population. Research has demonstrated that prevention programs are able to improve the levels of health in a community when implemented adequately [26].

The use of educational level in research on this area corresponds to an attempt to ascertain an individual's level of knowledge as it relates to their skills and abilities [36]. Moreover, education helps to improve one's health by increasing cognitive abilities and, thus, enabling one to be more efficient in maintaining good health [37]. The present study found that schoolchildren whose mothers had a low level of education (≤9 years) were 53% more likely to present dental treatment needs. It is believed that a child's mother's level of education is important for both preventing and treating health problems and disease [38]. Recently, literacy has become a mechanism used to link a women's level of education with mother-and-child health, while also providing women the ability to acquire more knowledge in order to improve health outcomes in their children [38]. Lawrence *et al.* [39] reported that children whose mothers have less than a secondary education or its equivalent presented a worse state of health than children whose mothers had graduated from university. Poor health in the child population has immediate and long-term consequences that affect the child well into adulthood [40]. Therefore, improving the level of a mother's education could be an important intervention for improving child health. Similarly, health education should begin at an early age and accompany the child's growth, thus helping to prevent disease. Education enables the child to acquire and develop the responsibility of identifying and resolving the main oral health problems affecting them.

One of the limitations of the present study was its cross-sectional design, which does not provide causal estimates. Secondly, the socioeconomic level of the parents was not evaluated, nor were the costs of the dental care received by the children participating in the research. Another limitation is that the caries evaluation was carried out over a certain period of time, which meant that other risk factors in the population could not be analyzed. On the other hand, one of the strengths of the present study was the standardization of the criteria used for the ICDAS evaluation, with both examiners presenting an over 85% level of agreement. Moreover, a sample size calculation was performed to detect specific differences among the study groups and, thus, be able to make statistical inferences.

5. Conclusions

The present study shows that 8–12-year-old Mexican children presented high levels of treatment need for moderate and extensive carious lesions. Poor oral hygiene, a low number of visits to the dentist, and the mother's low level of education were associated with the participant's treatment needs. However, as there may be other social determinants that explain the results obtained by the present study, other research is recommended to help confirm these findings. The results of the present study can be used to generate other lines of research, such as longitudinal studies on or randomized clinical trials for the use of remineralizing agents to prevent or stop the progression of caries. The implementation of long-term, simple, cheap and easy-to-evaluate oral health prevention, promotion and intervention programs is necessary to help protect schoolchildren's oral health.

AVAILABILITY OF DATA AND MATERIALS

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

AUTHOR CONTRIBUTIONS

AGP—designed the study, contributed to analyze the data, led the writing, reviewed the manuscript and contributed to discussion. AECO and CAOF—contributed to analyze the data and contributed to discussion. JARC, TVG, KAMN and HMFR—reviewed the manuscript and contributed to discussion. All authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The research protocol was reviewed and approved by the Ethics Committee at the Iztacala Faculty of Higher Studies of the National Autonomous University of Mexico (CE/FESI/102023/1663), while the study was carried out in accordance with the Declaration of Helsinki. Public primary school authorities, as well as the parents/guardians of the children were informed of the objectives of the study and the procedures that would be completed during the research. Consenting parents/guardians who agreed to their child's participation by providing their signed informed consent. Additionally, the children also provided their own informed consent to participate in the study.

ACKNOWLEDGMENT

Thanks to the Public Health Research Laboratory at the Iztacala Faculty of Higher Studies of the National Autonomous University of Mexico—particularly with the conceptual design of the study. The authors are very grateful to all the school-age children that participated. We are also very grateful for the opportunity to have worked with all the schools that participated in our study.

FUNDING

The authors received no financial support for the research, authorship, and/or publication of this article.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

REFERENCES

[1] Peres MA, Macpherson LMD, Weyant RJ, Daly B, Venturelli R, Mathur MR, *et al*. Oral diseases: a global public health challenge. The Lancet. 2019; 394: 249–260.

[2] Wen PYF, Chen MX, Zhong YJ, Dong QQ, Wong HM. Global burden and inequality of dental caries, 1990 to 2019. Journal of Dental Research. 2022; 101: 392–399.

[3] Lara-Capi C, Cagetti MG, Cocco F, Lingström P, García-Godoy F, Campus G. Effect of body weight and behavioural factors on caries severity in Mexican rural and urban adolescents. International Dental Journal. 2018; 68: 190–196.

[4] Giacaman RA, Bustos IP, Bazán P, Mariño RJ. Oral health disparities among adolescents from urban and rural communities of central Chile. Rural and Remote Health. 2018; 18: 4312.

[5] Aamodt K, Reyna-Blanco O, Sosa R, Hsieh R, De la Garza Ramos M, Garcia Martinez M, *et al*. Prevalence of caries and malocclusion in an indigenous population in Chiapas, Mexico. International Dental Journal. 2015; 65: 249–255.

[6] Selwitz RH, Ismail AI, Pitts NB. Dental caries. The Lancet. 2007; 369: 51–59.

[7] García-Pérez Á, Irigoyen-Camacho ME, Borges-Yáñez SA, Zepeda-Zepeda MA, Bolona-Gallardo I, Maupomé G. Impact of caries and dental fluorosis on oral health-related quality of life: a cross-sectional study in schoolchildren receiving water naturally fluoridated at above-optimal levels. Clinical Oral Investigations. 2017; 21: 2771–2780.

[8] Singh S, Talmale P. Impact of dental caries and nutritional status on oral health related quality of life in young Indian adolescents. Journal of Oral Biology and Craniofacial Research. 2023; 13: 506–510.

[9] Ditmyer M, Dounis G, Mobley C, Schwarz E. Inequalities of caries experience in Nevada youth expressed by DMFT index *vs.* Significant Caries Index (SiC) over time. BMC Oral Health. 2011; 11: 12.

[10] Piovesan C, Tomazoni F, Del Fabro J, Buzzati BC, Mendes FM, Antunes JL, *et al*. Inequality in dental caries distribution at noncavitated and cavitated thresholds in preschool children. Journal of Public Health Dentistry. 2014; 74: 120–126.

[11] Ismail AI, Sohn W, Tellez M, Amaya A, Sen A, Hasson H, *et al*. The International Caries Detection and Assessment System (ICDAS): an integrated system for measuring dental caries. Community Dentistry and Oral Epidemiology. 2007; 35: 170–178.

[12] Martignon S, Pitts NB, Goffin G, Mazevet M, Douglas GVA, Newton JT, *et al*. CariesCare practice guide: consensus on evidence into practice. British Dental Journal. 2019; 227: 353–362.

[13] Lara JS, Romano A, Murisi PU, Tedesco TK, Mendes FM, Soto-Rojas AE, *et al*. Impact of early childhood caries severity on oral health-related quality of life among preschool children in Mexico: a cross-sectional study. International Journal of Paediatric Dentistry. 2022; 32: 334–343.

[14] García Pérez A, González-Aragón Pineda AE, Rosales Ibáñez R, Rodríguez Chávez JA, Cuevas-González JC, Pérez Pérez NG, *et al*. Association between sociodemographic factors and noncavitated and cavitated caries lesions in 8- to 12-year-old Mexican schoolchildren. Medicine. 2021; 100: e26435.

[15] Medina-Solís CE, Ávila-Burgos L, Borges-Yañez SA, Irigoyen-Camacho ME, Sánchez-Pérez L, Zepeda-Zepeda MA, *et al*. Ecological study on needs and cost of treatment for dental caries in schoolchildren aged 6, 12, and 15 years: data from a national survey in Mexico. Medicine. 1010; 99: e19092.

[16] Wright J, Williams R, Wilkinson JR. Health needs assessment. Development and importance of health needs assessment. The BMJ. 1998; 316: 1310–1313.

[17] Prabakar J, John J, Srisakthi D. Prevalence of dental caries and treatment needs among school going children of Chandigarh. Indian Journal of Dental Research. 2016; 27: 547–552.

[18] Al-Thani MH, Al-Thani AA, Al-Emadi AA, Al-Chetachi WF, Akram H, Poovelil BV. Oral health status of six-year-old children in Qatar: findings from the national oral health survey. International Journal of Dental Hygiene. 2018; 16: 225–232.

[19] Herrera MS, Medina-Solís CE, Ávila-Burgos L, Robles-Bermeo NL, Lara-Carrillo E, Lucas-Rincón SE, *et al*. Treatment needs for dental caries and restorative care index on the permanent dentition of Nicaraguan children. The West Indian Medical Journal. 2017; 66: 159–164.

[20] Lucas-Rincón SE, Lara-Carrillo E, Robles-Bermeo NL, Rueda-Ibarra V, Alonso-Sánchez CC, Vázquez-Rodríguez SB, *et al*. Experience, prevalence, need for treatment and cost of care for caries: a multicenter study in a developing country. Community Dental Health. 2022; 39: 86–91.

[21] Orellana-Centeno JE, Guerrero SRN, Ramírez GJ, Juárez AEG. The democratization of dental health services. Revista Asociación Dental Mexicana. 2023; 80: 115–117. (In Spanish)

[22] Moreno-Barrera A, Morales-Ruiz P, Ribas Pérez D, Flores-Fraile J, Castaño-Seiquer A. Analysis and evaluation of dental caries in a Mexican population: a descriptive transversal study. International Journal of Environmental Research and Public Health. 2023; 20: 3873.

[23] Secretaria DB. Annual report on the situation of poverty and social backwardness. 2024. Available at: https://www.gob.mx/

bienestar/documentos/informe-anual-sobre-la-situacion-de-pobreza-y-rezago-social (Accessed: 09 June 2024).
[24] World Health Organization. Oral health surveys: basic methods. 5th edn. World Health Organization: Geneva. 2013.
[25] Dhand NK, Khatkar MS. Sample size calculator for comparing two independent proportions. 2014. Available at: http://statulator.com/SampleSize/ss2P.html (Accessed: 26 March 2024).
[26] Bani IA. Health needs assessment. Journal of Family & Community Medicine. 2008; 15: 13–20.
[27] Hiremath A, Murugaboopathy V, Ankola AV, Hebbal M, Mohandoss S, Pastay P. Prevalence of dental caries among primary school children of India—a cross-sectional study. Journal of Clinical and Diagnostic Research. 2016; 10: ZC47–ZC50.
[28] Jiménez-Malagóna MC, Fangb L, Diaz-Caballero A. Oral epidemiological profile and need for dental treatment of HIV/AIDS patients. Revista Clínica de Medicina de Familia. 2012; 5: 97–103. (In Spanish)
[29] Pérez-Cuevas, Muñoz-Hernández O. Importance of public health aimed at children and adolescents in Mexico. Boletín Médico del Hospital Infantil de México. 2014; 71: 126–133. (In Spanish)
[30] Arangannal P, Mahadev SK, Jayaprakash J. Prevalence of dental caries among school children in Chennai, based on ICDAS II. Journal of Clinical and Diagnostic Research. 2016; 10: ZC09–ZC12.
[31] Armas-Vega A, Parise-Vasco JM, Díaz-Segovia MC, Arroyo-Bonilla DA, Cabrera-Dávila MJ, Zambrano-Bonilla MC, *et al*. Prevalence of dental caries in schoolchildren from the Galapagos Islands: ESSO-Gal Cohort Report. International Journal of Dentistry. 2023; 2023: 6544949.
[32] Borges BC, de Souza Borges J, de Araujo LS, Machado CT, Dos Santos AJ, de Assunçao Pinheiro IV. Update on nonsurgical, ultraconservative approaches to treat effectively non-cavitated caries lesions in permanent teeth. European Journal of Dentistry. 2011; 5: 229–236.
[33] Macnab AJ. Children's oral health: the opportunity for improvement using the who health promoting school model. Advances in Public Health. 2015; 2015: 651836.
[34] Khawaja Khail AA, Ronis K, Mureed S. Dental caries and oral hygiene status among primary school children in Quetta, Pakistan: a quantitative approach. The Journal of the Pakistan Medical Association. 2023; 73: 143–146.
[35] Glenny AM, Walsh T, Iwasaki M, Kateeb E, Braga MM, Riley P, *et al*. Development of tooth brushing recommendations through professional consensus. International Dental Journal. 2024; 74: 526–535.
[36] Hoque KE, Hoque KF, A/P Thanabalan R. Relationships between parents' academic backgrounds and incomes and building students' healthy eating habits. PeerJ. 2018; 6: e4563.
[37] Borgonovi F, Pokropek A. Education and self-reported health: evidence from 23 countries on the role of years of schooling, cognitive skills and social capital. PLOS ONE. 2016; 11: e0149716.
[38] Mensch BS, Chuang EK, Melnikas AJ, Psaki SR. Evidence for causal links between education and maternal and child health: systematic review. Tropical Medicine & International Health. 2019; 24: 504–522.
[39] Lawrence EM, Rogers RG, Hummer RA. Maternal educational attainment and child health in the United States. American Journal of Health Promotion. 2020; 34: 303–306.
[40] Arpino B, Gumà J, Julià A. Early-life conditions and health at older ages: the mediating role of educational attainment, family and employment trajectories. PLOS ONE. 2018; 13: e0195320.

How to cite this article: Arturo Emiliano Carrillo Ortiz, Cesar Abraham Olvera Fuentes, Alvaro García Pérez, Jacqueline Adelina Rodríguez Chávez, Teresa Villanueva Gutiérrez, Hugo Marcelo Flores Ruíz, *et al*. Prevalence and severity of dental caries using ICDAS in predicting treatment needs in Mexican school-age children. Journal of Clinical Pediatric Dentistry. 2024; 48(6): 144-151. doi: 10.22514/jocpd.2024.134.