

# BMJ Open Clinical and non-clinical variables associated with preventive and curative dental service utilisation: a cross-sectional study among adolescents and young adults in Central Mexico

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## ABSTRACT

**Objective** The present study aimed to identify preventive and curative dental health service utilisation (DHSU) in the context of associated clinical and non-clinical factors among adolescents and young adults in Mexico.

**Design** Cross-sectional study.

**Setting** Applicants to a public university in Mexico.

**Participants** Participants were 638 adolescents and young adults aged 16–25 randomly selected from university applicants.

**Interventions** Data were collected using a self-administered questionnaire filled out by the students. For assessment of dental caries experience, we used the index of decayed, missing and filled teeth.

**Primary outcome** The dependent variable was DHSU in the previous 12 months, coded as 0=non-use, 1=use of curative services and 2=use of preventive services.

**Results** The mean age was 18.76±1.76 years, and 49.2% were women. The prevalence of DHSU was 40.9% (95% CI 37.1 to 44.8) for curative services and 22.9% (95% CI 19.7 to 26.3) for preventive services. The variables associated with curative services were age, sex, mother's education, dental pain in the previous 12 months, caries experience, use of self-care devices and oral health knowledge. For preventive services, the variables associated were mother's education, dental pain in the previous 12 months, caries experience, use of self-care devices and self-perception of oral health.

**Conclusions** While differences emerged by type of service, a number of variables (sociodemographic and socioeconomic characteristics as well as dental factors) remained in the final model. Greater oral health needs and socioeconomic inequalities remained as predictors of both types of DHSU. Given the differences revealed by our study, oral health policies should refer those seeking dental care for oral diseases to preventive services, and promote the use of such services among the poorer and less educated population groups.

## INTRODUCTION

It is estimated that there are 3.9 billion people affected by oral diseases around the world.

## Strengths and limitations of this study

- This is one of the first research projects to specifically evaluate dental health service utilisation among adolescents and young adults in Mexico.
- The results contribute to the design and framework of more detailed research on health services in the future.
- Analysis included a detailed multinomial model rather than a simple binary logistic model.
- The study is limited by its cross-sectional design and its focus on university applicants.
- The use of self-reported care may have led to overestimating or underestimating the use of dental health services.

Untreated dental caries in permanent teeth constitute their most common problem and represent the largest burden of oral diseases worldwide. Likewise, severe periodontitis and untreated dental caries in primary teeth are the sixth and tenth most prevalent conditions, affecting 11% and 9% of the world population, respectively. Severe tooth loss is also one of the most common conditions, with a global estimate of 2%; it has been ranked 36th overall.<sup>1</sup> In Latin America, oral diseases are also a public health problem.<sup>2,3</sup> In Mexico, dental caries in the primary dentition at age 6 are represented by decayed, missing and filled primary teeth (DMFT) ranging from 0.73 to 5.35, and indicate a prevalence ranging between 26.3% and 77.5%. Similarly, in the permanent dentition, dental caries at age 12 are represented by DMFT varying between 0.52 and 3.67, and indicate a prevalence ranging from 30.7% to 79.2%. At 15 years of age, the mean DMFT ranges between

1.12 and 5.31, with the prevalence of caries fluctuating between 37.6% and 88.6%.<sup>45</sup> Among young adults, dental caries yield a prevalence of around 75%, including a high percentage of untreated caries.<sup>6,7</sup>

One of the main goals of every healthcare system in the world is to provide services that the population actually needs. However, mismatching scenarios in Mexico affect needs and delivery of oral healthcare services. For example, dental services offered in the public sector provide only a limited variety of services (mainly sealants, tooth extractions and some preventive care). In addition, access to dental services is restricted to patients by excluding most specialised treatments (such as orthodontics, endodontics, periodontics, prosthetics and so on) from publicly funded health systems.<sup>8-11</sup> Such limited coverage leads to patients having to bear the full cost for care provided through private dental services; this limitation causes considerable, sometimes unaffordable, out-of-pocket expenses. These situations occasionally incur catastrophic expenses.<sup>8,11</sup>

Despite this scenario, the prevalence of dental health service utilisation (DHSU) is often low. For example, in children ages 6 and 7, 33.2% have never used any dental service in their lives.<sup>9</sup> In recent years, it has been estimated that the prevalence of DHSU for children and adolescents ranges from 15% to 65%,<sup>10,12-14</sup> while among adults (population >18 years of age) dental healthcare coverage is only 48%.<sup>11</sup> DHSU can be defined as the percentage of the population that makes use of dental services during a given period. DHSU is a complex phenomenon and a multifaceted human behaviour; several theories and conceptual models have been proposed to explain it.<sup>15</sup> Studies that address DHSU differences have increasingly used Andersen's health service utilisation model<sup>16</sup> or its variations to identify its determining factors. The model hypothesises that health service utilisation is influenced by three individual categories of factors that facilitate or hinder access and utilisation, specifically (1) predisposing factors, for example, sociodemographic characteristics that influence the assessment of individuals' health and knowledge of healthcare benefits; (2) facilitating factors, such as those supporting individuals in their pursuit and achievement of good health; and (3) the need for care, defined by individuals' perception of preventive interventions and necessary clinical treatments.<sup>17,18</sup>

DHSU studies in Mexico have been conducted predominantly in children and adolescents, often from 6 to 15 years of age.<sup>10,12-14,19</sup> Other population groups have rarely been addressed in the current literature.<sup>13</sup> To further delineate DHSU trends in the Mexican context, the present study aimed to quantify DHSU (distinguishing between preventive and curative services) together with associated factors in Mexican adolescents and young adults.

## MATERIALS AND METHODS

### Design, population and study sample

A cross-sectional study was conducted with adolescents and young adults 16–25 years old. The present report is part of a project in which several oral health indicators were measured. The methodology related to dental caries and treatment needs has been previously reported.<sup>20</sup> This study was conducted at the Autonomous University of San Luis Potosí (*UASLP*), the largest public university in the state of San Luis Potosí. Every year, approximately 13 000 *UASLP* applicants are automatically assigned a registration number for participating in the university admissions process, which includes academic tests and a free health examination. The latter comprised simple anthropometric evaluations, basic laboratory tests, and medical, eye and dental examinations. A team of dental and medical professionals is designated to examine the applicants. During our study, two dentists (previously standardised and trained by the research team in the use of the data entry form and indices) performed dental examinations (10–20 per day) and collected data for analysis. Invitations to take part in the research were extended to applicants during their stay in the waiting room, which lasted approximately 2 hours. Immediately after obtaining the informed consent of those who agreed to participate and administering the health questionnaire, we asked them whether they would also be willing to answer a research survey. We clearly explained to them that the survey was not part of the *UASLP* admissions process and had no bearing on their health examination or entrance results.

Based on a previous study,<sup>7</sup> we calculated the size of our sample in conformity with the following criteria: an estimated proportion of 75%, 95% CI, 3.5% accuracy and a 10% non-response rate. Out of the total number of applicants, the resulting sample size came to 653 participants. The inclusion criteria were being (1) of either sex, (2) between 16 and 25 years old, and (3) registered in the *UASLP* admissions process. The exclusion criteria were *UASLP* applicants who (1) failed to undergo the dental examination or (2) had fixed orthodontic appliances. The final analytical sample totalled 638 participants, with a response rate above 90%. The selection of participants for the study was performed using random numbers.

### Data collection and variable construction

Data were collected using a self-administered questionnaire filled out by the students. The questionnaire was structured in several sections that allowed for gathering information on sociodemographic and socioeconomic aspects, food intake, smoking, oral health practices, satisfaction with the oral appearance and use of dental services. For diagnosis of dental caries, we used the DMFT index. Clinical examinations were carried out using lighting from a dental lamp, a dental mirror and a WHO-type probe. The study research survey was anonymised.

The dependent variable of interest in this study was self-reported use of dental health services, which was measured by asking *Do you remember ever having gone to the*

*dentist in your life?* Those who gave an affirmative answer were asked *How long ago was your last visit to the dentist?* Those who answered they had had a visit within the last 12 months were asked *What was the main reason for your last visit to the dentist?* With these answers the dependent variable DHSU was categorised as 0=no utilisation or no utilisation in the last 12 months, 1=utilisation of curative services, and 2=utilisation of preventive services. Curative services included tooth extraction, consultation for pain or tooth fracture complaints, dental filling (restorations), and specialised treatment, if available (orthodontics, endodontics, periodontics and dental prosthetics). Preventive services included regular recall, fluoride or pit and fissure sealants, and cleaning (prophylaxis). If both types of services were provided in the last visit (curative and preventive), the visit was classified as one or the other based on the *main* reason for visit.

The independent variables included in the present study were sex (0=male, 1=female); age (from 16 to 25 years); number of people living in the household (from 1 to 11); whether the participant was working for a salary in addition to studying (0=no, 1=yes); whether the participant was financially dependent on his/her parents (0=no, 1=yes); father's and mother's highest level of education (0=high school and beyond, 1=less than high school); socioeconomic status (in tertiles); whether the participant lived in a household that owned a car (0=yes, 1=no); having public health insurance (0=with insurance, 1=without insurance); use of self-care oral hygiene devices (from 1 to 4); having had dental pain in the 12 months prior to the study (0=no, 1=yes); caries experience (0=DMFT=0, 1=DMFT >0); tobacco use (0=never, 1=former smoker, 2=current smoker); self-perception of oral health status (0=poor/very poor, 1=fair, 2=good/very good); oral health knowledge (0=poor, 1=basic, 2=broad)<sup>21</sup>; self-reported perception of having a dental disease (0=no/does not know, 1=yes); self-reported perception of having a gum disease (0=no/does not know, 1=yes); satisfaction with own dental appearance (from 1 to 5); satisfaction with own colour of teeth (from 1 to 5); and satisfaction with appearance of teeth alignment/position (from 1 to 5).

### Considerations about dental care services in Mexico, both within and outside publicly funded programmes

The Mexican dental healthcare system is a mixed and fragmented system comprising publicly funded services, Social Security carriers, third-party payment systems and private carriers. The overwhelming majority of services are delivered under a fee-for-item, out-of-pocket arrangement run largely by largely unregulated dental professionals in a free dental market. The public health sector is responsible for a small, essentially unidentified and fluid set of services largely restricted to urban settings. For example, the *Seguro Popular* (SP) is a voluntary public insurance scheme offering its members a package of 294 health interventions with partial coverage. The SP is financed primarily by the federal and state governments

and, to a lesser extent, by household contributions; it is free of charge for those households in the lowest three income deciles. The Social Security carriers serve two groups: civil servants with insurance funded by the government (Institute for Social Security and Services for State Workers) and those who work in private businesses (Mexican Institute of Social Security). The Army (*Secretaría de la Defensa Nacional*), the Navy (*Secretaría de Marina*) and the national oil company (*Petróleos Mexicanos*) have separate subsystems that provide services with more generous coverage. Finally, dozens of dental school clinics at numerous public and private universities offer dental services at greatly reduced prices. Dental insurance schemes, as commonly known in developed economies whereby dental offices accept payments, claims and reimbursements from dental insurance carriers, are essentially non-existent.<sup>8 11 22</sup>

### Statistical analysis

To create indicators of socioeconomic status and oral health knowledge, we used principal components analysis (polychoric correlation,<sup>23</sup> which allows for incorporating inter-related categorical variables to construct a single indicator variable). Tertiles were calculated for each variable generated: the first tertile referred to the group with the worst condition and the last tertile to the group with the best condition. Missing data for socioeconomic level (n=18), the father's highest level of education (n=26) and having health insurance (n=11) were predicted through regression imputation.<sup>24</sup>

A univariate analysis was performed to assess central tendency and dispersion measures for continuous variables, as well as frequency and percentages for categorical variables.

For bivariate and multivariate analyses, we used a multinomial logistic regression model because our dependent variable involved three categories. The strength of the associations between the dependent and independent variables is presented as ORs with 95% CI. P values are presented and were considered statistically significant when they were <0.05. Variance inflation factor testing was performed to analyse and avoid multicollinearity among independent variables. For the model construction, we considered variables that had a p value of <0.25 in the bivariate analysis.<sup>25</sup> Some interactions were tested but none was significant (age × caries, age × pain, sex × caries, sex × pain). The overall fit of the model was made with a goodness-of-fit test.<sup>26</sup> The statistical package used was STATA V.11.0.

### Patient and public involvement

The study was designed to investigate preventive and curative DHSU, together with non-dental variables. Neither patients nor members of the public were included in the design, recruitment or implementation of the study. Results will be disseminated in Mexican and international scientific and professional venues.

## RESULTS

The mean age of participants was 18.76±1.76 years, and 49.2% were women. A third of the sample studied and worked at the same time (31.8%), but most depended financially on their parents (90.1%). Almost all participants (98.4%) had used some form of dental service at least once in their lives. The prevalence of DHSU in the last year was 40.9% (95% CI 37.1 to 44.8) (n=261) for curative services and 22.9% (95% CI 19.7 to 26.3) (n=146) for preventive services. Other characteristics analysed are described in table 1.

Table 2 shows the results of the bivariate analysis performed on the basis of multinomial logistic regression. The following categories were associated (p<0.05) with the use of curative services at this level of analysis: women, young age, financial dependence on parents, mother's low education level, extensive use of self-care devices, having had dental pain in the 12 months prior to the study, caries experience, former tobacco use and broad oral health knowledge. The categories associated with preventive service use were (p<0.05) living in a household with numerous members, working and studying, financial dependence on parents, mother's low education level, extensive use of self-care devices, having had dental pain in the 12 months prior to the study, caries experience, good/very good self-reported oral health perception, self-reported presence of a dental disease, general satisfaction with teeth, satisfaction with the colour of teeth and satisfaction with the alignment of teeth.

## Multivariate model of multinomial logistic regression

The results from the final multivariate model are shown in table 3. As can be observed, the likelihood of using curative dental services decreased with age (OR=0.88, 95% CI 0.79 to 0.98), and women were more likely to use these services than men (OR=1.74, 95% CI 1.19 to 2.54). Furthermore, the odds of using curative services decreased when the mother's education level was less than high school (OR=0.66, 95% CI 0.44 to 0.97), but increased (OR=1.84, 95% CI 1.24 to 2.73) when dental pain had been experienced in the 12 months before the study. Participants with caries experience >0 were 2.48 times (95% CI 1.57 to 3.92) more likely to use curative services than those with DMFT=0. In addition, the employment of self-care oral hygiene devices increased the likelihood of using curative services at 37% (95% CI 11% to 70%) with each device used. Finally, the likelihood of using curative dental services increased 1.58 times (95% CI 1.05 to 2.38) when participants had broad oral health knowledge.

The odds of using preventive services decreased (OR=0.66, 95% CI 0.44 to 0.97) when the mother's education level was less than high school, and participants who had suffered from dental pain in the 12 months before the study used preventive services less (OR=0.55, 95% CI 0.32 to 0.93). On the other hand, participants with caries experience >0 were 1.78 times (95% CI 1.07 to 2.96) more likely to use preventive services than those with DMFT=0, and participants who used self-care devices more also used

**Table 1** Descriptive analysis of the variables included in the study

Variables	Mean±SD	Boundaries
Age	18.76±1.76	16–25
Number of household members	4.01±1.78	1–11
Number of dental hygiene aids/ devices used	2.89±0.91	1–4
Satisfaction with overall teeth appearance	3.21±1.18	1–5
Satisfaction with colour of teeth	2.80±1.18	1–5
Satisfaction with alignment of teeth	3.14±1.31	1–5
	<b>n</b>	<b>%</b>
<b>Sex</b>		
Male	324	50.8
Female	314	49.2
<b>Works</b>		
No	435	68.2
Yes	203	31.8
<b>Financially dependent on parents</b>		
No	63	9.9
Yes	575	90.1
<b>Mother's education level</b>		
High school and beyond	273	42.8
Less than high school	365	57.2
<b>Father's education level</b>		
High school and beyond	360	56.4
Less than high school	278	43.6
<b>Car ownership at home</b>		
Yes	513	80.4
No	125	19.6
<b>Socioeconomic status</b>		
First tertile (lowest)	217	34.0
Second tertile	219	34.3
Third tertile (highest)	202	31.6
<b>Health insurance</b>		
With insurance	410	64.3
Without insurance	228	35.7
<b>Dental pain in the last 12 months</b>		
No	421	66.0
Yes	217	34.0
<b>Caries experience</b>		
DMFT=0	150	23.5
DMFT >0	488	76.5
<b>Tobacco use</b>		
Never	469	73.5
Former smoker	36	5.6
Current	133	20.9
<b>Self-perception of oral health</b>		
Very poor/poor	84	13.2

Continued

**Table 1** Continued

Variables	Mean±SD	Boundaries
Fair	324	50.8
Good/very good	230	36.0
Oral health knowledge		
Poor	248	38.9
Basic	184	28.8
Broad	206	32.3
Self-reported dental diseases		
No/does not know	406	63.6
Yes	232	36.4
Self-reported gum diseases		
No/does not know	548	85.9
Yes	90	14.1

DMFT, decayed, missing and filled teeth.

preventive services more, with the use of these services increasing 56% (95% CI 21% to 101%) with each device used. Where self-perception of oral health was good or very good, the likelihood of using preventive dental services increased 2.01 times (95% CI 1.26 to 3.21).

## DISCUSSION

The present study aimed to determine the prevalence of DHSU in the context of predisposing, facilitating and need variables, and in relation to health and disease variables, in teenagers and young Mexican adults. The assessment of factors associated with using health services, including dental services, speaks to a major challenge to attaining more effective, equitable, efficient and accessible health systems. An integral approach to establishing determinants for seeking and using health services is limited in Mexico, compared with other countries in the world.<sup>27</sup> In the present study, almost all participants (98.4%) had used at least once in their lives some dental service (curative or preventive); in the previous year, 63.8% used a service (40.9% for curative services and 22.9% for preventive services). This prevalence is within the wide range previously reported in Mexico for children and adolescents at large (between 15% and 65%).<sup>9 10 12–14 19</sup> Because there are no readily comparable reports for an identical age group as in the present sample, our discussion of contrasts with other reports from Mexico or other parts of the world will be limited. Our discussion of findings in the context of relevant variables is carefully separated in the following three sections.

### Predisposing factors

The present study noted that sociodemographic variables such as age and sex are associated with DHSU, in particular for curative care. In Taiwan,<sup>28</sup> Nicaragua<sup>29</sup> and Brazil,<sup>30</sup> it was observed that women use more dental services, both curative and preventive. This information has also been confirmed in a systematic review.<sup>31</sup> In another study from Mexico,<sup>12</sup>

women are also the ones who are more adept at using such services, compared with men. Regarding age, there is still controversy. In Mexican preschool and school children, it has been reported that as age increased, dental service utilisation increased.<sup>12 14 19</sup> However, some studies have not found any association for these age groups.<sup>32</sup> When looking at a wider age range, between 10 and ≤60 years, dental service utilisation decreases with age.<sup>30 33</sup> As a general rule, it seems reasonable to affirm that the association between DHSU and age changes according to the specific age group analysed. This variability could also be moderated by the health needs exhibited or perceived by participants.

Previous studies have confirmed that self-care devices such as brushing teeth with toothpaste, flossing or using mouthwash increase the likelihood of using dental services for regular recall examination or receiving preventive treatments.<sup>12 14 19 32 34 35</sup> The findings of this study reveal that, although individuals who use self-care devices are more likely to visit dental offices seeking both types of services, the effect of this variable is greater on preventive services. Visits to dental health providers for check-ups with the aim of identifying signs of disease may lead to greater awareness of oral health issues and partially provide educational support regarding the importance of regular dental check-ups.<sup>34</sup> In Mexico, the proportion of clinical care represented by preventive services has been estimated at the lower end of the scale (~20%), whereas curative services lie in the upper 50%.<sup>19</sup> We propose that users of curative services might have been exposed to health education messages in the dental office and react to those appropriately, if we accept that preventive service use preceded curative services. Based on the current data, it may well be that clients who use predominantly preventive services and those who are more adept at using restorative services constitute entirely different segments of the market—or clients who have different benefits in their health plans. The role of increased understanding about oral health was partially confirmed in the present study, as we found that better knowledge about oral health was associated with increased DHSU—although only for curative services. It is worthwhile pointing out that dental care services in Mexico have been largely focused on addressing health issues through curative or emergency services instead of preventive services. Further research to dissect carefully the underlying mechanisms would be necessary to fully understand these issues.

### Facilitating variables

Socioeconomic inequalities influencing oral health are a major public health problem. The underlying assumption is that such disparity may be addressed through improving access to dental care in socioeconomically disadvantaged groups. It is still unclear the exact mechanism through which dental health service use and socioeconomic status are associated. The mechanisms involved are likely a combination of healthy behaviours, healthy lifestyles and improved access to medical care.<sup>29</sup> In several studies carried out around the world, it has been observed that variables related to socioeconomic

**Table 2** Crude analysis of multinomial logistic regression showing the association between DHSU and the independent variables

Variables	Curative services		Preventive services	
	OR (95% CI)	P value	OR (95% CI)	P value
<b>Sex</b>				
Male	1*		1*	
Female	1.83 (1.28 to 2.61)	0.001	0.97 (0.64 to 1.47)	0.875
<b>Age</b>				
Age	0.90 (0.81 to 0.99)	0.041	0.90 (0.80 to 1.01)	0.082
<b>Number of household members</b>				
Number of household members	1.00 (0.91 to 1.11)	0.912	1.18 (1.05 to 1.32)	0.005
<b>Works</b>				
No	1*		1*	
Yes	0.69 (0.47 to 1.01)	0.055	0.55 (0.35 to 0.87)	0.011
<b>Financially dependent on parents</b>				
No	1*		1*	
Yes	1.90 (1.07 to 3.40)	0.029	2.54 (1.18 to 5.47)	0.018
<b>Mother's education level</b>				
High school and beyond	1*		1*	
Less than high school	0.69 (0.48 to 0.99)	0.044	0.52 (0.34 to 0.79)	0.002
<b>Father's education level</b>				
High school and beyond	1*		1*	
Less than high school	0.94 (0.66 to 1.35)	0.748	0.73 (0.48 to 1.12)	0.151
<b>Car ownership at home</b>				
Yes	1*		1*	
No	0.92 (0.60 to 1.43)	0.724	0.73 (0.43 to 1.25)	0.254
<b>Socioeconomic status</b>				
First tertile (lowest)	1*		1*	
Second tertile	1.18 (0.78 to 1.80)	0.432	0.94 (0.56 to 1.57)	0.809
Third tertile (highest)	1.14 (0.73 to 1.77)	0.570	1.52 (0.92 to 2.51)	0.102
<b>Health insurance</b>				
With insurance	1*		1*	
Without insurance	0.72 (0.49 to 1.04)	0.082	1.05 (0.69 to 1.61)	0.816
<b>Number of dental hygiene aids/devices used</b>				
Number of dental hygiene aids/devices used	1.48 (1.21 to 1.80)	<0.001	1.69 (1.33 to 2.15)	<0.001
<b>Dental pain in the last 12 months</b>				
No	1*		1*	
Yes	1.85 (1.28 to 2.68)	0.001	0.48 (0.29 to 0.79)	0.004
<b>Caries experience</b>				
DMFT=0	1*		1*	
DMFT >0	2.25 (1.46 to 3.46)	<0.001	1.35 (0.85 to 2.17)	0.203
<b>Tobacco use</b>				
Never	1*		1*	
Former smoker	2.55 (1.05 to 6.22)	0.039	2.15 (0.80 to 5.83)	0.13
Current	1.07 (0.69 to 1.63)	0.768	0.64 (0.37 to 1.11)	0.111
<b>Self-perception of oral health</b>				
Very poor/poor	1*		1*	
Fair	1.16 (0.69 to 1.95)	0.561	1.85 (0.87 to 3.97)	0.112
Good/very good	1.35 (0.77 to 2.35)	0.289	4.19 (1.94 to 9.05)	<0.001

Continued

Table 2 Continued

Variables	Curative services		Preventive services	
	OR (95% CI)	P value	OR (95% CI)	P value
Oral health knowledge				
Poor	1*		1*	
Basic	0.99 (0.64 to 1.53)	0.958	1.08 (0.66 to 1.77)	0.765
Broad	1.62 (1.06 to 2.48)	0.026	1.19 (0.72 to 1.97)	0.503
Self-reported disease in the teeth				
No/does not know	1*		1*	
Yes	1.12 (0.78 to 1.62)	0.854	0.74 (0.40 to 1.37)	0.337
Self-reported disease in gums				
No/does not know	1*		1*	
Yes	0.95 (0.58 to 1.57)	0.854	0.74 (0.40 to 1.37)	0.337
Satisfaction with overall appearance of teeth	0.97 (0.84 to 1.23)	0.696	1.22 (1.02 to 1.46)	0.032
Satisfaction with colour of teeth	1.01 (0.87 to 1.17)	0.905	1.27 (1.06 to 1.52)	0.009
Satisfaction with alignment of teeth	1.06 (0.92 to 1.21)	0.409	1.23 (1.05 to 1.45)	0.011

The reference group for the outcome variable was no visit.

\*Reference category.

DHSU, dental health service utilisation; DMFT, decayed, missing and filled teeth.

status are good predictors of DHSU, such as education level.<sup>12 29 30 33 35 36</sup> Mothers' education level was associated with using dental services in our study, which presumably indicates that lower access to knowledge and poorer understanding of oral health may be associated with unhealthy behaviours; it is unclear whether such scenario leads to lower engagement in preventive and curative treatment. It has been shown that education level can also encompass non-financial domains, such as acquiring knowledge that may in turn influence adoption of healthy habits.<sup>37</sup> Education can lead people to be more health-conscious and help them make healthier lifestyle choices.<sup>32</sup> Lower educational attainment has been found to be linked to lower levels of dental knowledge and negative dental attitudes.<sup>38 39</sup>

### Needs

Oral health needs can be appraised through two lenses, normative and subjective. Dental visits for curative reasons are directly related to the presence of dental caries or other oral diseases. The use of dental services is often driven by the presence of pain, oftentimes a consequence of untreated dental caries.<sup>31</sup> In Mexico, oral health status is a strong predictor of DHSU.<sup>12 14 19</sup> The present study indicated that dental caries were more strongly associated with curative than with preventive DHSU. It also showed that having suffered from dental pain in the last year increased the likelihood of using curative and reduced the likelihood of using preventive dental services. In the present study, dental caries were observed more strongly associated with curative DHSU than the preventive. Also, it was observed that participants with dental pain in the last year were more likely to use curative dental

services and less likely to use preventive dental services. Because perception of oral health status was associated with DHSU,<sup>29 31 32</sup> we believe our findings support the notion that greater (perceived) need for oral health is an important predictor of DHSU in children and adults.<sup>29</sup> A negative perception of oral health status was a reason to pursue dental care. At an aggregate level, the presence of a problem in teeth and gums is associated with the perception of poor oral health status, regardless of socio-economic status. For example, in Brazil a higher prevalence of DHSU was observed in individuals who rated their oral health as 'good' compared with those who rated it as 'poor'.<sup>29 32</sup> At a perhaps simplistic level of analysis, such consistent performance of a single item rating perceived oral health makes it an attractive option for a screening factor in some population groups.<sup>31 35</sup>

### Strengths and limitations

The present study aimed to determine the prevalence of DHSU in the context of health and disease variables among teenagers and young Mexican adults—an age group hitherto sparsely characterised both in Mexico and in many other locations. Having a large sampling framework in one state of Mexico is a methodological strength. Curative and preventive dental service care were jointly analysed, which allowed for a richer interpretation of results. However innovative, the present research has limitations, such as its cross-sectional study design; associations found cannot be interpreted as causal. Another limitation is the possibility of introducing memory error (recall bias) due to collection of data through questionnaires. More sobering is the fact that applicants to

**Table 3** Adjusted multivariate model of multinomial logistic regression for dental health service utilisation

	Curative services		Preventive services	
	OR (95% CI)	P value	OR (95% CI)	P value
<b>Predisposing variables</b>				
Age	0.88 (0.79 to 0.98)	0.026	0.90 (0.79 to 1.02)	0.094
<b>Sex</b>				
Male	1*		1*	
Female	1.74 (1.19 to 2.54)	0.004	0.95 (0.61 to 1.48)	0.819
Number of dental hygiene aids/devices used	1.37 (1.11 to 1.70)	0.004	1.56 (1.21 to 2.01)	0.001
<b>Oral health knowledge</b>				
Poor/basic	1*		1*	
Broad	1.58 (1.05 to 2.38)	0.027	0.96 (0.59 to 1.55)	0.865
<b>Facilitating variables</b>				
<b>Mother's education level</b>				
High school and beyond	1*		1*	
Less than high school	0.66 (0.44 to 0.97)	0.036	0.56 (0.36 to 0.89)	0.013
<b>Needs</b>				
<b>Caries experience</b>				
DMFT=0	1*		1*	
DMFT >0	2.48 (1.57 to 3.92)	<0.001	1.78 (1.07 to 2.96)	0.025
<b>Dental pain in the last 12 months</b>				
No	1*		1*	
Yes	1.84 (1.24 to 2.73)	0.003	0.55 (0.32 to 0.93)	0.026
<b>Self-perception of oral health</b>				
Very poor/poor/fair	1*		1*	
Good/very good	1.22 (0.80 to 1.86)	0.361	2.01 (1.26 to 3.21)	0.003

The reference group for the outcome variable was no visit.

Goodness-of-fit test for the multinomial logistic regression model:  $X^2(16)=10.052$ ,  $p=0.864$ .

\*Reference category.

DMFT, decayed, missing and filled teeth.

a publicly funded, large state college are a considerable segment of the young Mexican urban population in this specific location but by no means constitute a representative sample of this age group at large.

## CONCLUSIONS

In conclusion, curative services made up most of DHSU by adolescents and young adults in a large study, college applicant sample. Multiple differences by type of service, socio-demographic, socioeconomic and dental variables were associated with higher likelihood of preventive or curative DHSU in the final model; higher oral health needs and socioeconomic inequalities remain as predictors of DHSU. A number of differences emerged by type of service, with sociodemographic and socioeconomic variables as well as oral health knowledge linked to a higher likelihood of curative DHSU, but only self-perceived oral health status associated with the likelihood of preventive DHSU. Given these differences, oral health policies should focus on promoting the use of preventive services, requiring that patients seeking dental care for an oral disease be referred

to preventive services. Likewise, information campaigns should be implemented to promote the use of preventive services among the poorer and less educated population groups, most of which are unaware that these services are covered by public health insurance.

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