COMMUNITY
DENTISTRY AND
ORAL EPIDEMIOLOGY

Factors associated with dental health care coverage in Mexico: findings from the National Performance Evaluation Survey 2002–2003

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Pérez-Núñez R, Medina-Solis CE, Maupomé G, Vargas-Palacios A. Factors associated with dental health care coverage in Mexico: findings from the National Performance Evaluation Survey 2002–2003. Community Dent Oral Epidemiol 2006; 34: 387–97. © Blackwell Munksgaard, 2006

Abstract – *Objectives:* To determine the level of dental health care coverage in people aged ≥18 years across the country, and to identify the factors associated with coverage. *Material and methods:* Using the instruments and sampling strategies developed by the World Health Organization for the World Health Survey, a cross-sectional national survey was carried out at the household and individual (adult) levels. Dental data were collected in 20 of Mexico's 32 states. The relationship between coverage and environmental and individual characteristics was examined through logistic regression models. *Results:* Only 6098 of 24 159 individual respondents reported having oral problems during the preceding 12 months (accounting for 14 284 621 inhabitants of the country if weighted). Only 48% of respondents reporting problems were covered, although details of the appropriateness, timeliness and effectiveness of the intervention(s) were not assessed. The multivariate regression model showed that higher level of education, better socioeconomic status, having at least one chronic disease and having medical insurance were positively associated with better dental care coverage. Age and sex were also associated. *Conclusions:* Overall dental health care coverage could be improved, assuming that ideal coverage is 100%. Some equality of access issues are apparent because there are differences in coverage across populations in terms of wealth and social status. Identifying the factors associated with sparse coverage is a step in the right direction allowing policymakers to establish strategies aimed at increasing this coverage, focusing on more vulnerable groups and on individuals in greater need of preventive and rehabilitative interventions.

The 2000 World Health Report made a distinction between the health systems' ultimate and intermediate goals, and acknowledged the instrumental nature of the latter to achieving the former (1). While there is no doubt about their importance, instrumental goals are desirable only to the extent that they improve overall health, are responsive to the legitimate expectations of the population, and promote equitable distribution of financial resources (2). As changes in health are difficult to capture using traditional health indicators, and as health system strategies need to be evaluated in the short term, instrumental goals – such as the proportion of the population covered by effective interventions – have become key indicators of the health systems' performance assessment (3). According to this assumption, the time lag between the actions within a health system and

its identifiable impact on the client population is shorter than that between the actions and their final outcomes. In this context, it is difficult to unequivocally attribute outcomes to actions (4).

Health interventions are a pathway through which health services can contribute to social objectives, such as improving population health and reducing health inequalities (1, 3–5). In this way, the degree to which a health system carries out such activities can determine how effectively populations are covered by health interventions (3, 4, 6). For this reason, coverage of effective interventions has been seen as one of the more reliable indicators to assessing health care services' impact to attaining health goals (3).

Because studies have dealt with various aspects of health system coverage, the concept has been used for many purposes, thereby rendering it ambiguous in some applications. Most of the times, coverage is meant to signify 'legal coverage', the term used by social security or health insurance organizations (private or public) to describe affiliation to some insurance plan (medical or dental). 'Functional', 'geographic', 'potential' and 'real coverage' are other connotations of the coverage concept (7). Perhaps the more dynamic description of coverage has been as a pyramid, where at the base lies the availability of coverage – the amount of resources and technologies available, in relation to the size of the target population. The following layer in the pyramid would be accessibility coverage, which depicts how accessible those resources are to the population, mostly as physical accessibility (in terms of distance or travel time). The next layer up would be the acceptability coverage, which measures the proportion of people for whom services are culturally acceptable and affordable. Subsequently, contact coverage would be understood as the proportion of the population who have contacted a health service provider. Finally, the effective coverage at the top of the pyramid would be the proportion of people who have received effective interventions (8).

Traditional health service measures have not always clearly identified a link between health care needs and the health systems' response to those needs (5). Some of the more salient shortcomings in this regard are that coverage is sometimes equated to access to services and sometimes to utilization of services (1), focusing mostly on the types of services used (4). Furthermore, most studies describe the use of services in relation to perceived needs and use the perception of need as an independent variable to explain utilization patterns, rather than as an indicator to gauge how well health systems address population needs (1, 3, 4, 8–10). Finally, while coverage can be measured for a specific health intervention (as in the case of the evaluation of a health program) by ascertaining its distribution through more vulnerable and priority groups (8), this has not always been feasible.

Dental diseases are assumed to be a public health problem in Mexico because of their high prevalence and incidence, and they appear to unequally impact the disadvantaged and the poor (11–14). While dental health care falls by default within the purview of the activities of the Ministry of Health, as well as specifically within Social Security, only a fraction of the treatment variety and clinical services are in fact available through these large systems. Therefore, even patients who have some sort of dental insurance plan might end up seeking private dental care from independent practitioners, incurring out-of-pocket expenditures (15), or forgoing dental care even when it is needed. The extent of this phenomenon, although thought to be widespread, has never been objectively established. The present study determined the level of dental health care coverage in people aged ≥18 years across the country's population, and identified the factors associated with coverage.

Material and methods

Assumptions of the model

This study defines coverage as the ability of the health system to address the population's health care needs and to produce health gain. In this context, there are two possible ways to conceptualize coverage: at the population level and at the individual level. At the population level, coverage can be defined as the proportion of the population benefiting from effective interventions (1). At the individual level, coverage becomes a binary variable: an individual with specific sociodemographic characteristics and background, who has certain health care needs, may receive a health intervention or not (1). Even if two individuals have the same probability of needing a certain intervention, their probability of getting the intervention might be different (1). The focus on health care needs and effective interventions makes the measure of coverage more congruous with potential health gains attainable in a given health system (1, 5).

Although data on coverage for specific interventions are usually reported *ex post*, the common sense notion of coverage is of an anticipatory, or *ex ante*, character: individuals believe that they are covered by the health system if they receive appropriate interventions in case they need them (4). In the context of the present study, the mismatch between this notion of individual coverage and the convenience of measuring it *ex post* can be fixed by thinking of coverage as the probability of an individual receiving an intervention conditional on the presence of a dental health problem (1, 3–5, 8). The statement 'I am covered by the health system' could then be taken to mean 'if I get sick the health system will take care of me and provide appropriate interventions' (4). In this sense, the definition accommodates the concepts of access, utilization, and effectiveness (1).

Design, population, and study sample

In the present study, secondary analyses on health survey data from a nationally representative sample in Mexico were conducted and the methodology has been previously published (16, 17). The National Performance Evaluation Survey 2002–2003 (ENED) was part of the technical collaboration between the Ministry of Health of Mexico (SSA) and the World Health Organization (3), which used the survey instrument and sampling strategies developed by WHO for the World Health Survey (WHS).[1] The National Institute of Public Health (INSP) and the General Direction of Performance Evaluation of the SSA implemented the ENED. ENED provides policymakers with reliable and internationally comparable baseline information on a variety of health indicators, including measures of general population health and the effectiveness of health systems.

ENED was conducted between November 2002 and April 2003, collecting information from 38 746 households, with a mean of 1250 households for each state. The sample design was probabilistic, multistage, stratified, through conglomerates, and was calculated to provide representative information at the state level, and across urban and rural areas. Three strata were considered: (a) cities or metropolitan areas (locales with >100 000 inhabitants); (b) urban settings (locales with 2500 to 99 999 inhabitants), and (c) rural areas (locales with <2500 inhabitants). The sample size considered: 9% as the smaller proportion to estimate; state estimations with a maximum relative error of 25%; a confidence level of 95%; nonresponse rate of 15%; and a design effect of 1.7. The complete WHS instrument was not used in every state, and in some cases the dental items were omitted. Data on dental conditions are only available for 20 of the 32 states of Mexico, leading to a total of 24 159 households included in this study. The national nonresponse rate was 3.1%.

Variables included in data collection and data collection process

The survey comprised household and individual face-to-face questionnaires.

Environment variables

The household survey included general topics, such as physical characteristics of the household and ownership of consumable goods, which were used to construct a wealth index, using principal components analysis (PCA). Owning a refrigerator, washing machine, dishwasher, personal computer, car, bicycle, television, etc., were the goods combined in the polychoric PCA (18). From the house, the building materials of the walls and floor, the number of rooms in the house, the characteristics of bathroom and kitchen, the source of water, having electricity and heating, and an estimate of household overcrowding, were the aspects incorporated into this wealth index. Once divided by deciles and quartiles, the first decile/quartile represents the poorest households of the distribution. In addition, the municipal (county level) marginalization index, was taken from official reports prepared by the National Council on Population (CONAPO).[2]

Overview of the Mexican health system

The Mexican health care system is a mixed, fragmented health system composed of public

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[1]Both questionnaires (individual and household) and general methodological issues are available in WHO's web page: http://www3.who.int/whs/P/instrumentandrel8293.html

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[2]The Consejo Nacional de Poblacion (National Council on Population, CONAPO) classifies the degree of marginalization of a municipality using an index which includes the following variables: percentage of illiterate population over 15 years of age, percentage of population without complete elementary school over 15 years of age, percentage of houses without sewage or bathroom, percentage of dwellers in houses without drinking water, percentage of houses with overcrowding, percentage of occupants in houses with dirt floor, percentage of population in areas of <5000 inhabitants, and percentage of employed population with an income of less than two minimum wages.

services and social security efforts supplied by public institutions, third-party payment systems, and private carriers (19). Employment status, geographic locale, and socioeconomic status are the three main variables governing the degree of sophistication of health services available and, in some cases, the extent of overlap across systems for a given person. The social security system has five main institutions, the Instituto Mexicano del Seguro Social (IMSS) that insures workers in the private sector; the Instituto de Seguridad y Servicios Sociales para los Trabajadores del Estado (ISSSTE) that insures workers employed by the various levels of government; the health system supported by the one oil company in the country, Petróleos Mexicanos (PEMEX); and the health systems caring for the armed forces – army (Secretaría de la Defensa Nacional) and navy (Secretaría de Marina) (SEDENA and SEDEMAR, respectively). The last three systems are more sophisticated than IMSS or ISSSTE, both in terms of diversity of services and extent of benefits. A more recent development is the Seguro Popular, which is a voluntary public insurance scheme encompassing the bulk of nonmandatory, nonemployment-related health services. IMSS can also insure people (and families) who voluntarily contract with the institution (20).

The Ministry of Health (SSA) caters to the noninsured population – usually the poor, informal workers, sub-employed, and unemployed people. Other institutions such as IMSS-Oportunidades and the Sistema Nacional para el Desarrollo Integral de la Familia (DIF) also provide health care to noninsured people.

The private health care system is usually of the fee-for-service type. About 3% of the overall population has a private insurance plan. Cost and quality of the private health care system is highly heterogeneous and poorly regulated. In 2002, about 49% of the overall population had no insurance (neither public nor private). IMSS on its own insured 40% of the remaining population (20). Funding for health services is derived from tax contributions, third-party payment contributions from employees and employers (in public social security), and payment of premiums and fees at point of service. More than 50% of total health expenditures is in the private sector, and most of this amount is out-of-pocket (21). In 2003, total health expenditures were 6.1% of gross domestic product (GDP) (a percentage below the average for Latin America) with 3.3% of GDP for private expenditure, and 2.8% of GDP for public expenditure (SSA). The ratio of public to private expenditure varies markedly between states, and across populations served by different subsystems.

Individual variables

The individual questionnaire targeted individuals at least 18 years of age and collected information addressing health status, risk factors, health care expenditures, and coverage for specific interventions and conditions. A chronic disease variable was constructed if people self-reported a diagnosis of arthritis, angina, asthma, or diabetes. A physical impairment variable was constructed through interviewer's report of problems to walk, being confined to a wheelchair, or using cane, crutches, or walker. Those reported with at least one limb paralyzed or amputated, and those with mental health conditions, were also included in this category.

To measure dental health care coverage, we classified as covered everyone who self-reported having had any problem with their mouth and/or teeth during the last 12 months and received any clinical care from a dentist or from any other oral health specialist. People who reported a problem but did not receive treatment, or answered 'no' to all possible oral health intervention questions were considered not covered and included in the denominator – 60 persons answered 'no' to all questions that sought to identify the type of intervention received (counseling on dental care and oral hygiene, medication, dental prostheses, surgical, and dental work from a trained dental health provider and other oral treatment).

Statistical analysis

For statistical analysis, we considered the sample design strategy used to make our analysis more robust, using the statistical package STATA 9® (module for complex samples). First, a univariate analysis was conducted to report the summary measures per case (for nominal and ordinal variables, frequencies and percentages; for continuous variables, dispersion and central tendency measures). For this purpose the probabilistic weight factor was used, assuming that the inverse of the probability was that the observation was included because of the sampling design. To use this module, we first defined the strata that specify the variable that contains stratum identifiers, the primary sampling units (psu = clusters). We then

performed a bivariate logistic regression analysis, reporting odds ratios (OR), 95% confidence intervals (CI 95%), and *P*-value of the test. Finally, a multivariate logistic regression model incorporated all variables available (sociodemographic and environmental) that were thought to be related to individual coverage and associated at the bivariate analysis level with a *P*-value <0.25, to control for possible confusion (22, 23). Although marital status and chronic illnesses were not statistically associated with dental coverage, they were considered in the final model because of their relevance to oral health (24–26).[3]

To identify multicolinearity in the variables included in the final model, the variance inflation factor (VIF) test was performed. Finally, the Box-Tidwell test and additive generalized models were performed to evaluate whether continuous variables were related with the logit of the dependent variable lineally or not (27); the Pearson, and Hosmer and Lemeshow's goodness-of-fit tests evaluated the global adjustment of the final model (*P* > 0.05). In addition, the model was evaluated in terms of its residuals and leverage.

Results

Only 6098 of the 24 159 individual respondents self-reported having had a problem with their mouth and/or teeth during the preceding 12 months [63.6% of respondents were female and 36.4% male; mean age was 43.7 years (95% CI, 41.55–43.83)] (Table 1). This sub-sample accounted for a total of 14 284 621 people, of approximately 104 million inhabitants in the country, if expanded to the entire population by means of the weight factor. Throughout the Results section, only weighted data will be presented.

Only 48% of the people in need of oral health care received clinical care or treatment from a dentist or other oral health specialist for their problem, with locale values ranging from 67% in Mexico City to 38% in the State of Puebla (Fig. 1).

Table 2 shows that sex, age, schooling, medical insurance, Indian ethnic status, physical impairment, wealth index, health self-perception, resi-

dence strata, and municipal marginalization were the variables associated with dental health coverage in the bivariate analyses.

The multivariate binary logistic regression model (Table 3) showed that the group with lower educational attainment was less likely to be covered (ORs 0.50–0.88), compared with the group with higher level of educational attainment. Sex and age were also found to be associated: women and those of younger age were more likely to be covered. According to the wealth index, respondents in better socioeconomic positions were more likely to be covered. The variables introduced in the multivariate model did not show collinearity (VIF < 10 and mean VIF = 1.83). The nonparametric test for trends was positive for wealth index and schooling, suggesting that the likelihood of dental coverage increases with socioeconomic affluence at the personal level. Compared with noninsured people, having medical insurance increased the probability of being covered (OR 1.26; 95% CI 1.09–1.45). In contrast, a significant association with dental coverage was observed in the presence of chronic disease (OR 1.16; *P* = 0.043).

When the goodness-of-fit was tested (Pearson, and Hosmer and Lemeshow), the probabilities estimated by the model were statistically similar to the observed probabilities, with a *P*-value >0.05 in both cases.

Discussion

Measurement of coverage for most specific health interventions is uncommon. The main source of information has been the administrative records – with its known limitations (1, 3, 7). The present study is one of the first efforts at evaluating coverage and its associated factors in Latin America at the national and sub-national levels, using standardized, widely accepted instruments. While a number of studies have documented the utilization of these services in Mexico, they are limited to child populations (15, 28, 29).

One of the limitations of previous efforts to measure coverage was the tenuous link between the measurement exercise and management practice. It was not clear how coverage figures could be interpreted so as to aid in designing effective remedial actions and strategies to improve oral health system performance. The focus of WHO's renewed attention on health system coverage is the

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[3]In addition, for this work it was particularly relevant finding whether individual physical characteristics affected coverage or not. The underlying rationale was that if a person has difficulties to go to the dental professional on his/her own, the national program would then pay more attention to this accessibility issue.

Table 1. Characteristics of the population included in the analyses, based on ENED 2002–2003

	Summary statistics		
Variables	N Sample	N Weighted	% Weighted
Sex			
Female	3827	9 059 349	63.4
Male	2271	5 225 272	36.6
Marital status			
Single	954	2439 313	17.1
Married	3515	8 214 431	57.5
Separated/divorced	412	900 029	6.3
Widowed	619	1 157 591	8.1
Cohabiting	598	1 573 257	11.0
Maximum level of schooling			
No formal schooling	920	1 938 033	13.6
Below elementary	39	75 393	0.5
Complete elementary	2547	5 771 591	40.4
Complete secondary	1251	3 130 626	21.9
High school/equivalent	824	2 087 331	14.6
College/higher	517	1 281 647	9.0
Occupation			
Government employee	586	1 160 257	8.1
Nongovernment employee	675	1 741 379	12.2
Self-employed	1505	3 571 757	25
Employer	13	13 497	0.1
Voluntary worker	28	73 106	0.5
Does not work	3291	7 724 625	54.1
Ethnic Indian status*			
Not Indian	5739	13 184 642	93.1
Indian	307	975 008	6.9
Physical impairment			
No	5516	12 903 978	90.3
Yes	582	1 380 643	9.7
Religion			
Catholic	5077	11 674 753	91.9
Other	442	1 029 533	8.1
Type of insurance			
Not insured	3700	8 763 230	61.4
Voluntary insurance[†]	63	94 123	0.7
IMSS/ISSSTE	2140	4 813 550	33.7
PEMEX/SEDENA/SEDEMAR	173	576 093	4.0
Private insurance	9	21 619	0.2
Health Self-perception[‡]			
Very good	950	2 490 091	17.4
Good	2312	5 460 613	38.2
Moderate	2314	5 135 364	36.0
Bad and very bad	522	1 198 553	8.4
Chronic disease			
Without diagnosis	5059	11 903 110	83.3
Chronic disease	1039	2 381 511	16.7
Smoking			
Daily	508	1 150 471	8.1
Sometimes	920	2 390 453	16.7
Never	4670	10 743 697	75.2
Residence strata			
Rural	1698	3 181 992	22.3
Urban	1703	3 282 863	23.0
Metropolis	2697	7 819 766	54.7
Municipal marginalization			
Very low	2724	7 864 610	55.1
Low	1348	2 205 042	15.4
Medium	869	1 425 664	10.0
High	974	2 232 750	15.6
Very high	183	556 555	3.9

Table 1. (Continued)

Variables	Summary statistics		
	Mean	Median	SD
Continuous variables (study population)			
Age	43.97	41	16.89
Wealth index	−0.042	0.23	1.38
Municipal marginalization index	0.95	−1.05	0.95

*Indian status was taken from the answer of a proxy-variable: 'What is your mother language?'
†Seguro Popular or IMSS.
‡Health self-perception is assessed in ENED/WHS as: 'How do you rate your health today?'
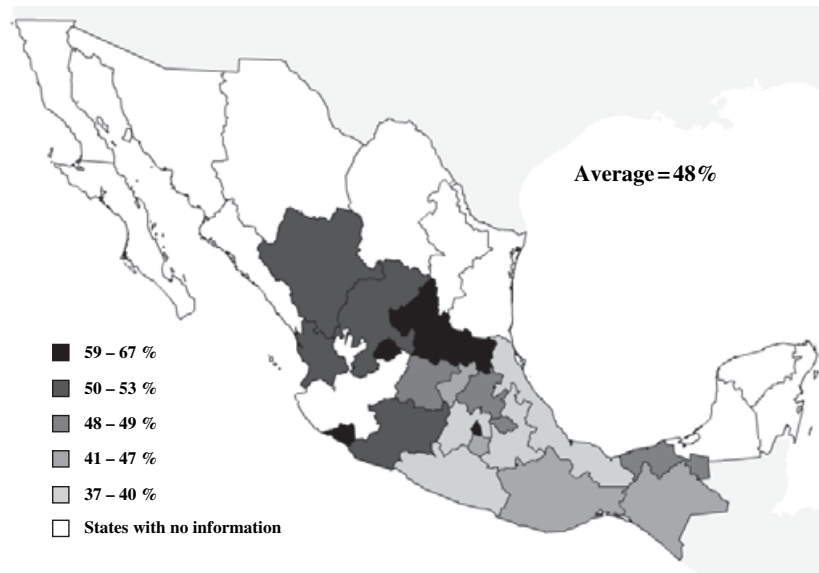

Fig. 1. Dental benefit coverage at the sub-national level.

practical application to the management of health system at the national and sub-national levels. Based on this analysis, a step-down approach can be applied to the evaluation of the health service delivery function at the state level (8). Establishing baseline data on coverage is necessary to monitor progress on the performance of systems. In the short term, the more reliable way to generate the data seems to be through population-based surveys. The medium- and long-term goals, however, should be to strengthen routine health information systems by improving service registries, and effectively combining them with periodic surveys conducted for validation purposes. High-quality population surveys (like WHS) can help in devising methods for adjusting the currently available service data and making the data more useful for management and policy decisions in developing countries (1). According to the WHO, the evaluation should ideally start with the measurement of effective coverage (8). If the level of effective coverage is satisfactory, the evaluation process does not have to go further, but if it is inadequate, an attempt should be made to establish contact coverage. If contact coverage is satisfactory, the factors that prevent users from receiving effective services must be determined. With these results, if a health care manager is not satisfied with the level of coverage in a given locale, he or she may attempt to understand the factors preventing the achievement of a desirable level of effective coverage. Measurement of the different domains of coverage may help in such analysis (8). The key would be comparing the level of goal attainment for the entire population with the level of goal attainment that would be achieved with the best and worst performances of those subsystems. In this sense, the operational challenge will be how to define the best and worst attainable lines for a given subsystem (2).

Table 2 Bivariate relationship between coverage and selected variables of study

Variables	OR	95% CI	P-value
Sex			
Female	1*		
Male	0.836	0.754–0.928	0.001
Age	0.992	0.989–0.995	0.000
Marital status			
With spouse	0.997	0.895–1.109	0.951
Without spouse	1*		
Maximum level of schooling			
None and below elementary	0.258	0.205–0.323	0.000
Complete elementary	0.369	0.301–0.451	0.000
Complete secondary	0.483	0.389–0.599	0.000
High school/equivalent	0.777	0.615–0.981	0.034
College/higher	1*		
Occupation			
Government employee	1.456	1.219–1.740	0.000
Nongovernment employee	1.061	0.899–1.252	0.483
Self-employed/employed	0.751	0.665–0.849	0.000
Voluntary worker/does not work	1*		
Indian ethnic status			
Not Indian	1*		
Indian	0.499	0.391–0.636	0.000
Physical impairment			
No	1*		
Yes	0.739	0.622–0.879	0.001
Medical insurance†			
Not insured	1*		
Insured	1.813	1.634–2.012	0.000
Wealth index	1.457	1.395–1.521	0.000
Chronic disease			
Without diagnosis	1*		
Chronic disease	1.080	0.945–1.235	0.256
Health self-perception			
Very good	1*		
Good	1.263	1.085–1.469	0.003
Moderate	1.084	0.932–1.261	0.295
Bad and very bad	0.713	0.574–0.887	0.002
Residence strata			
Rural	0.546	0.487–0.612	0.000
Urban and metropolis	1*		
Municipal marginalization	0.791	0.749–0.834	0.000

*Reference category.
†Medical insurance includes public and private insurance schemes.

Although the definition of coverage for oral health care services in the present study is not exactly effective coverage as it does not measure health gain – it remains a measure of coverage in that it reflects the presence or absence of therapeutic interventions – this definition lies somewhere between the standard definition of coverage and effective coverage because it considers utilization only for people in need. Furthermore, it assumes as covered only those people who received an effective intervention, such as counseling on dental care and oral hygiene, medication, dental prostheses, surgical and dental work from a trained dental health provider as a quality component. Appropri-ateness and quality of health care provision has not always been considered in the evaluation of coverage because, at the most superficial level of analysis, it is thought to be implicit and consequently its evaluation was usually relegated to a subsequent level of analysis (8). Coverage, as defined in this paper, could be thought of as an estimate of effective coverage and posits that the minimum amount of process and input is insufficient to effectively reach or cover everyone in need (8). The relatively low level of coverage in this study, however, could not be exactly linked to the domain of coverage – availability coverage, accessibility coverage, acceptability coverage, contact

Table 3. Multivariate logistic regression model for dental health care coverage

Variables	ORA	95% CI	P-value
Sex			
Female	1*		
Male	0.995	0.752–0.956	0.007
Age	0.996	0.993–0.999	0.017
Indian ethnic status			
Not Indian	1*		
Indian	1.061	0.757–1.486	0.731
Marital status			
With spouse	1.084	0.965–1.216	0.174
Without spouse	1*		
Occupation			
Government employee	1.015	0.869–1.185	0.851
Nongovernment employee	0.955	0.805–1.132	0.594
Employer/self-employed	0.906	0.777–1.057	0.211
Voluntary worker/not working	1*		
Maximum level of schooling			
None and below than elementary	0.499	0.381–0.656	0.000
Complete elementary	0.580	0.467–0.719	0.000
Complete secondary	0.639	0.500–0.817	0.000
High school/equivalent	0.875	0.700–1.095	0.244
College/higher	1*		
Wealth index	1.309	1.237–1.385	0.000
Medical insurance			
Not insured	1*		
Insured	1.257	1.092–1.447	0.001
Physical impairment			
No	1*		
Yes	0.911	0.734–1.131	0.397
Chronic disease			
Without diagnosis	1*		
Chronic disease	1.161	1.005–1.341	0.043
Residence strata			
Rural	0.991	0.793–1.238	0.935
Urban and metropolitan	1*		
Municipal marginalization	0.994	0.919–1.076	0.888

ORA, odds ratio adjusted by variables contained in the table and health self-perception.
Hosmer and Lemeshow's goodness-of-fit test 0.618.
Pearson $\chi^2 = 0.4058$.
Pseudo $R = 0.0553$.
*Reference category.

coverage, effective coverage – that had the largest impact (1, 3, 8).

An individual's coverage can be modified by several factors. Some of these factors are intrinsic to the health system. Examples are the cost of seeking care, physical proximity to the provider, availability and distribution of medical technology and human resources, insufficient financial resource allocation, and coordination between health subsystems and institutions. Other factors are extrinsic, such as sociodemographic characteristics (e.g., poverty, unemployment, schooling, and income distribution) and public policies. Individuals with similar characteristics likely share similar experiences while seeking care for the same health problem (4, 8). Therefore, by looking at the *ex post* coverage of a group of individuals with shared characteristics, we may theoretically be able to predict the coverage of similar individuals who do not have the health problem currently, but may require a health intervention in the future (4). Such aspect is beyond the scope of this article.

The haphazard directions that we found for some levels of occupation and insurance status suggest that those extrinsic factors are affected by the characteristic lack of stability along socioeconomic spectra in Latin America, thereby making their interpretation more problematic. Unless we unequivocally establish what income level can be ascribed to the various situations aggregated in, for

example, the 'self-employed' category (which may encompass a street vendor pushing a cart, as opposed to an entrepreneur running a store within the formal economy), the role of extrinsic factors will be difficult to accurately identify.

Some methodological caveats apply to the interpretation of these results. We are limited to the domain of self-reported health conditions – oral or otherwise. While some insidious health conditions may not be apparent to the lay public, some reports outside Mexico suggest that validation of perceptions of health status and satisfaction did show promise as an adjunct to other forms of group-level evaluation (30–33). Other predictors of health care services use, such as having medical and/or dental insurance, modify the perceptions of health status and satisfaction. The perceptions of the lay public in terms of need for care do not necessarily lead to making use of available resources (34), as other factors come into play (35). Interestingly, the lay public rate fairly correctly their oral conditions and whether their oral health is poor or not (36). Moreover, it should be noted that the coverage could be overestimated because some people in need of oral health care may not have identified themselves as in need, specially ethnic groups that tend not to perceive health problems, even when they commonly have greater unmet needs. Improvements in the detection of needs should be made in order to better estimate the coverage of dental health care (1).

This study had other limitations that emphasize a cautious interpretation of results. A cross-sectional study measures cause and effect at the same point in time, introducing the problem of temporal ambiguity and the inability to establish causal relationships. In addition, it is necessary to state that there could be a mismatch between the oral health problems that the individual had and the type treatment received (intervention). Furthermore, the accuracy of the multivariable model depends on the quality of the variables and could be limited by the lack or inadequacy of the information. Finally, it is often difficult to confirm true occurrence of interventions by asking questions in a survey, on account of recall bias.

The present study showed that the dental health care coverage in Mexico is currently low, considering that, ideally, 100% of the people in need should have had care services. The level of coverage attainment was different across states, sex and age groups, different wealth levels, schooling profiles, and health/medical insurance, thus high-lighting some equality problems. These results emphasized the necessity of making oral health services accessible to people in need, who frequently are the most vulnerable.

Future studies of coverage should be contrasted with the inputs that systems allocate to the specific programs or interventions evaluated to better interpret and analyze these results. Human and material resources – especially financial resources – should be correlated with the level of attained coverage to determine the best and worst lines of performance at the sub-national level (5). National experiences could be shared to offer feedback to other countries in the region. While there is no evidence on whether the amount of financial resources invested in dental health, or their efficient use, modify the observed level of coverage, in the future we should attempt to determine if the observed impacts are due to the interventions (8).

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