Assessing self-reported oral health status of three Andean indigenous communities in Ecuador

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Abstract
Aims: The aim of this study was to assess how individuals in three rural communities in Ecuador self-rate their oral health status. Materials and Methods: This was a cross-sectional descriptive study that utilized a survey to assess the community awareness of risk factors for oral health. Because fluorosis is an issue that affects these communities, local water systems were tested for excess fluoride. Results: One hundred and eighty-five individuals aged 18 years and older participated in the study. Two-thirds of the participants described the state of their teeth as average or poor and more than half stated that they had sought dental care due to pain and need for treatment during the past year. Age and education had a statistically significant effect on how people described the state of their teeth. Significant associations were found between number of years of education and age and number of natural teeth the participants had ($r_g = 0.43, n = 177, P \leq 0.001$; $r_g = -0.53, n = 178, P \leq 0.001$). Likewise, significant associations were found between number of years of education and age and how participants described the state of their teeth ($r_g = -0.228, n = 177, P \leq 0.001$; $-0.617, n = 177, P < 0.001$). A very high-fluoride level ($4.86 \text{mg/L}$) was found in one of the communities. Conclusions: Social and physical determinants of health seem to have a significant impact on the oral health of rural communities in Ecuador. Lack of regular access to dental care and low levels of education are important barriers for oral health in these communities.

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Introduction
Despite oral disease being preventable, many factors influence and predispose individuals to their becoming affected by it. The WHO defines social determinants of health as “the conditions in which people are born, grow, work, live, and age, and the wider set of forces and systems shaping the conditions of daily life.”[1] The interrelatedness of the determinants of health is such that many negative social and behavioral determinants of health are excellent predictors of other determinants of health. As these determinants are the situations that people are born into, they are typically unevenly distributed. Understanding the characteristics and impact of structural determinants of health such as income, education, gender, the role of the environment (i.e., assessing environmental exposure to fluoride), the role and availability of the dental care delivery system, and the personal characteristics of the population on oral health behaviors are crucial to guide our work and enhance our understanding of the role of social determinants on population health and on health inequalities.[2] This unequal allocation of dental disease presents “even within a single country and the disparities by social standing exist in large part because of differences in diet, fluoride use, and social empowerment.”[3] The greatest global health disparities, including oral health problems, are in poor and developing populations. One study found that there is a distinct relationship between lower social gradients and increasing disparities in oral and general health. As the income and education gradient were lowered, “the prevalence of poorer perceived oral and general health, periodontal disease, and ischemic heart disease was greater.”[4] Poverty is an overarching factor that, when present, is associated with many negative health opportunities and outcomes. In our area of research in Ecuador, a high percentage of rural indigenous population (approximately 62%) is poor. “People living in low economic resource households or indigenous housing and people living in rural areas (many of them having the three characteristics at the same time) had less possibility of using health services.”[5] This is especially pronounced in indigenous populations which overwhelmingly reside outside the urban areas where access to care is greater. Due to simple economics, groups who experience higher levels of poverty have a lesser rate of utilizing dental care.[6]

The availability of dental healthcare systems plays a significant role in oral health in developing nations. When lack of regular access to a dental provider occurs the cumulative effects of dental disease can build up and culminate in significant orofacial pain. Under this level of daily discomfort, the patient seeks relief and if dental care is found that the treatment is usually dental extractions.[2] This in turn can lead to loss of function, missed work days, chronic pain, and malnutrition.

Utilization of health care in developing countries is directly related to some of the social determinants discussed in this section, namely, socioeconomic status, age, gender, level of education, and urban/rural location.[5,7] Guzman-Herreño and Aguadelo found that in Colombia, women were more likely to pay out of pocket for their medical care than men ($P < 0.0001$).[7] López-Cevallos and Chi state “despite health reform efforts in Latin America, drastic socioeconomic inequalities persist across the region, including Ecuador.”[8] The results of this study indicate that income, indigenous ethnicity, and gender were strong predictors for less access to health care, including dental care.
Parent's level of education is a strong predictor of children's caries experience. Both maternal and paternal levels of education are statistically associated with greater rates of decay and levels of childhood obesity.[9] This is likely due to the relationship between poorer eating habits and a lower socioeconomic status.

Risk factors are defined as "any attribute, characteristic or exposure of an individual that increases the likelihood of developing a disease or injury" (WHO 2016). Common risk factors for dental disease are tobacco use (in its many forms), sugar intake, alcohol use, inadequate oral hygiene practices, and overall diet.

Malnutrition is prevalent in poor communities in Ecuador. The World Bank 2007 reported that while almost 1/3 of children under 5 in Ecuador showed signs of stunted growth, indigenous, and rural communities were twice as likely to show nutritional stunting compared to the rest of the country. Malnutrition has a strong association with oral disease. There are several studies that have shown a strong association between malnutrition and early childhood caries.[10],[11]

A study done in five remote villages in Mexico found the caries experience to be exceptionally high. In fact, "multivariable models (in the study) showed age and drinking soda between meals to be significantly associated with decayed, missing, filled surfaces (DMFS), and drinking juice, and being female was significantly associated with DMFS."[12] Another study which utilized the International Caries Detection and Assessment System found the "caries prevalence in the (rural) villages (to be) very high, ranging from 94.7% to 100% of the children studied" and this was linked to the risk factors of "drinking sugared beverages, poor oral hygiene habits, and lack of access to tap water."[13] The frequent ingestion of fermentable carbohydrates is linked to dental caries because of multiple species of bacteria, but most notably Streptococcus mutans. This species is notable as being highly cariogenic, virulent, and the chief bacterium to initiate decay. It has also been proven to be transferred horizontally and vertically.[14]

Exposure to excess fluoride is another concern in the population. While fluoride is a great way to prevent dental caries, overexposure can lead to dental fluorosis (which causes enamel defects and discoloration of the teeth) as well as to other important healthcare issues.[15],[16] Much research has been done in the nation of Brazil in regard to social and behavior determinants of health, but much less in other Latin American nations. Ecuador is one such nation with scant research and study into this important aspect of oral health. It is important to evaluate the relationship between these factors and the populations as they differ in many respects from one nation to another.

A cross-sectional descriptive study in 2015 was performed in Ecuador and three other Latin American countries. The study focused on the application of historical information on the oral health system of the nations. In Ecuador, economic changes led to meetings in 1972 and 1983 in Cuenca, Ecuador that formed groundwork for social medicine to take flight. Juan Cesar Garcia, a sociologist, proposed the right to health based on social determination, but this was at odds with the traditional market dental practices. The Constitution of 2007 later "defines health as a right the state must guarantee, which permits the implementation of the National Health System of Ecuador with the comprehensive intercultural, family, and community healthcare model."[17] The study found that Ecuador's distribution of dentists and resources was currently unevenly distributed, with most keeping to urban areas. This was at odds with the "increasing unemployment of dentists" in the country.[17] The study also recommended further research into epidemiological profiles and group determinants of health for groups in Ecuador in line with group risks of oral disease.

A study done in Chile indicated a strong correlation between gender and tooth loss. Tooth loss in this study was used to demonstrate the unfortunate negative results of dental disease. The same study also showed a gradient increasing in number of teeth lost to patient's decreasing social and educational standing among adolescents.[18] Another study surveyed nearly 10,000 Chilean high-school students and found a significant association between socioeconomic status and periodontal disease, another source of dental concern. [19] Many of these same social determinants are strongly related to frequency of dental visits. Any behaviors or determinants that predispose patients to avoid or be unable to visit dental health providers will essentially be tied to worse dental health. With indigenous communities, these factors can even be more pronounced and need further investigation.

The purpose of this study was to assess how some of these social determinants of health impact the way people in rural communities self-rate their oral health status.

**Materials and Methods**

This was a cross-sectional descriptive study that utilized the Oral Health Assessment on Oral Health and Risk Factors in Adults survey developed by the WHO to assess the community awareness of risk factors for oral disease.[20] The length of the study since inception until presentation of the results was approximately 1 year. Contact with the communities' leadership started in the spring of 2016. Nonprobability consecutive sampling method was used to recruit the participants who meet the inclusion criteria as they become available. Participants were included in the study if they were 18 years old or older and were considered residents of the communities where the study took place. Recruitment of the participants was done through coordination with the health centers and contact with the community leaders. The survey was administered by researchers and students from four universities in Ecuador in group settings, usually in schools or community centers. Since most of the adults are partially or totally illiterate, the informed consent and the survey were read to the participants.

The data collection was supervised by trained personnel (authors) and took place during the summer of 2016. The questionnaire in Spanish was slightly adapted to make it suitable for the local communities [Appendix I] [SUPPORTING:1]. For example, one of the specific sweets consumed by these communities were added to the questions. A pilot study was performed on a sample of patients attending the University of San Francisco de Quito (USFQ) dental clinic, and the relevant and needed amendments were included in the final questionnaires.

Because fluorosis is an issue that affects these communities, we tested the local water systems for excess fluoride. Fluoride testing was conducted by researchers from USFQ. Based on CDC's recommendations, four samples should be collected, a minimum of 1 week apart, and the results compared. If one sample was above 4 mg/L and the other samples were n = 18) of these participants were female. Over 1/3 of the participants (n = 78) had not seen the dentist within the last year. One hundred and forty-eight participants (80%) had 20 teeth or more; 15% of the participants (n = 28) had 1–19 teeth. Among those without teeth (n = 7), the majority were over 70 years old and female (66.7%). More than half of the participants (n = 125) described the state of their teeth and gums as average or poor and more than half (n = 100) stated that they had felt oral pain or discomfort during last year [Figure 1].

Five percent of the participants had never received dental care in their lives. More than half of the participants reported that they only sought dental care because of pain or need for treatment (i.e. extractions) during the past year. One-fourth of the participants reported brushing their teeth once a day or less frequently. Six percent of the participants reported that they smoke and 22% reported that they drink alcohol on a regular basis. The majority of the participants (92%) had never used dental floss. The participants' diet was high in sugars and fermentable carbohydrates [Table 1].

The distance between the communities and the closest health-care center ranged from 2 to 10 miles.

Significant associations were found between the number of years of education and age and number of natural teeth the participants had (rs = 0.43, n = 177, P ≤ 0.001; rs = −0.53, n = 178, P ≤ 0.001). Likewise, significant associations were found between number of years of education and age and how participants described the state of their teeth (rs = −0.228, n = 177, P ≤ 0.001; rs = −0.53, n = 178, P ≤ 0.001).

Individuals with only elementary education (kindergarten to sixth grade) were more likely to have fewer than 20 teeth (28%) than those who had more than 6 years of education (7%) and to report having poor dental health in the last year (67%). Individuals who reported having difficulty biting food, those who reported having dental pain or discomfort during the past 12 months, and individuals with more than 20 teeth were more likely to report poor dental health than their counterparts (P ≤ 0.05) [Table 2].
Discussion

This study is the first of its kind in Ecuador and contributes to the understanding of how social determinants of health such as age, education, and access to health care may contribute to how individuals self-assess their oral health status in three rural indigenous communities in Ecuador. The results of this survey showed that the level of education in these communities was very low with women being less likely than men to receive formal education. The literature has shown that lower educational levels and gender differences are associated with a lack of knowledge and poor preventive practices related to oral health. Furthermore, studies have shown that women are more likely to perceive that poor oral health impacts their lives than men.[21],[22] The literature has shown a direct association between educational level, oral health, and oral hygiene habits with positive correlations between number of years of education and the number of natural teeth the participants had, which attests to the impact of this important social determinant of health and oral health outcomes.[23],[24] We found poor prevention practices in these communities. Dental visits were only sought in response to pain and need for treatment. A good proportion of the participants reported not having seen a dentist within the last year. This could be the result of the lack of continuous dental care provided at the healthcare centers. We also found a diet high in sugars and carbohydrates. It is known that individuals in rural communities tend to exchange or sell animals, eggs, and other sources of protein for sugars, pasta, bread, and rice which may explain the high consumption of these products among these three communities.

The majority of the individuals in these communities reported they do not smoke or drink. This may be due to the reluctance to self-report a behavior, they consider unacceptable or because most of these communities have been exposed to certain religious practices that may condemn these risky behaviors. This may also be the result of awareness of tobacco and alcohol use as a risk factor for oral cancer, and increase in the prices and taxes which play a role in achieving behavioral changes.

The great distances between the communities being served and the health centers in the absence of reliable transportation constitutes a significant barrier to access to dental care. Control of oral disease depends on availability and accessibility to oral health providers and a medical team. The goal for every patient should be to have a dental home, where the doctor knows the patient and the patient is comfortable with and knows their health provider team. This goal can be realized if inequalities in access to care are corrected.

Prevention is a key, but it has been approached incorrectly for a long time. The notion that increased knowledge will prevent unhealthy behaviors and encourage healthy ones does not always hold true. People are complex and their decision-making is not so simple. Systematic reviews show that behavioral modification is complex and suggests the need to develop effective approaches that can help individuals change their behaviors.[25],[26] There is evidence that traditional approaches to oral health education based on information received and provider counseling and advice are largely ineffective. The literature suggests that for individuals to change their behaviors, they need to learn how to integrate new skills and knowledge into their daily routine. Watt (2005) proposes a more comprehensive approach in oral disease prevention and health promotion that includes strengthening healthcare systems (i.e. policy development, organizational change, and legislation), involving influential community partners (i.e. priests and/or pastors, teachers, community leaders) and reorienting the provision of services so that primary care providers and dental providers work together to provide holistic care and promote comprehensive strategies that address the broader social determinants of oral health.[27] The results of this study suggest the need to develop an effective model for oral health promotion that incorporates effective models for chairside oral health promotion to promote behavioral change strategies such as oral hygiene practices, decrease in amount, and frequency of consumption of sugar and fermentable carbohydrates as well as reinforce strategies for tobacco use prevention and excessive alcohol consumption.

One of the controversies raised by this study is the fact that the levels of fluorosis in one of the community's water systems is very high, which has the community highly concerned. The systemic and topical beneficial effect of fluoride has been well documented as a caries prevention strategy, yet exposure to high levels of fluoride in the water can cause enamel fluorosis with highly disfiguring brown and black staining of the teeth which can have a significant psychological impact, embarrassment, and social stigma, particularly among children and adolescents. A multidisciplinary approach involving researchers, policy makers, and community leaders will be needed to address this issue.

This study was limited by several factors. This study utilized cross-sectional data, and therefore, causality cannot be inferred. Data were self-reported; therefore, they may be subject to recall and information (social desirability) bias. The sample used in this study was one of convenience; thus, the results of the study cannot be generalized as participation in this study was restricted to those living in these three rural communities in Ecuador.

Conclusion

Our findings shed light on the association between social and physical determinants of health and the way oral health was perceived by individuals in three rural communities in Ecuador as well as on the lack of access to dental care and prevention strategies related to oral health in indigenous communities. We hope that the findings of this study enhance the understanding of inequities in public health dentistry in Ecuador and suggest areas that can be addressed through the implementation of health promotion policies that focus on the underlying social, economic, and environmental causes of dental disease. Our findings illuminate areas for further research. Further qualitative research is needed to generate relevant social information that will enhance the understanding on values, beliefs, and cultural perceptions pertaining to oral health to design effective and culturally appropriate educational programs. Finally, in light of proven evidence for innovative approaches for health promotion and behavior change, this study reinforces the need for research on the impact of interventions that address underlying social determinants of oral health to alter participant's behaviors related to oral health.

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Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.
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