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Assessing the oral health status of three indigenous communities in Ecuador

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## Abstract

**Purpose:** To assess the impact of social determinants of health such as diet/nutrition, tobacco use and alcohol consumption, education level, oral hygiene practices, environmental exposure to fluoride, and availability of oral health services on oral health in three rural communities in Ecuador. **Methods:** This will be a cross-sectional descriptive study that will utilize a survey to assess the community awareness of risk factors for oral health. Approximately 140 individuals 18 years and older will participate in the study. Non-probability consecutive sampling method will be used to recruit the participants who meet the inclusion criteria as they become available. In addition to collecting data about risk factors and behaviors related to oral health, in these communities, we plan to conduct a brief Caries Risk Indicator/Clinical examination of approximately 200 school age children (7-12 years) in order to assess: a) obvious white spots, decalcification, obvious decay, and presence of fluorosis; b) restorations placed in the last 2 years; c) obvious presence of plaque on the teeth and bleeding gums; and d) absence of permanent teeth. Because fluorosis is an issue that affects these communities, we plan to test the local water for excess fluoride. This research project will be coordinated with staff from the University of San Francisco in Quito-Ecuador (SFQU). Dentists and dental hygienists attending a class at the SFQU will participate in the project. **Discussion:** By conducting research about oral health issues in a developing country such as Ecuador, we hope to show the disparities that exist in the oral health status among subgroups (i.e. rural vs urban) as well as the impact of lack of access to oral health care and education on oral health outcomes.

### **Statement of the problem**

Although oral health is a preventable disease, it affects a good portion of vulnerable populations such as the elderly, children, low income individuals and certain racial and ethnic groups. Early childhood caries remains the most prevalent chronic childhood condition worldwide and periodontal disease is the most common cause of tooth loss among adults. Indeed, according to the World Health Organization or WHO (2012) worldwide 60-90% of school children and nearly 100% of adults have dental cavities, and severe periodontal disease is found in 15-20% adults between the ages of 33-44 years. Common risk factors for oral diseases include an unhealthy diet, tobacco and alcohol use, poor oral hygiene and lack of access to health care.

### **Purpose of the study**

The purpose of this study is to assess the level of awareness of three indigenous rural communities in Ecuador (Tingo- Pucara, Salasaca, and Tumbaco) about the risk factors for oral disease and the impact of the social determinants of health such as diet/nutrition, tobacco use and alcohol consumption, education level, oral hygiene practices, environmental exposure to fluoride, and availability of oral health services on the oral health of these communities. These communities are isolated and deprived of most of the basic services. They all lack access to public water and it is believed that there is an extremely high fluoride concentration in the water causing dental fluorosis in lifelong residents (Petersen, et al., 2005). Through an epidemiologic assessment of the oral health status and prevalence of risk factors of the community and a basic clinical oral health assessment of a sample of school age children, we expect to provide a picture of the oral health effects of socio-behavioral factors of the communities for future planning community-oriented oral disease prevention and oral health promotion programs.

The three communities involved include (data for these communities was provided by researchers from the University of San Francisco de Quito):

Guangaje, it is 3700 meters above sea level and has two communities we will conduct assessments in: Tingo Pucará (+/-20 families) and Curingue (-/+40 families). There are approximately 100 children (5 members per family) total and the communities experience a 100% poverty level where 35% are living in extreme poverty. This community is two hours away from the capital of Quito with poor access roads and no public water. Guangaje is three kilometers from the nearest health center and the spoken language is Quecha (indigenous dialect). The second community is Salasaca, which is 2600 meters above sea level, the community of Wamanloma is found here with (+/- 80 families) with approximately 100 children (5 members per family). Salasaca is more developed than the previous community of Guangaje because the town has a small textile industry. They experience an 80% poverty level. The community is two hours away from the capital of Quito with better access roads. The nearest health center is three kilometers away. It is important to note that the water has been shown by testing to have 3.7 ppm of fluoride and we are concerned about fluorosis in this community. The final community we will evaluate is Valle de Tumbaco, at 2400 meters above the sea level. There are two communities here, Tumbaco and Lumbisí, both of which are very close to the capital at only 20 minutes away. Tumbaco has approximately 200 families at (5 members per family). This is a mixed race community (Mestizos) who live at 20% of poverty level. The community has access to water and has experienced some cases of fluorosis because of excess of fluoride in the natural water. Lumbisí has approximately 500 families (5 members per family) who live at 30% of poverty level. Both of these communities have a health center and schools.

They also experience the closest access to treatment and preventative care compared to the other communities.

In addition to collecting data about risk factors and behaviors related to oral health, in these communities, we plan to conduct a brief Caries Risk Indicator/Clinical examination of school age children (7-12 years) in order to assess: a) obvious white spots, decalcification, obvious decay, and presence of fluorosis; b) restorations placed in the last 2 years; c) obvious presence of plaque on the teeth and bleeding gums; and d) absence of permanent teeth. Because fluorosis is an issue that affects these communities, we plan to test the local water for excess fluoride.

This oral health assessment will be the first of its kind conducted in these communities and we hope that it will provide the baseline for future studies. This research project will be coordinated with staff from the University of San Francisco in Quito-Ecuador (SFQU). Dentists and dental hygienists attending a class at the SFQU will participate in the project.

### **Definition of Terms**

**Risk factors:** A risk factor is any attribute, characteristic or exposure of an individual that increases the likelihood of developing a disease or injury. (WHO, 2015)

**Social Determinants:** The social determinants of health are the conditions in which people are born, grow, live, work and age (WHO, 2015).

**Periodontal Disease:** Periodontal disease is an inflammatory disease that affects the soft and hard structures that support the teeth. In its early stage, called gingivitis, the gums become swollen and red due to inflammation, which is the body's natural response to the presence of harmful bacteria. In the more serious form of periodontal disease called periodontitis, the gums

pull away from the tooth and supporting gum tissues are destroyed. Bone can be lost, and the teeth may loosen or eventually fall out. (American Academy of Periodontology, 2015)

### **Conceptual framework**

There are several frameworks for understanding social determinants of health. The conceptual framework that will be used in this research study is the “Conceptual framework for assessing the impact of social determinants of oral health on rural communities” which is based on a health systems perspective (WHO, 2010). 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 is crucial to guide our work and enhance our understanding of the role of social determinants on population health and on health inequalities (FDI World Dental Federation, 2015).

This framework highlights the role of health behaviors (oral hygiene practice, the role of diet, tobacco and alcohol consumption, and dental services utilization) as intermediate dependent variables, which in turn influence oral health outcomes (oral health status and community knowledge, as well as, attitudes and practices about oral health).

By focusing on this risk-factor approach to promotion of oral health we hope to be able to collect meaningful data that shows the oral health status and prevalence of risk factors in these three communities in Ecuador. This information should be useful for surveillance of disease patterns, self-assessment of oral health and common risk factors, and understanding of oral health trends over time.

### **Literature Review**

While many noncommunicable diseases (NCDs), like cardiovascular disease and diabetes, take precedence over oral health diseases today, there has been much research to show that it is and should be of major public health concern. Oral health conditions are preventable, yet early childhood caries remains the most prevalent chronic childhood condition worldwide and periodontal disease is the most common cause of tooth loss among adults. According to FDI World Dental Federation in their *Oral Health Atlas* publication (2015), “more than 4 billion people worldwide suffer from oral diseases, generating an enormous health and economic burden”. According to the WHO (2012), 60-90% of school children and nearly 100% of adults have dental cavities, and severe periodontal disease is found in 15-20% adults between the ages of 33-44 years. These statistics are staggering when, as stated previously, these diseases are completely preventable if the proper education and tools are presented to the public. Risk factors associated with poor oral health, include: income, education, diet, tobacco and alcohol use, role and availability of dental care systems, oral hygiene practices, and exposure to fluoride.

The greatest health disparities, including oral health problems, found globally are in poor and developing populations. In the study *Social Gradients in Oral and General Health* conducted by Sabbah, Tsakos, Chandola, Sheiham, and Watt (2007), it was found that there is a distinct relationship between lower social gradients and increasing disparities in oral and general health. They found that as the income and education gradient was lowered, “the prevalence of poorer perceived oral and general health, periodontal disease, and ischemic heart disease was greater” (Sabbah, et. al., 2007). The availability of dental healthcare systems plays a significant role in oral health in developing nations. Lack of access to preventative care and treatment is a major issue, if an individual is able to find treatment, more attention is paid to extraction of the

decaying teeth than restorative or preventative interventions (FDI, 2015). This in turn can lead to increasing missed work days, chronic pain, and even malnutrition.

Malnutrition is prevalent in many poor communities and is related to oral disease. The article Nutrition and Oral Health in the *Journal of Postgraduate Medicine* by Ehizele, Ojehanon, and Akhionbare (2009), found that “it affects the development of the oral cavity and the progression of the oral diseases through an altered tissue homeostasis, a reduced resistance to the microbial biofilms and a reduced tissue repair capacity”. Therefore, diets of the populations must be taken into account, whether it be lack of nutrition or over indulgence in foods high in sugar (known to cause dental caries) and fats. Additionally, widespread alcohol and tobacco consumption increases the risk of oral cancer by 15 times and tobacco use negatively impacts 50 percent of periodontal disease in the population (FDI, 2015). 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 (Petersen, et al., 2005).

We believe that all of the previously discussed risk factors may affect the populations in the rural communities of Ecuador we plan to study. We plan to document and study these issues, so that we can provide a picture of the effects of socio-behavioral factors on the oral health of the communities for future planning of community-oriented oral disease prevention and oral health promotion programs.

### **Objectives and Methodology**

Specific objectives for this study include: a) assessing the communities oral health knowledge, attitudes and behaviors regarding oral health; b) determining risk factors (low, moderate and high) for caries among children; c) measuring fluoride concentrations in the water following CDC

guidelines for testing; d) fostering collaboration and partnerships between the communities and the entities involved in the study in order to promote community capacity building and sustainability; e) exploring further collaboration with the SFQU school of dentistry for follow-up studies and educational activities.

This will be a cross-sectional descriptive study that will utilize the Oral Health Assessment on Oral Health and Risk Factors in Adults survey developed by WHO (2013) to assess the community awareness of risk factors for oral disease. Approximately 140 individuals 18 years and older will participate in the study. A non-probability consecutive sampling method will be used to recruit the participants who meet the inclusion criteria as they become available. In addition to collecting data about risk factors and behaviors related to oral disease in these communities, we plan to use a modified American Dental Association (ADA) Caries Risk Assessment Form (Age>6) (CAMBRA) with approximately 200 school age children (7-12 years) in order to assess: a) risk factors; b) protective factors; and c) oral disease indicators for caries. Because fluorosis is an issue that affects these communities, we plan to test the local water for excess fluoride. Recruitment of the participants will be done through coordination with the health centers and contact with the community leaders. The survey will be administered by the primary investigator, researchers and students from SFQU in a group setting such as a school or a church or by home visitation . The majority of the population in rural areas is partially or totally illiterate; therefore, the informed consent and the survey will be read to the participants. The children's surveys, including a brief oral examination will be conducted by the primary investigator and dental students from SFQU in a community location selected by the community leaders. Each exam should take less than 5 minutes and will not require special accommodations. Respondents will be asked to sign informed consent forms to participate in the study and to allow the children to receive an oral exam. To ensure the

principle of beneficence is met, important consideration will be given to making children comfortable when receiving the oral exam which is totally non-invasive. An age appropriate explanation of what will happen during the oral exam will be given to each child that participates. In order to minimize apprehension from the children, in addition to the parents' consent we will require an oral consent from the child. Even when the parents have agreed and provided consent, if the child does not want to receive the oral exam, he/she will be excused.

Fluoride testing will be conducted by researchers from University of San Francisco de Quito. The CDC (2015) recommends at least four samples should be collected, a minimum of one week apart, and the results compared. If one sample is above 4 mg/L and the other samples are less than 4 mg/L, then the lesser value may be accepted.

The data will be analyzed using SPSS software (version 22). Univariate analysis including distribution, measures of central tendency and dispersion will be conducted on interval/ratio variables. Chi-square test for independence and logistic regression analysis will be used to examine associations between the proximity to dental healthcare programs and staff and knowledge about oral health risk factors. Odds ratios and confidence intervals will be calculated.

Data from the oral examinations given to school children will be charted in dental records and left at the health department for prevention and treatment follow-up. A summary of the findings will be compiled and the results will be shared with the authorities and community leaders. Data from the fluoride tests will be reported to the local health authorities for further action.

### **Protection of Human Rights**

This study will be submitted for approval by the Bioethics Committee at the University of San Francisco. The approval letter will be shared with the UWF IRB for internal approval (The

primary investigation has already discussed this issue with the UWF IRB director). The anonymity and privacy of those who will participate in this study will be protected by not having names identified on the instruments and interview data. The study will be conducted in a culturally sensitive manner and informed consent will be collected from the participants as well as from the community leaders.

### Timeline

The study will take place during the first or second week in June 2016 (as the school year will end at the end of June) and after we have received IRB approval from the University of San Francisco and UWF. A week before the study start we will train the surveyors on how to conduct the survey.

### Budget Narrative

<b>Budget</b>			
<b>Expense</b>	<b>Details</b>	<b>Cost</b>	
Flight	Delta flight to Quito, Ecuador (UIO) from Pensacola, Florida departing June 2016 and returning July 2016	1 ticket	\$1,200.00
Overweight Luggage	\$200.00 extra in airline fees to carry supplies in overweight luggage	\$200.00 x 1	\$200.00
Instruments	Extech FL700 Fluoride Meter for all 3 communities	\$209.00 x3	\$627.00
Transportation	Bus transportation for length of study and food for the primary investigator and 3 surveyors	\$25.00 per day per 10 days x 4 people	\$1,000.00
Dental Supplies	Gloves and oral mirror sets	200	\$623.00
Participation Incentives	Provide each participant with \$5.00 each	270 x \$5.00	\$1,350.00
<b>TOTAL</b>			<b>\$5,000.00</b>

The travel period for this study will be June – July 2016, a Delta airline flight will be procured from Pensacola International Airport (PNS) in Pensacola, Florida to Quito, Ecuador

(UIO); the estimated ticket price is \$1,200.00. The extra funds of \$200.00 will be necessary for an overweight luggage fee, the luggage will carry supplies needed for the study. The Extech FL700 Fluoride Meter will be used to test the fluoride levels in the drinking water of the three communities, we believe that there is an excess of fluoride (more than 2mg/L) that is causing dental fluorosis particularly among children. Transportation funds will be used for travel to and from communities via bus for the length of the study, this cost also includes food for the primary investigator and 3 surveyors. We will provide toothbrushes and toothpastes to the children after their clinical exam is completed. These supplies have been donated by Colgate. We plan to use this as an opportunity to educate the children on how to effectively brush their teeth. We are also considering giving a \$5.00 incentive to each person who participates in the survey, to promote active participation throughout the communities.

### **Discussion**

The final outcome of this research study is publication of the findings, which not only will contribute to the primary investigation's research agenda, but will also enhance the understanding of health disparities and inequities in public health dentistry in the developing world. The findings of this study should help communities develop models to address some of the risk factors related to oral disease which can be used to improve oral health in other communities; therefore, promoting community development and sustainability. We believe that this study not only will add value to UWF, but the Department of Health, particularly the MPH program, will benefit significantly from it. The MPH program is interested in expanding its global public health connections and outreach to other regions of the world. We believe that partnering with the University of San Francisco de Quito will open the doors for student and

instructor exchange, student recruitment, as well as the possibility to conduct further research in Ecuador.

***Significant advances in the field and future research opportunities***

The findings generated by the community needs assessment will identify and direct what further action is needed. Conversations have started with SFQU School of Dentistry to provide education to the communities in order to increase their awareness about risk factors that affect oral health. The oral examinations conducted among children will also serve as a baseline for longitudinal studies that could be a source of future external funding. The results of the oral examinations will be shared with the community health centers for follow-up care. The education provided to parents and children during the clinical exams (as part of anticipatory guidance - CAMBRA) and later reinforced by USFQ dental students will modify some of the current practices and will improve the oral health status of the children. In the future we would like to measure changes in behavior due to the intervention.

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## **EDUCATION**

**NOVA Southeastern University,**  
Fort Lauderdale, Florida  
Degree: Doctor in Health Sciences. 2007-2010  
60 Semester Hours  
**Major: Global Health.**

**University of Kansas Medical Center.**  
Kansas City, Kansas US  
Degree: Master in Public Health, 1994-1996 (Conferred with honors).  
36 Semester Hours  
**Major: Epidemiology**

**Central University of Quito, Ecuador.**  
Degree: Doctor in Dental Surgery, 1975-1980

**CDC. Distance Learning Program.** Public Health Practice Program Office: Self-Instructional Course in Principles of Epidemiology (1998)

**University of Oklahoma. Health Agency Training**  
Certified Instructor for Introduction to Basic Epidemiology  
(2000)

**Quality Matters (QM) Peer Review Process**  
Certified Quality Matters Peer Reviewer for online courses  
(2012)

## **GRANTS AWARDED**

HRSA (\$650,000). Co-writer for the PCA main grant. Purpose: To provide training, technical assistance and support to new and existing Health Center Program grantees and look-alikes in Kansas.

HRSA (\$500,000). Co-writer for the SEARCH grant. Purpose: To place medical and dental students in rotations at the Kansas safety net clinics.

Corporation for National Community Health Service (\$200,000). Purpose: To place 15 AmeriCorps members at the safety net clinics to act as "bridges" between the clinics and the communities. The AmeriCorps members were trained to be case managers and support diabetes,

cardiovascular and oral health programs.

United Methodist Health Ministry Foundation (\$50,000 per year). Purpose: To provide training opportunities for clinicians working at the safety net clinics. Approximately 15-20 healthcare providers received clinical and management training every year.

Susan G. Komen Foundation (\$30,000 per year). Purpose: To train AmeriCorps members to be case managers, promote screening mammograms and pap smears for women 50 and over and do yearly follow up appointments. The AmeriCorps members were able to work directly with the Kansas Breast and Cervical program in order to better serve the women.

Kansas Department of Health and Environment (\$15,000 per year). Purpose: To implement the diabetes collaborative in at least 10 safety net clinics. The goal of the diabetes collaborative was to improve the quality, delivery and use of clinical and other preventive services to address prevention and management of hypertension and diabetes.

Kansas Department of Health and Environment (\$70,000 per year). Purpose: To develop an emergency preparedness plan for each of the clinics that included mitigation and preparedness, response and recovery activities.

Kansas Sunflower Foundation (\$100,00 per year). Purpose: To hire and place a nurse and a behavioral health consultant for the Heartland Community Health Center.

Kansas Volunteer Commission (\$100,000 per year). To place 10 AmeriCorps members at the Heartland Community Health Center.

## PROFESSIONAL PUBLICATIONS

Dischler, T., Alexander, J., **Curtis, D.**, and Markson, M. (2013). Improving inter-professional communication among medical and dental providers treating Bisphosphonate therapy patients may reduce the risk of osteonecrosis of the jaw. *Universal Journal of Clinical Medicine*, 2(2); pp. 35-42. DOI: 10.13189/ujcm.2014.020201

Falen, T., Alexander, J.L., **Curtis, D.**, & Unruh, L. (2013). Developing a hospital-specific electronic inpatient fall surveillance program: phase I. *Health Care Manager*, 32(4), 359-36

Glavaz, J., Alexander, J.L., **Curtis, D.**, & Eskes, C. (2014). Physician assistant Program directors' attitudes, practices, and plans regarding financial compensation to clinical sites. *Journal of Physician Assistant Education*, 25(4), 12-20.

Jones, B., Alexander, J., **Curtis, D** and Easterling, L. (2015). Comparison of Hospitalist Physicians' Religion and Spirituality to Other Physician Specialties. *Journal of Non-Significant Differences*

Kupferer, K.M., Bush, M., Cornell, J.E., Lawrence, V.A., Alexander J., Ramos, R.G. and **Curtis, D.** (2014). Femoral neck stress fracture in Air Force basic trainees. *Military Medicine* 178(1), 56-61

Saunders, M., **Curtis, D.**, Alexander, J., and Williams, E.(2013). Can Christian divorce support groups influence forgiveness and health outcomes in black divorcees? A phenomenological investigation. *Journal of Divorce and Remarriage*, 54(7). DOI:10.1080/10502556.2013.828985

Curtis D. *Evaluation of Community Health Assessment in Kansas* .Journal of Public Health Management. June, 2002.

## BOOKS/MANUALS/MATERIALS AUTHORED

Operation Manual for Health Center Oral Health Programs. Chapter Six. National Network of Oral Health Access (2012). NNOHA's Practice Management Committee and Quality Workgroup member and contributor (<http://www.nnoha.org/practicemanagement/manual.html>).

Pickard S., **Curtis D.**, Tasheff J. 2000. *Selected Topics in Women's Health and Review of Community Approaches to Intervention.*

Curtis D., Pickard S. 2000. *Healthy Kansans 2000. Mid-Course Review.*

Curtis D., Pickard S. 2000. *Outcomes of Community Health Assessment.*

Curtis D., Pickard S., Hunt C., Thompson B. 2001. *Health Risk Behaviors of Kansans 1998*

## PRESENTATIONS

- *Public Health Surveillance Systems.* Presented at a public health symposium at Universidad San Francisco de Quito-Ecuador. June 22, 2015
- *Differences in Healthy Days among US,-and Foreign Born Hispanics in Kansas.* Paper presented at the 15<sup>th</sup> National Conference on Chronic Disease Prevention and Control. November 29-December 1, 2000. Washington D.C.
- *Cultural Competence: The patient, the culture and the clinical encounter.* The Midwest/Northeast Cluster Senior Leadership Meeting. Cincinnati, Ohio, 2004
- 18 presentations/trainings on Basic Epidemiology, Outbreak Investigation, and Public Health Surveillance. Kansas, 2003-2004
- *Self-management goals for diabetes. Tips and tools.* Topeka, Kansas, 2004
- *Why do Clinical Measures Matter?* KAMU annual conference. Wichita, Kansas, 2006
- *Data gathering and analysis for community needs assessment.* On line class taught at the Community Health Center Executive online program offered by the University of Kansas Medical Center's Health Policy and Management Department in July, 2008
- *Health Literacy and the Rural Patient.* Greeley County Wellness Conference. Tribune, Kansas, October 2008.
- *How to Develop a Tabletop Exercise.* Primary Care Association Emergency Preparedness Learning Teams meeting. Chicago. October, 2008.
- *Cultural Competence in Health Care.* Heartland Community Health Center. May, 2012

## POSTER PRESENTATIONS

Anidi, L. and **Curtis, D.** November, 2015. Effect of Performing WARM-up and Cool-DOWN Exercises on the Flexibility of the Calf and Hamstring prior to a 50 Minute Workout. Poster presented at the American Public Health Association Conference, Chicago, IL.

Carbonell, I., **Curtis, D.**, Alexander, J., Brocato, R. Healthcare practitioners' TB screening practice preferences. April 2015. Poster presented at Society of Army Physician Assistants Conference, Fayetteville, NC

## UNIVERSITY TEACHING

Shoubaki, L. and **Curtis, D.** Basics of EpiInfo 7. April 2015. Presentation/training to Escambia County Local Health Department staff. Advisor. Internship

**PROFESSIONAL NOMINATIONS**

Secretary of the APHA Oral Health Section (2015-2018)