



SCHOOL OF DENTISTRY

INDIANA UNIVERSITY
IUPUI

Promotion and Tenure Documents for External Review

Karen M. Yoder

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Karen M. Yoder, MSD, PhD
Associate Professor and Director, Division of Community Dentistry
Department of Preventive and Community Dentistry
Indiana University School of Dentistry
June 18, 2007

Candidate's Personal Statement

This statement, together with other components of my dossier, is intended to (1) provide evidence of excellence in community engaged service; (2) show that community engaged scholarship has informed and directed my activities in teaching and research, and (3) document the impact the work has had on the academic and public health communities.

“**Scholarship** is teaching, discovery, integration, application and engagement; clear goals, adequate preparation, appropriate methods, significant results, effective presentation, and reflective critique that is rigorous and peer-reviewed.”

“**Community-engaged scholarship** is scholarship that involves the faculty member in a mutually beneficial partnership with the community.”

*Linking Scholarship and Communities: The Report of the
Commission on Community-Engaged Scholarship in the Health Professions*

“The **scholarship of engagement** means connecting the rich resources of the university to our most pressing social, civic and ethical problems, to our children, to our schools, to our teachers and to our cities...”

Ernest Boyer in *The Scholarship of Engagement*

My career took a non-traditional path. I accrued many years of experience in private practice and public health prior to completing an MSD in dental public health and a PhD in dental science with a minor in health policy and becoming a full-time faculty member at Indiana University School of Dentistry. Career experiences led to a desire to learn the theoretical underpinnings of these disciplines and allowed me to enter graduate work with a depth of understanding of many practical aspects of the subjects that I now teach and research. In this statement, I am using broad brush strokes to paint a picture of the progression of the path, the underlying themes, and the outcomes.

My dental public health work in higher education can be characterized by emphasis on three major components

1. Service learning as a pedagogy and community engaged scholarship as an integral component for teaching dental students dental public health, civic responsibility, health policy advocacy, and cultural respect.
2. Improving equity in access to oral health services at all stages of life, but especially for children

3. The appropriate use of fluoride for prevention of dental caries in communities and for individuals

In this statement, my pertinent history is divided into four categories: (1) relevant early history, (2) international public health experience, (3) Indiana public health experience, (4) Academic role at IUSD.

Relevant early history: I am including this section because it had a profound impact on choices and the direction of my scholarly activities. A dentist who would become my first and most significant mentor offered me a job as a part-time dental assistant while I was still in high school. That opportunity was a pivotal life event, not only because it introduced me to dentistry, but because it introduced me to a philosophy of providing health care that has guided my professional and academic life. Dr. Ralph Schimmele was the kind of dentist who sat on the cabinet top in the operatory and sang while he was waiting for the anesthetic to make the tooth numb. When he knew a family was having financial difficulties, there was no bill for his services. His career path ultimately resulted in becoming associate dean at IUSD where he directed the establishment of the four regional campus dental hygiene programs and developed the IUSD extramural program for dental students. His humanistic philosophy followed him to academia. He worked closely with the Chancellor and Dean, but he not only knew the names of all of the maintenance workers at IUSD and the regional campuses...he also knew their children's names and often inquired about them. By his example he taught me important goals for dental professionals and the value of being able to relate to people in all walks of life—an invaluable attribute in public health

When Dr. Schimmele suggested that I apply for the dental hygiene program, I agreed immediately. During my second year of the program, the bachelor degree in public health dental hygiene was created at IUSD. I decided to enroll, not because I anticipated a career in public health...I was dating a dental student and didn't want to leave Indianapolis. Forty-three years later that proved to be a good investment of time—and it also opened a door that wasn't entered until ten years later.

International Public Health Experience

After ten years of private practice in a small town in northern Indiana, my husband and I and our four children moved to East Africa to provide dental services at a referral hospital in Tanzania. We worked under the sponsorship of an organization similar to Peace Corp. It was during those five years that public health became a driving force in my life. My role evolved into being a health educator in elementary schools on Mount Kilimanjaro and providing oral screening. We would put the few children (5%) who had dental caries into the Land Rover and take them to the hospital for treatment. Through this experience I stumbled upon an observation that evolved into research that impacted vast numbers of people in that culture and still influences my presentations for professional audiences in this country. Severe dental and skeletal fluorosis existed where there was no fluoride in the water supply; this seemed impossible. I learned of a cultural practice that involved putting an additive into the pot to hasten cooking hard foods like beans and meat. The additive, called magadi, was harvested from the shores of soda lakes during the dry season. I completed dental caries and fluorosis examinations on Tanzanian children. After returning to Indiana, at IUSD's Oral Health Research Institute I analyzed more than 800 samples of magadi, food cooked with magadi and children's urine to determine their fluoride bioburden. My research documented that magadi contained enormous amounts of fluoride. This finding showed that a cultural practice was contributing to the severe disfigurement, and sometimes destruction of their teeth and in some cases crippling skeletal fluorosis.

A publication followed [attached] (*Severe dental fluorosis in a Tanzanian population consuming water with negligible fluoride concentration*). This was my first opportunity to make a significant contribution to a population through community engaged scholarship. It was through the cooperation of the Tanzanians that I learned of the use of magadi, and that I was allowed to conduct this research with participation of 98% of the children.

It was my ethical responsibility to disseminate the results to the villagers and Tanzanian policy makers for their benefit. The following year (1997) I returned to Tanzania and reported the results of my research to my collaborators, the Ministry of Health and the World Federation of Public Health Associations which was meeting that year in Tanzania. I then proceeded to South Africa to give an oral presentation on this information at the World Congress on Preventive Dentistry. This presentation was enthusiastically received and I learned from other Africans at the meeting that this type of food additive is being used in many African countries, but has been mentioned in only one article in the dental literature. This research led to a continuing interest in the appropriate use of fluoride and prevention of dental fluorosis. In 2000 and 2005 I conducted questionnaire surveys to determine Indiana dental professionals' knowledge and protocols for use of fluoride. These surveys resulted in articles that have been accepted for publication in the Journal of Dental Public Health and the Journal of Dental Hygiene

Working in Tanzania five years, becoming fluent in a new language (Swahili) and learning from the customs of another culture was the most dynamic and meaningful learning experience of my adult life. It had an immense impact on the direction of my teaching and research. It resulted in my resolve to share my privilege with students from IUSD, many of whom have never had the opportunity to learn from other cultures. This experience had a direct relationship to my initiation of international service-learning programs at Indiana University School of Dentistry. Early in my faculty role at IUSD I went to Mexico with IU School of Medicine faculty and students to assess the possibility of a role for IUSD in an Alternative Spring Break medical service program. With the help of Drs. Angeles Martinez and Timothy Carlson, programs became a reality not only in Mexico, but also in Haiti and Ecuador, and Dr. Michael Stropes mentored a new site in Guatemala this year. Another new site in Brazil, mentored by Dr. Andrea Zandona, will begin in June 2007. All of these programs are examples of community engaged service because they connect the resources of the university to pressing social problems and operate in a true service-learning format including community partnerships, broad academic preparation for the students, and reflection before, during and following the experience. We have fully funded all travel and related costs for the students and faculty who have participated in IUSD's international service-learning programs through external funding including grants, solicitations, and creative fund raising. Since the program's inception 98 students, 20 of whom have traveled with the teams two or three years and nine faculty members who are predominantly repeaters have participated in IUSD's international service-learning programs. Indiana University Foundation has received \$163,000 in contributions to cover costs of students and faculty. An additional \$30,000 was awarded to the program by the West Foundation with Dr. Angeles Martinez submitting the grant application and during the first several years funds were awarded to students through the IUPUI Graduate Office.

International service-learning is of great importance in my academic plans. I am currently working toward IUSD involvement in research and service-learning at Moi University in Kenya cooperation with IU School of Medicine and in Liberia in cooperation with Dr. Wvannie Scott, CEO of John F. Kennedy Hospital in Monrovia, faculty member of IU School of Nursing, and sister of Liberia's President, Ellen Johnson Sirleaf. .

Indiana Public Health Experience

My 24 years of experience in public health prior to becoming a full time faculty member at IUSD had a profound impact on my subsequent teaching and community-engaged service at IUSD. Following our return from Tanzania in 1978 I began working as a dental consultant in the Dental Division of the Indiana State Board of Health (now the Indiana State Department of Health). As a part of that work I was assigned to teach dental public health for the Indiana Purdue Fort Wayne (IPFW) Dental Hygiene Program. There I had the luxury of having five credit hours of the students' time which allowed for extensive and creative teaching and community based programs. The balance of the time was spent developing programs, creating educational materials and providing technical assistance. It was during this time that the infection control revolution occurred in dental offices throughout the country, and ISDH was assigned the lead role in bringing Indiana dentistry into compliance. My role was to develop educational materials, provide continuing education and monitor offices that were reported as being out of compliance. Because I had ten years of experience in private practice prior to entering public health, I had the ability to develop educational materials and protocols that were practical and acceptable to practitioners. In my current role as module director for the third year dental public health course, the experience of promoting effective infection control in Indiana dental offices contributed to my ability to help dental students understand the transition that they must make from the dental school setting, to the private practice setting where they will be responsible for setting policy, monitoring compliance and training personnel regarding infection control practices.

In my role with ISDH, I was a consultant for Head Start programs in Indiana. This experience led to my current position as the Region V (Michigan, Minnesota, Illinois, Indiana, Ohio, and Wisconsin) Head Start Oral Health Consultant for the Administration for Children and Families, Department of Health and Human Services. I use IUSD's allotted 20% FTE faculty development time for this role. In this position I am one of 12 consultants nationwide who develop and promote oral health programs for Head Start nationally. This enables me to be a part of a closely aligned group of dental public health professionals including the immediate past director of Health Resources and Services Administration's MCH oral health section. This group uses a listserv frequently, confers by conference call monthly and meets twice annually. This appointment enhances my ability to remain current on important public health information and places me in a nationally recognized role. Being a Head Start consultant, first at the state, then at the federal level, and working at the State Health Department has given me a depth of understanding about governmental programs including Head Start, Medicaid and federal and state funded community health centers that provide safety net services for populations with low-income or disabilities. These experiences enrich my ability to develop community engaged public health programs for IUSD and to teach dental students how to understand and work with governmental agencies. Because my learning occurred, to a great extent, through work related experiences, I am an advocate for experiential learning. In my teaching at IUSD I influence students to independently find multiple resources and delve into the literature to answer questions about the demographics of a community, the beliefs and practices of a culture, the ramifications of a proposed oral health policy and other dental public health issues.

While working at ISDH I learned to work effectively with the Indiana dental community. For my efforts I was awarded the (first ever) ISDH Innovation Award, the Indiana Dental Association Charles W. Gish Community Dental Health Award, The IUSD Alumni Association Distinguished Service Award and the IUSD Alumni Association Distinguished Dental Hygiene Alumna Award. One of each of these awards is given annually.

Academic Role at Indiana University School of Dentistry

The Dental Division of Indiana State Department of Health (ISDH) has traditionally had a close relationship with IUSD and often ISDH dentists become part-time faculty members. In 1988, while still employed at ISDH I received a 20% FTE academic appointment at IUSD. During that part-time appointment I received promotion to associate professor, but because of my part-time status tenure was not an option; therefore my dossier will include application for tenure. My assignment at IUSD was to participate in teaching the dental public health course for third year dental students and provide guest lectures for the dental hygiene public health and preventive dentistry courses. At that time I began my persistent attempts to incorporate community-based clinical assignments into the students' rotations. When I suggested a rotation for fourth year dental students at People's Dental Clinic so they could learn to provide services for and become comfortable treating people who are homeless, Dean Gilmore challenged me to prove that such services were wanted and needed. After conducting an interview questionnaire and intraoral assessment in Indianapolis' homeless shelters, the data verifying need and attitude was presented. The rotation at People's Dental Clinic still continues for the fourth year dental students.

Dr. Arden Christen was chair and I was coordinator of the precursor to the Division of Community Dentistry. The committee was called the IUSD Outreach Committee and met monthly with a wide range of community partners from Indiana agencies and organizations with the goal of broadening community engaged programs linking IUSD with the Indianapolis community. Many of the resulting programs still exist today.

While part-time faculty at IUSD I initiated and wrote grant applications for the first four community or school based sealant programs in Indiana; two of which involved student participation. These programs were the precursor to IUSD's current state-wide mobile dental sealant program, SEAL INDIANA:

- (1) IUSD sealant program for Indiana Boys and Girls Club participants. Funding from the Indianapolis Foundation (\$25,000). Services provided at the IUSD pediatric dentistry clinic
- (2) Matthew 25 Health and Dental Clinic. Services provided one evening per week with volunteer staff. Funding from Thousand Points of Light (\$30,000)
- (3) ISDH State-wide Volunteer Sealant Program: Services provided in their communities by volunteer dental professionals throughout Indiana using materials provided by ISDH. Funded by Maternal and Child Health (\$25,000)
- (4) Neighborhood Health Clinic, Inc. (Fort Wayne). Services provided at no cost to children in all nine Title I schools in Fort Wayne. Funding from ISDH Maternal and Child Health (\$120,000). Mary Haupt, CEO of NHCI assisted with grant writing.

During the period in which I had a part-time position at IUSD, I had the opportunity to learn two teaching methodologies that have shaped all of my teaching and community engagement since that time. The two methods that I learned concurrently were (1) service-learning, and (2) problem based learning (PBL). I was introduced to service-learning through the University of Washington's Community Campus Partnerships for Health (CCPH), which is the premier organization promoting service learning and community engaged scholarship in health professions schools. I learned PBL at three-day workshop at the University of New Mexico. I incorporated both methods into my two semesters of public health courses (5 credit hours) for Fort Wayne dental hygiene students. The combination was synergistic and highly successful. I used PBL to enhance didactic learning about

populations to be served and used service-learning to integrate all components of optimal community engaged service and scholarship. I use service-learning extensively in my current work at IUSD and concentrate on effective community partnerships, broad participatory preparation, reflection and scholarship. I am a member of CCPH's mentor network and was the sole speaker for one or two-day service-learning workshops at three of the Robert Wood Johnson Dental Pipeline grant recipient schools: University of Illinois at Chicago, University of Washington, and Ohio State University. I represented CCPH as meeting facilitator for the 2006 meeting of the twelve dental schools that are recipients of Ryan White Community Based Dental Partnerships Program grants. As a member of the Midwest Service-Learning Consortium for Service-Learning in Health Professions Schools (from Wright State University), I was one of two presenters for service-learning workshops in 20 colleges and universities in Indiana and Ohio. This summer will be the sixth year that I have been faculty for the three-day CCPH Summer Service-Learning Institute in Washington State. Because of my work with service-learning I was elected as a fellow in IU School of Nursing's Institute for Action Research in Community Health (IARCH) and was accepted into the first cohort of IUPUI Boyer Scholars.

In 2006 I authored a publication in the Journal of Dental Education that introduced a framework for service-learning [attached] (*A framework for service-learning in dental education*). The framework emerged from done to prepare for my teaching role at the CCPH Service-Learning Institutes and my interactions with the IUPUI Boyer Scholars program. I have received many positive comments about the framework and several requests for permission to use the framework for continuing education programs.

In January 2004, IUSD was invited to be one of 10 health professional schools applying for a grant to support pursuing creative ways of carrying out recommendations of the Report of the Commission on Community-Engaged Scholarship in the Health Professions. The grant was awarded by the Fund for the Improvement of Postsecondary Education (FIPSE) of the US Department of Education. Schools of medicine, nursing and pharmacy are participating in the project; IUSD and the University of North Carolina are the only schools of dentistry included in the collaborative which was named Community Engaged Scholarship for Health Collaborative. I chaired the IUSD committee for the collaborative from 2004 until it the end of the grant period in May 2007. The primary accomplishments of the committee were to (1)restructure IUSD's promotion and tenure guidance to focus the service component on community engaged scholarship, and (2) propose a new IUSD Committee on Community Engaged Scholarship, which is currently being formed and will support IUSD's community engagement mission.

From 1997 to the present I have been an active member of the Oral Health Section of the American Public Health Association, serving as section councilor, newsletter editor and member of the APHA Governing Council.

In 2001 I was appointed director of the newly created Division of Community Dentistry, by Dr. Domenick Zero, the incoming Chair of the Department of Preventive and Community Dentistry. In 2002 I left my State Health Department position to become full-time faculty at IUSD. My 1996 election to membership in the dental honor society, Omicron Kappa Upsilon in 1996 and subsequent election in 2001 as president is evidence that I was considered to be making contributions to the academic community.

Since 2002 my work has been focused on introducing service-learning to the vocabulary of the faculty and to the dental school curriculum. Although I demonstrated a continual pattern of publications throughout my dental public health career, there was a lull in publications between 2002 and 2005. This time was completely dedicated to developing new IUSD community-based programs and curriculum to involve the students in community engaged scholarship. I am now proceeding with writing for publication that will document the learning, program development and teaching innovations that have occurred during these years.

I led the conceptualization and implementation of the SEAL INDIANA program and the service-learning rotation that is required of all fourth year dental students and second year dental hygiene students. In 2003 Mr. John Gosney, Dr. Larry Garetto and I were chosen as Ameritech Fellows, with an \$18,000 stipend, to design an innovative computer based curriculum discovery tool to use as online exercises for students to complete prior to and following the rotation. Students research socio-economic and racial/cultural demographics of the community where they will work, identify political representatives of the area and respond to a scenario. Following the rotation students return to the website, write a reflection piece, revisit the scenario to report on how their response would change after the rotation, and compose a letter to a legislator for the area advocating for an oral health program of their choice. The Seal Mobile travels state-wide providing sealants, and other preventive, educational and referral services for children from low-income families. From the program's inception in March 2003 through March 2007 more than 12,000 Indiana children from low-income families have received services, including 18,000 dental sealants from faculty, staff and students of IUSD through the SEAL INDIANA Program. I wrote two grant applications for the start-up costs of \$547,000 that were submitted under the department chair's name for technical reasons, and I wrote and was identified as the primary investigator in 15 grant applications for operational costs that resulted in receiving \$800,001 from foundations, state and federal government for SEAL INDIANA.

In 2006 IUPUI received a President's Higher Education Community Service Award; one of three nationally. SEAL INDIANA was listed in a report that was distributed, as one of the four IUPUI programs described in the award application.

Dentists who volunteer for the Indiana Donated Dental Services program have provided more than \$5m dollars worth of free dental services in their offices for people with disabilities who have low-incomes. I have been on the BOD since 1992 and when I was president from 1998-2002. I addressed the dearth of young dentist volunteers by initiating an elective for fourth year dental students. By obtaining \$10,000 from the West Foundation we were able to pay for the dental fees incurred through students' treatment. Community partner mentors from Goodwill Industries helped to design the program, select the recipients of dental services from among their clients and meet with the dental students each month to teach them about adults who are developmentally disabled. As a result the students have an opportunity to continually learn about this population while they are providing ongoing dental treatment. The elective has been in existence since 2002, has involved about 90 dental students and has been funded by \$40,000 from my grant applications.

In 2006 Goodwill Industries presented IU School of Dentistry with its Community Partner of the Year Award at a black tie event complete with a video production with highlights about the elective. In 2007 Indiana Dental Association presented IUSD an Outstanding Service Award for the contributions of the service-learning elective to the goals of Indiana Donated Dental Services;

providing free dental services for low-income people with disabilities. Dean Goldblatt accepted the plaque at the IDA annual session awards program.

Since dental education is competency based, it seemed necessary to have a public health competency in order to measure students' progress, so that was a primary goal that was accomplished. Since we have an excellent Master of Public Health program at IUPUI it seemed opportune to create a coordinated DDS and Master of Public Health (DDS/MPH) degree option. This coordinated degree allows dental students to begin working toward a MPH degree while in their third year of dental school. They receive credit for some of their pre-doctoral dental classes toward the MPH. A benefactor agreed to provide scholarship funding to cover half the cost of in-state tuition for dental students or graduate dentists who pursue the combined DDS/MPH or a Certificate in Public Health.

Equity in access to oral health is more than a need for volunteerism; it is a much larger societal issue, and therefore, dental professionals who are experts in oral health must be skilled in influencing oral health policy. Because there was a void in teaching these skills, together with Dr. Burton Edelstein and the Indiana Dental Association (IDA) we initiated the first annual Oral Health Policy Forum for fourth year dental students. The event is held at the Indiana Dental Association conference room and is partially funded by IDA. The morning is spent hearing a keynote address defining and teaching oral health policy skills. This session is followed by small group discussion about current legislation and then selected students present brief advocacy arguments. The afternoon is spent at the Indiana State House meeting legislators and practicing advocacy skills. This forum has completed its third year and has been refined and improved. It is funded in part by Indiana Dental Association and by an annual \$5,000 grant from a Division of Community benefactor, retired US Public Health Service dentist, Dr. Donald W. Johnson.

Future plans:

The programs that I have developed and fostered at IUSD are all consistent with IUPUI's statement in *Toward a Vision for 2010: Indiana University Purdue University Indianapolis* "Civic engagement—professional service, community-based learning, and other collaborations with the local, state, national, and international communities—is one of IUPUI's distinguishing characteristics. The campus has gained national recognition as one of America's most civically engaged universities. ...In his installation address, "The Power of Two" Chancellor Bantz committed the campus to expanding civic engagement effort at home and abroad even further."

My primary goals for the future are consistent with IUPUI goals and are to: (1) to integrate service-learning throughout all levels of the dental school curriculum, and (2) to conduct community based participatory research focused on improving access to oral health care and (3) disseminate information through professional publications about methods used to achieve effective community engaged research and service.

CURRICULUM VITAE
IUPUI Dossier Format

NAME:

Yoder, Karen M.

EDUCATION:

Undergraduate: A.S.D.H. Dental Hygiene, Indiana University School of Dentistry, 1962

B.S., Public Health Dental Hygiene. Indiana University School of Medicine, 1963

Graduate: M.S.D., Master of Science in Dentistry. Major, Public Health; Minor, Education. Indiana University School of Dentistry, 1983. Thesis: Development of a Computerized School Dental Data Recording System.

Ph.D., Indiana University School of Dentistry, 1997. Major, Dental Science; Minor, Health Policy and Health of the Community. Dissertation: Altitude, Diet and Dental Fluorosis: A Study in Tanzania.

ACADEMIC APPOINTMENTS AND PROFESSIONAL CONSULTANTSHIPS

2001- present Associate Professor and Director, Division of Community Dentistry, Department of Preventive and Community Dentistry, Indiana University School of Dentistry, Indianapolis (2002 full-time appointment)

2000 – present Adjunct Associate Professor, Department of Public Health, Indiana University School of Medicine

1988 - 2002 Indiana University School of Dentistry, Indianapolis: 20% FTE

1978 - 2000 Indiana University-Purdue University at Fort Wayne 20% FTE

1970 – 1973 Instructor, Indiana University at South Bend 20% FTE

1968 – 1970 Clinical Instructor, Indiana University at Fort Wayne 20% FTE

1996 -1998 Research Associate, Muhimbili University of Health Science, Faculty of Dentistry, University of Dar es Salaam, Tanzania

1996 Omicron Kappa Upsilon, National Dental Honorary Society, elected as an honorary member. (1998-2000 secretary-treasurer; 2001 president)

1994 Indiana University School of Dentistry Alumni Association, Distinguished Service Award.

1993 Indiana State Department of Health Innovation Award.

1992 American Dental Association Community Preventive Dentistry Meritorious Award, for a project entitled: Oral Health Promotion for People with Disabilities – Indiana’s Cooperative Effort.

1989 Indiana Dental Association Charles W. Gish Community Dental Health Award.

1986 Dental Hygiene Distinguished Alumnus Award; Indiana University School of Dentistry Alumni Association.

1979 American Dental Association Certificate of Recognition for Community Preventive Dentistry.

1982 Professor of the Year; Dental Auxiliary Education Indiana University at South Bend.

TEACHING ASSIGNMENTS:

| | |
|----------------|---|
| 2005 – Present | Module Director; T720F Dental Public Health. 1 credit hour, 100 students, fall semester |
| 2003 – Present | Module Director: T850E Seal Indiana rotation. 100 students, Fall, Spring, Summer |
| 2001 – Present | Elective Director: T820 #114. Service-Learning in Community Oral Health, 15 students, Fall, Spring |
| 2006 – Present | Elective Director: T820 #298. Health Policy Elective. 1- 4 students, Spring |
| 2005 – Present | Elective Instructor: T820 #292. Enhancing Health Care to Diverse Communities, 20 students, Fall, Spring |
| 2005 – Present | Elective Instructor: T820 #296 Shelter Sealant Elective, 30 students, Fall Spring Summer |

PROFESSIONAL SERVICE:

| | |
|--------------------------------|--|
| 1992 – Present | Indiana Foundation of Dentistry for the Handicapped BOD; president 1998 – 2002 |
| 1983 – 2001 and 2007 – Present | Matthew 25 Health and Dental Clinic, Fort Wayne; Chair 1989-1996 |
| 1999 – 2002 | Health Advisory Committee, Fort Wayne Head Start Programs |
| 2002 – Present | Community Dental Clinic BOD (serving the Amish community in northern Indiana) |

2002 – Present Special Olympics Special Smiles, Indiana State Games oral health screening program director

Reviewer for Publications or Presentations:

Journal of Public Health Dentistry 2007

Journal of the American Dental Association 2007

Community Dentistry and Oral Epidemiology, 1998-present

Bulletin of Environmental Contamination and Toxicology, 1999

American Public Health Association. 1998- present- reviewed abstracts submitted for presentation at annual sessions.

The Journal of Practical Hygiene. 1992- 2000

Access – Publication of the American Dental Hygienists’ Association 1993, 1998 – present

Reviewer for Grant Applications:

Institute for Oral Health, American Dental Hygienists’ Association. 1999- 2001.

Maternal and Child Health, Indiana State Department of Health 1995- 2001

Centers for Disease Control and Prevention. Prevention Research Programs. 1999 and 2004

UNIVERSITY SERVICE:

2007 – Present IUSD Task Force on Diversity

2005 – Present IUPUI Council on Civic Engagement

2004 – 2007 Chair, IUSD Community Engaged Scholarship Collaborative, IUSD Committee (10 universities represented). A Fund for Improvement of Higher Education (FIPSE) grant project through University of Washington, Community Campus Partnerships for Health

2003 – Present IU School of Medicine-Moi University (Kenya) Advisory Committee

2003 – Present IU School of Medicine- Children’s Health Services Research Dyson Grant Committee

1997 – 2003 Coordinator, IUSD Outreach Committee

1983 – 1991 Indiana University School of Dentistry Alumni Association BOD; Secretary-treasurer 1986-1991

OTHER PROFESSIONAL ACTIVITIES:

2002 – present Dyson Project: IU School of Medicine, Department of Pediatric Medicine 10% FTE

Continuing Education Presentations:

May 2007 Leadership and Professional Development Conference. Ohio Head Start Association. “Oral Health, Partnering to Obtain Dental Services” and “Achieving Optimal Oral Health for Children Enrolled in Head Start”. 3 hour presentation

April 2007 Indiana Head Start Spring Training Conference. 1.5 hr oral presentation. "Achieving Optimal Oral Health for Children Enrolled in Head Start.

October 2006 Service-Learning in Dental Education. University of Washington School of Dentistry. Three hour presentation.

January 2006 Update on the Use of Fluoride for Dental Caries Prevention. Indianapolis Westside Study Club. One hour presentation

September 2005 Update on the Use of Fluoride for Dental Caries Prevention. IUSD Continuing Education Three hour presentation. Hyatt, Indianapolis

November 2004 Service-Learning in Dental Education. University of Illinois College of Dentistry. Sole speakers for a two day workshop

September 2003 Update on the Use of Fluoride for Dental Caries Prevention, IUSD Cont. Education. 3 hours. Indianapolis.

June 2000, 2001, 2003, 2005, 2006, 2007 Service-Learning Institute, Community Campus Partnerships for Health, University of Washington, Faculty mentor. Sleeping Lady Mountain Lodge, Leavenworth, WA. Three-day institute

April 2002 Service-Learning in Dental Education. Ohio State University, School of Dentistry. Three-hour presentation

Invited and Competitive Presentations at State, National and International Professional Meetings:

March 2007 American Dental Education Association. Creating Service-Learning Opportunities with Head Start in Dental Schools. Oral presentation in symposium entitled: Academic Dental Education and Head Start Programs: Giving Students a Head Start to Service

January 2007 Update on the Use of Fluoride for Dental Caries Prevention. IU School of Dentistry Alumni Association. At Sea in the Caribbean. One hour oral presentation.

August 30, 2006 Community-Based Dental Partnership Program for dental school recipients of Ryan White Grants. Speaker and facilitator for the all-day meeting.

October 2006 Introduction to Service-Learning. University of Washington School of Dentistry, Seattle. Attendees were 50 faculty and community preceptors. Two hour presentation.

June 30, 2006 Dental Professional's Knowledge About Fluoride. International Association for Dental Research, Brisbane, Australia. Poster presentation.

May 16, 2006 Optimizing Oral Health in Rural Areas. Maternal and Child Oral Health Institute. Atlanta May 15-16, 2006 Oral presentation. HRSA, US Dept of Health and Human Services. Oral presentation

May 11, 2006 Promising Approaches for Enrolling Children in Medicaid/SCHIP and Linking them to Dental Homes. Oral presentation. Workshop: Improving the Oral Health of School Aged Children: Strengthening School-Based Dental Sealant Program Linkages with Medicaid/SCHIP and Dental Homes. Washington D.C., HRSA, US Dept of Health and Human Services

May 2, 2006 Fluoride Knowledge and Protocols of Indiana Dental Professionals. National Oral Health Conference. Oral Presentation. Little Rock

March 29, 2006 Achieving Optimal Oral Health for Children Enrolled in Head Start. Oral presentation. Indiana Head Start Association Annual Training Conference, Merrillville, IN

March 2005 Using Technology to Support Community Oral Health Service-Learning. American Dental Education Association TechnoFair and Expo.

June 2004 Reducing Disparities in Access to Dental Care for Indiana's Children, Indiana Rural Health Association Annual Session, French Lick Springs. Concurrent Session

May 2004 Development of a Web-based Discovery Tool for Enhancement of Dental Service-Learning and Civic Engagement Programs. IU/SBC Summer Leadership Forum 2004. Poster Session

February 2004, Keynote Speaker, Building Community Partnerships through Service-Learning. University of Texas Health Sciences Center at San Antonio

August 2003 Update on the Use of Fluoride for Caries Prevention. The National Primary Oral Health Care Conference 2003, Sedona AZ

March 2003, Update on the Use of Fluoride for Caries Prevention. West Central Dental Society, Lafayette, IN

March 2003 Implementing Service-Learning Components into a Community-Based Course. American Dental Education Association Lunch & Learn

March 2003 Enhancing Community-Based Education Through Service-Learning Partnerships, American Dental Education Association, panelist.

October 2003 Update on the Use of Fluoride for Caries Prevention. Phoenix College, Center for Health Professions. 3 hour continuing education presentation

June 2002 Institute Faculty. Community Campus Partnerships for Health Service-Learning Institute (three days) . Leavenworth, WA

March 2002 Service-Learning in Dental Education: From Vision to Reality. American Dental Education Association. Three-hour Faculty Development Workshop. Panelist

October 2001 Oral Health Assets and Challenges in Developing Countries. American Public Health Association. Atlanta, GA Oral Presentation.

October 2001 School Based Sealant Programs. Indiana School Nurses' Association. Bloomington, IN

July 2001 Illinois State Oral Health Conference. Plenary Session: Update on the Use of Fluoride for Caries Prevention. Bloomington, Illinois

May 2001 National Oral Health Conference. Round Table: Dental Professional Understanding of Optimal Fluoride Use. Portland Oregon

May 2001 Community Campus Partnerships for Health, Annual Conference. Integrating Healthy People 2010 Oral Health Objectives into Service-Learning Programs. Panel presentations. San Antonio

March, 2001 American Dental Education Association. Integrating service-learning into dental education. Chicago, Panel presentation

May 18-20, 2000. Indiana Dental Association Annual Session. Presented two 1.5 hours presentations. (1) Update on the Use of Fluoride, (2) Introducing Indiana Donated Dental Services.

August 2000. Illinois State Oral Health Conference, Bloomington, IL. Fluoride Update. Three-hour oral presentation.

June 24 – 27, 2000 Institute Mentor. Community-Campus Partnerships for Health Service-Learning Institute. Leavenworth, WA.

June 1999 Evidence Based Decisions About Fluoride: American Dental Hygienists' Association 76th Annual Session. San Diego. Two-hour scientific session, oral presentation.

June 1999 Evidence Based Decisions About the Use of Fluoride: American Dental Hygienists' Association 76th Annual Session. San Diego. Two hour round table presentation and discussion.

June 1999. Setting Objectives and Tracking Progress in Community Oral Health Programs. American Dental Hygienists= Association 76th Annual Session. San Diego. Panel participant.

November 1997 Altitude, Diet and Dental Fluorosis: A Study in Tanzania. American Public Health Association. Indianapolis. Oral presentation.

October 1997 Severe Dental Fluorosis in a Population Consuming Water with Negligible Fluoride Concentration. World Congress on Preventive Dentistry. Cape Town, South Africa. Oral presentation

October 1997 Magadi in the Cooking Pot: Contributing to Fluoride Toxicity in Tanzania World Federation of Public Health Associations. Arusha, Tanzania, East Africa. Poster presentation

1997, March. Altitude, Diet and Dental Fluorosis: A Study in Tanzania. International Association for Dental Research. Orlando, Florida. Oral presentation.

1996, August. Altitude, Diet and Dental Fluorosis: A Study in Tanzania. School of Health Science Convocation. Indiana-Purdue Fort Wayne. Oral presentation.

1996, September. Altitude, Diet and Dental Fluorosis: A Study in Tanzania. South Bend Dental Hygienists' Association. Oral presentation.

1996, February. Idiopathic Dental Fluorosis on Kilimanjaro. Kilimanjaro Christian Medical Centre. Moshi, Tanzania. Oral presentation.

1994, October. "Making It Happen: Synergism at the ADA Component Level" Annual Meeting of the Association of Component Executive Directors of ADA. New Orleans, Hilton. October 22, 1994. Oral presentation.

1994, August. "Indiana's Community Based Sealant Programs: Three Models" National Conference for Public Health Dental Sealant Programs. Association of State and Territorial Dental Directors. Columbus, Ohio. Poster Session.

1994, November. "Infection Control Topics for 1994" 24th Annual Miami Winter Meeting. East Coast District Dental Hygienists' Society. Scientific Session. 2.5 CEU's. Oral presentation.

1993, November. "Oral Health Promotion for People with Disabilities: Indiana's Cooperative Effort". 56th Annual Meeting of the American Association of Public Health Dentistry. San Francisco, CA. Poster session

1993, September. "Oral Health Promotion among the Homeless" 3rd Annual Conference: Health Care for the Homeless and Poor. Indiana Government Center, Indianapolis. Oral presentation.

1992, November. "Promotion of Infection Control Practices in Dental Offices". American Public Health Association Annual Meeting. Washington, D.C. Oral presentation.

1992, April. "Documentation of Infection Control Policies and Procedures", Indiana Society Of Pediatric Dentistry, Indianapolis, IN. Oral presentation.

1992, October. "Infection Control Policy and Documentation in the Dental Office", Southeastern Component of Indiana Dental Association. Oral presentation.

1992, October. "A Systematic Method of Documenting Office Infection Control Policies and Practices", Isaac Knapp Component of Indiana Dental Hygienists' Association. Oral presentation.

1991, October. 54th Annual Meeting of the American Association of Public Health Dentistry. Seattle. "Two Models of Community Based Free Sealant Programs for Low Income Children" Poster Session. (Abstract published in the Journal of Public Health Dentistry 52(3) Spring, 1992.

1991, April. "Dental Office Infection Control Update", Elkhart Component of Indiana Dental Hygienists' Association.

1991, October. 12th Annual Family Health Conference. Indianapolis. “Access to Dental Services for Indiana’s Indigent Children”. Oral presentation.

1990 December. 5th Annual Indiana Public Health Days. Indianapolis. “The Public Health Nurse: Advocate for Access to Dental Care for Low-income Children.” Oral presentation.

1990 October Annual Session of the American Public Health Association in New York. “Using the Healthy Cities Model for Promotion of Oral Health”. Poster Session

1988 May Indiana Dental Hygienists= Association Annual Session. “Broadening Professional Horizons” Oral presentation.

1988 March, American Association Dental Schools Annual Session. Montreal, “Prevention of Disease Transmission”. Abstract Published in Journal of Dental Education 53 (1), January 1988. Educational Exposition.

1987 American Dental Hygienists’ Association Annual Session. St. Louis, “Prevention of Disease Transmission in the Dental Office”. Table Clinic.

1986 American Association of Public Health Dentistry, Miami, FL. “Patients’ Attitudes Toward the Routine Use of Surgical Gloves in the Dental Office”, Abstract Published Journal of Public Health Dentistry, Vol 47, No. 1, Winter 1987. Oral presentation.

1986 Indiana Dental Hygienists Association Annual Session. “Infection Control in the Dental Office” Oral presentation.

1986 American Dental Hygienists’ Association, Washington D.C. “In Vivo Dental Plaque Removal by a Zirconium Silicate Chewing Gum”. Table Clinic.

1984 American Association of Public Health Dentistry, Atlanta, Georgia. “Development of a Computerized School Dental Data Recording System”. Abstract Published Journal of Public Health Dentistry, Vol. 45, No. 1 Winter 1985, Pg. 41. Oral presentation.

1984 National Agenda on Dental Hygiene Research A.D.H.A. and U of Colorado. Denver, CO. “Development of a Computerized School Dental Data Recording System”. Poster Session.

1984 Sixth Annual Great Lakes Conference on High Blood Pressure Control. Indianapolis IN “Development of Hypertension Learning Centers.” Table Clinic

1982 Indiana Dental Hygienists Association Annual Session. “The Role of Private Practice Dental Hygienists in Dental Public Health”. Oral presentation.

GRANTS AND FELLOWSHIPS: Principal Investigator for All

| Source | Amount | Program / Effective Dates |
|---|---------------|--|
| Delta Dental Foundation | \$75,000 | Seal Indiana: 5/07 – 4/08 |
| IUPUI Center for Service and Learning | \$5,000 | Boyer Scholar Fellowship 8/05 – 9/06 |
| Health Resources and Services Administration (HRSA) | \$65,000 | Seal Indiana 9/06 – 8/07 |
| Indiana State Department of Health (ISDH) Maternal and Child Health Block Grant (MCH) | \$37,500 | Seal Indiana 10/07 – 9/08 |
| ISDH – MCH | \$37,500 | Seal Indiana 10/06 – 9/07 |
| Anthem Foundation | \$150,000 | Seal Indiana 3/06 – 2/07 |
| ISDH – Special Project | \$30,000 | Marketing 10/05 – 9/06 |
| ISDH – MCH | \$37,500 | Seal Indiana 10/05 – 9/06 |
| HRSA | \$68,263 | Seal Indiana 9/05 – 8/06 |
| ISDH – Special Project | \$10,000 | Marketing 12/04 – 9/05 |
| HRSA | \$65,000 | Seal Indiana 9/04 – 8/05 |
| ISDH – MCH | \$37,500 | Seal Indiana 9/04 – 8/05 |
| HRSA | \$96,738 | Seal Indiana 10/03 – 9/04 |
| ISDH – MCH | \$30,000 | Seal Indiana 10/03 – 9/05 |
| ISDH – MCH | \$80,000 | Seal Indiana 4/03 – 6/03 |
| West Foundation | \$10,000 | Service-learning elective 2002 |
| West Foundation | \$10,000 | Service-learning elective 2003 |
| IUPUI Solutions Center | \$10,000 | Service-learning elective 9/05 – 8/06 |
| IUPUI Solutions Center | \$10,000 | Service-learning elective 9/06 – 8/07 |
| IUPUI Center for Service and Learning | \$16,900 | 11 Service-learning assistantships 5/04 – 8/07 |
| Marion County Health Department | \$85,000 | Survey: Children’s Oral Health Status 2001 |

TOTAL
\$966,901

PRINT AND ELECTRONIC PUBLICATIONS:

- * indicates in rank (associate professor full time since 2002)
- indicates published since beginning at IUSD (20%FTE, assistant professor in 1988)

(I) Teaching a. Refereed

* Garetto L, Yoder KM. Basic Oral Health Needs: A Professional Priority? *Journal of Dental Education*. 70(11)2006: 1174-1179.

- Schaaf J, Yoder KM. Antibiotic Prophylaxis for Dental Patients with Prosthetic Joints, *Indiana Medicine, JIMA.*, December 1989.

- Yoder KM: The dynamics of pregnancy in the dental treatment setting. *Practical Hygiene*. March/April 1995. 4(2)25-28.

b. Non refereed

(II) Research a. Refereed

* Yoder KM, Maupome G, Ofner S, Swigonski N. *Knowledge and Use of Fluoride Among Indiana Dental Professionals*. In press: Accepted for publication in *Journal of Public Health Dentistry* Vol.67(3) Summer 2007

* Swigonski N, Yoder KM, Maupome G, Ofner S. Dental providers attitudes regarding the application of fluoride varnish by pediatric health care providers. Submitted to *Ambulatory Pediatrics*, June 2007.

* Yoder KM, Maupome G, Ofner S, Swigonski N. Fluoride knowledge and practices of Indiana dental hygienists. Revisions submitted to *Journal of Dental Hygiene*, June 2007

- Yoder KM, Mabelya L, Robison VA, Dunipace AJ, Brizendine EJ, Stookey GK. Severe dental fluorosis in a Tanzanian population consuming water with negligible fluoride concentration. *Community Dentistry and Oral Epidemiology* 1998; 26:382-93

- Yoder KM, Schimmele RG. The oral health of Indiana's independent, disabled adults. *J Indiana Dent Assoc*, 1997:76(3)7-11

- Yoder KM. Tuberculosis: Indiana's Status and Implications for Dental Health Care Workers. J Indiana Dent Assoc, Winter 1994.

- Yoder KM. Tuberculosis: A reemerging hazard for oral healthcare workers. Journal of Dental Hygiene. May-June 1993;67(4)208-213.

- Schaaf J, Yoder KM. Antibiotic Prophylaxis for Dental Patients with Prosthetic Joints: Indiana Orthopaedic Surgeons' Recommendations, J Indiana Dent Assoc July/August, 1988

Yoder KM. Patients' Attitudes toward the Routine Use of Surgical Gloves in a Dental Office. Journal of the Indiana Dental Association. Nov/Dec 1985.

b. Non refereed

- Yoder KM, Mabelya L, Robison V. Magadi in the Cooking Pot: Contributing to Fluoride Toxicity in Tanzania. Selected Proceedings from the Eighth International Congress World Federation of Public Health Associations. Published 1999.

- Yoder KM: Sleep Apnea...A Serious Disorder. Access. August, 1995. (7)32-36.

(III) Professional Service

a. Refereed

* Yoder KM. Indiana's Dental Workforce: Distribution and Related Issues. In press: Accepted for publication in the July 2007 issue of Journal of the Indiana Dental Association

* Yoder KM. The Status of Kindergarten and Middle School Entry Dental Examinations in Indiana, JIDA 2005; 83(5)15-18

* Yoder KM. A Framework for Service-Learning in Dental Education. Journal of Dental Education. 70(2)2006: 115-123

* Yoder KM. Service learning at IUSD: fostering civic responsibility. JIDA 2005; 83(4) 21-23

- Yoder KM, Yoder KE: Outreach in Indiana Communities: More than meets the eye. J Indiana Dent Assoc, Spring 1995;74(1)20-30.

- Yoder KM. Caregiver's guide to oral health, J Indiana Dent Assoc, 1992: 71(2)8-10.

- Yoder KM. Community Outreach: Fort Wayne's Matthew 25 Health and Dental Clinic, J Indiana Dent Assoc May/June, 1990.

Yoder KM, McCullough. Indiana Well Elderly: Profile of Perceived Oral Health Needs and Utilization of Services, J Indiana Dent Assoc, January, 1984.

b. Non refereed

- Yoder KM. Being a good neighbor: a report from the IUSD Outreach/Service Learning Committee. IUSD Alumni Bulletin 1999;13(1)46-50.

- Yoder KM. Message from MOM^{*}: Oral health is basic to wellness. Indiana University School of Dentistry (IUSD) Alumni Bulletin, 1992: 6(3)10-12, (* Maternity Outreach Mobilization Project)

- Yoder KM. A Ride in the Country (China), IUSD Alumni Bulletin, Winter, 1991: 5(2)28-31

- Yoder KM, Schimmele RG. A conversation with Ruth White, IUSD Alumni Bulletin, Spring 1988.

Yoder KM, Schimmele RG. Dental and Medical Team Puts a New Face on Life for a Vietnamese Refugee, I.U. School of Dentistry Alumni Bulletin, April, 1986.

Yoder KM, Zonakis P. Matthew 25 Dental Clinic Aids the Needy in Fort Wayne. I.U. School of Dentistry Alumni Bulletin, Fall, 1984.

Yoder KE, Yoder KM. Dentists Focus on Health Awareness Campaign, J Indiana Dent Assoc, March, 1983.

PUBLICATIONS: TEXTBOOKS & THESIS:

- Yoder KM. Community Oral Health, Chapter 31, in Dentistry for the Child and Adolescent. Editors, McDonald and Avery. Mosby, 7th edition. 2000

- Yoder KM. Altitude, Diet and Dental Fluorosis: A Study in Tanzania. Doctoral dissertation. On file at IUSD library. April 1997

- Yoder KM. Preventing Disease Transmission in the Dental Office. 1992. Self published manual and documentation system. Reviewed in Journal of Dental Hygiene 67(1) 10:1993

Yoder KM. Development of a Computerized School Dental Data Recording System. Masters Thesis. On file at the IUSD Library. Abstract published in the Journal of Public Health Dentistry, Winter 1985.

Harris NO, Yoder KM. School Based Dental Health Programs, Chapter 18 in Primary Preventive Dentistry, First Edition, Prentice Hall Publishing Co., 1981

Darnell KT, Yoder KM, Dental Public Health, Chapter 15 in Primary Preventive Dentistry, First Edition, Prentice Hall Publishing Company, 1981.

June 3, 2007

Date:

Signature of Candidate

Severe dental fluorosis in a Tanzanian population consuming water with negligible fluoride concentration

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Yoder KM, Mabelya L, Robison VA, Dunipace AJ, Brizendine EJ, Stookey GK: Severe dental fluorosis in a Tanzanian population consuming water with negligible fluoride concentration. Community Dent Oral Epidemiol 1998; 26: 382-93.
Munksgaard, 1998

Abstract – Objectives: To identify risk factors for dental fluorosis that cannot be explained by drinking water fluoride concentration alone. **Methods:** Two hundred eighty-four Tanzanian children ages 9 to 19 (mean 14.0±SD 1.69), who were lifetime residents at differing altitudes (Chanika, 100 m; Rundugai, 840 m; and Kibosho, 1,463 m; Sites 1, 2, and 3 respectively) were examined for dental fluorosis and caries. They were interviewed about their food habits, environmental characteristics and use of a fluoride-containing food tenderizer known locally as magadi. Meal, urine, water and magadi samples supplied by the participants were analyzed for fluoride content. Urine samples were also analyzed for creatinine concentration. Four magadi samples from Sites 1 and 3 were analyzed for complete element composition. **Results:** Of the 13 water samples from Site 2, 10 contained > 4 mg/L F, ranging from 1.26 to 12.36 mg/L with a mean±SD of 5.72±4.71 mg/L. Sites 1 and 3 had negligible water fluoride of 0.05±0.05 and 0.18±0.32 mg/L respectively. Mean TFI fluorosis scores (range 0-9) for Site 2 were high: 4.44±1.68. In Sites 1 and 3, which both had negligible water fluoride, fluorosis scores varied dramatically: Site 1 mean maximum TFI was 0.01±0.07 and Site 3 TFI was 4.39±1.52. Mean DMFS was 1.39 ± 2.45, 0.15±0.73 and 0.19±0.61 at Sites 1, 2, and 3, respectively. There were no restorations present. Urinary fluoride values were 0.52±0.70, 4.34±7.62, and 1.43±1.80 mg/L F at Sites 1, 2, and 3, respectively. Mean urinary fluoride values at Site 3 were within the normal urinary fluoride reference value range in spite of pervasive severe pitting fluorosis. Meal and magadi analyses revealed widely varied fluoride concentrations. Concentrations ranged from 0.01 to 22.04 mg/L F for meals and from 189 to 83211 mg/L F for magadi. Complete element analysis revealed the presence of aluminum, iron, magnesium, manganese, strontium and titanium in four magadi samples. There were much higher concentrations of these elements in samples from Site 3, which was at the highest altitude and had severe enamel disturbances in spite of negligible water fluoride concentration. An analysis of covariance model supported the research hypothesis that the three communities differed significantly in mean fluorosis scores (P<0.0001). Controlling for urinary fluoride concentration and urinary fluoride:urinary creatinine ratio, location appeared to significantly affect fluorosis severity. Urinary fluoride:urinary creatinine ratio had a stronger correlation than urinary fluoride concentration with mean TFI fluorosis scores (r=0.43 vs r=0.25). **Conclusions:** The severity of enamel disturbances at Site 3 (1463 m) was not consistent with the low fluoride concentration in drinking water, and was more severe than would be expected from the subjects' normal urinary fluoride values. Location, fluoride in magadi, other elements found in magadi, and malnutrition are variables which may be contributing to the severity of dental enamel disturbances occurring in Site 3. Altitude was a variable which differentiated the locations.

Key words: acid-base balance; altitude; dental caries; fluorosis; food additives; hypobaric hypoxia; nutrition

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Accepted for publication 10 July 1998

Fluorosis of greater severity than can be accounted for by water fluoride concentrations has been reported in studies conducted in several African nations and in other developing countries (1-3). Metabolic factors related to altitude of residence (4), food additives, (5, 6) malnutrition (7) and composition of diet (8) have been considered as potential causes of disproportionately severe fluorosis.

This study was conducted in Tanzania, East Africa, where many residents are experiencing excessive fluoride intake from naturally occurring fluoride in their water sources. Water samples from scattered locations in 10 of Tanzania's 19 districts contained ≥ 16 mg/L F (9). This has resulted in both dental and crippling skeletal fluorosis (3, 10).

The mechanisms that cause dental fluorosis are dynamic and not fully understood. Water consumption, as predicted by mean annual temperature, has been the sole determinant of optimal fluoride concentration in community water supplies. Prudent public health practice dictates examining variables other than the mean daily temperature that may influence fluoride intake or fluoride metabolism. If contributors to excessive fluoride ingestion exist, those variables should be identified in order to be able to provide optimal fluoride benefits while protecting individuals from excessive fluoride intake.

This study was conducted to identify possible risk factors for dental fluorosis that cannot be explained by drinking water fluoride concentration alone. Previous studies have identified unexpectedly high mean fluorosis scores among East Africans consuming water with negligible fluoride (1, 5, 6). Researchers have theorized, through animal research, that lifelong residence at high altitude may be contributing to dental fluorosis (4). This study investigated the possible contribution of altitude to dental fluorosis in a human population.

Other researchers have implicated a high fluoride-containing food tenderizer used in East Africa with increasing fluoride ingestion (5, 6). The food additive, locally known as magadi, is a trona which is gathered from the shores of alkaline lakes. When combined with water and vegetables or meat over a fire, magadi shortens the cooking time. This study examined, for the first time, the effect of magadi on the fluoride concentrations of foods. It also related the fluoride concentration of food consumed to fluoride bioburden as measured by fluoride concentration in subjects' first morning urine void. In 1997 Mabelya et al. (6) reported on urinary fluoride concentrations of children with fluorosis,

in parts of Tanzania, who consumed foods cooked with magadi. They found a positive correlation between the severity of fluorosis and the urinary fluoride concentrations among these children. This study examined children in three other study sites, not part of the previous study, in Tanzania. Subjects in one village (Site 3) were found to be consuming magadi, had severe dental fluorosis, but had normal urinary fluoride concentrations, suggesting that something other than fluoride may be causing the enamel disturbances, or that urinary excretion of fluoride in children is decreased at the altitude of Site 3 (1463 m).

The research hypothesis stated that children living at or near 1500 m altitude will have significantly higher mean fluorosis scores than children living near sea level, controlling for drinking water and urinary fluoride concentrations.

Material and methods

This study was conducted in collaboration with the Muhimbili University College of Health Sciences of the University of Dar es Salaam. Four sites were originally planned for this analytical epidemiologic study: high and low altitude crossed with high and low water fluoride concentrations; however, neither high altitude-high fluoride nor low altitude-high fluoride sites exist in Tanzania. Therefore, three sites representing high and low altitude with negligible fluoride and a mid-altitude site with high water fluoride concentration were selected from records of the Ministry of Health and Social Welfare of the United Republic of Tanzania. The mid-altitude-high fluoride site was used to document the dental enamel response to high fluoride concentrations in this population. The three sites chosen were: Site 1, Chanika School, situated near sea level (100 m) and reported to have negligible fluoride in the water; Site 2, Rundugai School, located in the plains at 840 m and reported to have high water fluoride concentration; and Site 3, Kibosho School, with negligible fluoride in the water and located at 1463 m on Mount Kilimanjaro, a volcanic mountain. The residents at all three sites were primarily farmers and not nomadic.

Subjects were randomly selected from class rosters and were required to be lifelong residents of the study site from which they were recruited, to be in good health and to consent to participation. The children were questioned by a Tanzanian interviewer regarding the length of residence at that location; their consumption of tea, fish, and milk;

the family's use of magadi; the family's cooking location (over an open fire inside or outside of the home) and type of fuel used; frequency of use of insecticide on crops; and their younger siblings' ingestion of tea and food cooked with magadi. The questions focused on current patterns of consumption and use and were based on the assumption that dietary and agricultural practices are static in this culture. Parents were not questioned. The families live in a very close physical relationship; therefore, as the subjects were old enough to be aware of their siblings' eating habits and their mothers' cooking practices, they were judged to be dependable sources of information. Subjects were asked to list what foods they had eaten the previous day in order to survey the types of foods consumed in that village.

Information on the subjects' nutritional status was obtained from records of the Regional Maternal and Child Health (MCH) Office. These data are collected at the village level during monthly MCH clinics where children are weighed, measured and evaluated according to World Health Organization standards. The available records contained summary information on the district level rather than individual records of the study subjects.

The subjects were examined for dental fluorosis using both the Thylstrup Fejerskov Index (TFI) (11) and the Tooth Surface Index of Fluorosis (TSIF) (12) to enable comparison of the use of these indices in a population with severe fluorosis. Dental caries was recorded as decayed, missing and filled permanent surfaces (DMFS) by Radike's criteria (13). One examiner (Mabelya) quantified TFI scores at all sites; Robison examined for TSIF scores at Site 1 where minimal fluorosis existed; and Yoder examined for TSIF scores at Sites 2 and 3 where severe fluorosis existed. First, TSIF examinations were conducted without drying teeth, then children were moved to another examiner and gauze was used to dry teeth for the TFI examinations. Mabelya examined for caries. A qualifier (S) was added to both fluorosis indices to indicate an anterior tooth which, by observation and by questioning, was determined to have been artificially abraded with a stone or other object, for the purpose of removing the pitting and discoloration of fluorosis. The qualifier "S" signified *sagua*, a Swahili word meaning to rub or abrade. A qualifier (A) was added to TSIF scores to indicate an occlusal surface which had more abrasion than would be expected in a child of that age. Previous fluorosis data were available only for Site 3 (14).

Ethical clearance and official written permission to conduct this study were obtained from the Tanzanian Ministries of Health and Education. Meetings were held with village councils at the study sites. Village leaders, parents, teachers, and representatives of various village committees attended. The councils were presented with an explanation of why their village's school was chosen and what procedures would be utilized. As is the custom, these authorities took responsibility for informing parents about the ongoing research activity and sought their permission to examine the children. Prior to examination a meeting was held with the headmaster of each school, teachers and the students who were potential subjects to explain how the study would be conducted. Children were specifically informed during this orientation that they were free to refuse to participate if they preferred not to be involved in the study.

Intraoral mirrors and explorers were used for the examinations. Battery-powered head lamps were used; no electricity was available. Aseptic procedures were followed.

Two days prior to the study a calibration session was held at the University of Dar es Salaam School of Dentistry. During the study intra-rater reliability for TSIF and TFI fluorosis scoring was measured by random and blind reexamination of 10% of the subjects. Inter-rater reliability was not required because each examiner scored different indices. Robison and Yoder both scored TSIF, but in populations with extremely differing fluorosis severity.

Samples of drinking water ($n=42$), meals ($n=280$), urine ($n=280$), and magadi ($n=139$) were analyzed for fluoride concentration. Only 42 water samples were analyzed for 284 subjects because there are no water sources within individual homes; water is taken from centrally located springs, rivers, streams, and pipes. Water, urine, and magadi were directly analyzed for fluoride using a fluoride ion-specific electrode (Orion Research, Boston, MA, USA). Foods were analyzed by a modification of the diffusion method of Taves (15). Two hundred seventy-seven samples of urine were analyzed for creatinine concentration to enable determination of the urinary fluoride:urinary creatinine ratio as a means of correcting for collecting spot urine specimens rather than 24-hour samples (16, 17).

Subjects were given two closable 8-oz containers and were instructed to return the next day with a sample of their evening meal in one and a sample of their first morning urine void in the other. Meals

were typically a combination of beans and rice or maize meal and spinach; therefore children were asked to bring a mixture representing all components of their meal, excluding the drink; usually water or tea. They were also asked to bring a sample, about a tablespoonful, of the magadi used in their home. All samples were analyzed for fluoride concentration at the Oral Health Research Institute of Indiana University School of Dentistry. Urine samples were analyzed for creatinine concentration at the Indiana University Hospital Endocrinology Laboratory. Element analysis of four magadi samples, randomly selected from the 98 specimens from Sites 1 and 3 was done at the Indiana State Department of Health, Environmental Laboratory. Cost limitations precluded element analysis of a greater number of samples.

Results

Demographics

Two hundred eighty-four school-children ages 9 to 19 (mean 14.0 ± 1.69 years) were examined in three locations of varying altitude in Tanzania during 1996. Tribal composition of the sites varied: Sites 1 and 2 were heterogeneous, each having representatives of 15 or more tribes, while Site 3 was composed of only one tribe. There was a range of 2 to 18 members in the households with a median of 7.

Calibration

The calibration exercises with a 10% random sample which was reexamined to verify intra-examiner reliability for TSIF and TFI fluorosis scores resulted in complete agreement at the surface level in 82%, 99%, and 65% of the first and second examinations by the three examiners. Kappa statistic, which is used as a measure of agreement beyond that due solely to chance, was 0.74, 0.89, and 0.60 for the three examiners regarding fluorosis scores. All of these measures of calibration were within acceptable limits (18).

Water fluoride concentrations

Table 1 summarizes fluoride concentration of water and other variables. Water fluoride concentrations at Site 2 varied dramatically, ranging from 1.26 to 12.36 (5.72 ± 4.71 mg/L). Sites 1 and 3 had negligible water fluoride concentrations of 0.05 ± 0.05 mg/L and 0.18 ± 0.32 mg/L respectively.

Dental fluorosis

Mean TFI scores (range: 0–9) for Sites 1, 2, and 3, respectively, were 0.01 ± 0.07 , 4.44 ± 1.68 , and

Table 1. Summary of specimen values and mean maximum fluorosis scores

| Site | Water fluoride (mg/L) | Magadi fluoride (mg/L) | Meal fluoride (mg/L) | Fluoride (mg/L) | Urine | | | Mean TFI score (range 0–9) | Mean TSIF score (range 0–7) |
|---|--|---|---|---|---|---|---------------------------------------|---------------------------------------|-----------------------------|
| | | | | | Creatinine (mg/100 mL) | Urine: creatinine ratio (μ M/mM) | Urine: creatinine ratio (μ M/mM) | | |
| Site 1: Chamika Altitude: 100 m (328 ft) Subjects $n=84$ | $n=14$ $\bar{x}=0.0463$ $s=0.0472$ | $n=8$ $\bar{x}=16.010$ $s=28.514$ | $n=80$ $\bar{x}=0.4915$ $s=2.1557$ | $n=82$ $\bar{x}=0.5220$ $s=0.6947$ | $n=81$ $\bar{x}=59.99$ $s=63.24$ | $n=81$ $\bar{x}=8.01$ $s=9.56$ | $n=84$ $\bar{x}=0.01$ $s=0.07$ | $n=84$ $\bar{x}=0.01$ $s=0.05$ | |
| Site 2: Rundugai Altitude: 840 m (2756 ft) Subjects $n=100$ | $n=13$ $\bar{x}=5.7170$ $s=4.7076$ | $n=90$ $\bar{x}=4.113$ $s=2.446$ | $n=106$ $\bar{x}=2.4700$ $s=3.5512$ | $n=106$ $\bar{x}=4.4282$ $s=8.3777$ | $n=105$ $\bar{x}=47.72$ $s=42.91$ | $n=105$ $\bar{x}=65.48$ $s=61.63$ | $n=100$ $\bar{x}=4.44$ $s=1.68$ | $n=100$ $\bar{x}=3.14$ $s=1.52$ | |
| Site 3: Kibosho Altitude: 1463 m (4800 ft) Subjects $n=100$ | $n=15$ $\bar{x}=0.1794$ $s=0.323$ | $n=41$ $\bar{x}=5.037$ $s=1.815$ | $n=94$ $\bar{x}=2.1427$ $s=3.8947$ | $n=92$ $\bar{x}=1.4284$ $s=1.7920$ | $n=91$ $\bar{x}=36.71$ $s=28.62$ | $n=89$ $\bar{x}=28.56$ $s=24.58$ | $n=100$ $\bar{x}=4.39$ $s=1.52$ | $n=100$ $\bar{x}=3.59$ $s=1.41$ | |

4.39±1.52. Figures 1 and 2 illustrate the distribution of TFI scores at Sites 2 and 3. Subjects at Site 1 had negligible fluorosis; therefore, a figure is not provided. Figure 2 demonstrates that 98% of the subjects at Site 3, which was located at high altitude and had negligible water fluoride concentration, had at least 50% of teeth with TFI scores ≥1. Likewise, 20% of the subjects at this site had 36% of teeth with TFI scores >7. Mean TSIF scores (range: 0-7) were 0.01±0.05, 3.14±1.52, and 3.59±1.41 for Sites 1, 2, and 3 respectively. Figures 3 and 4 illustrate dental fluorosis observed at Site 3. Tables 2 and 3 report percentage distribution of fluorosis scores for Tooth Surface Index of Fluorosis and Thylstrup Fejerskov Index of Fluorosis.

Eighty-five percent of the subjects with maximum TSIF scores of 6 or 7 had four or more molars with occlusal surfaces which were excessively abraded by wear. Many occlusal surfaces and cusp tips of the most severely fluorosed teeth were devoid of surface enamel. This abrasion, caused by mastication, was assumed to be caused by weakened enamel resulting from the porosity character-

istic of enamel with severe fluorosis. None of the subjects with maximum TSIF scores of 0 to 3 exhibited such abrasion of occlusal surfaces.

More than half of the subjects who had maximum TFI scores of 7 to 9 appeared to have abraded their anterior teeth with a stone in an attempt to remove the pitting and discoloration. Upon questioning, most of the students admitted to having inflicted the anterior abrasion upon themselves or having it done for them by another person. Thirty-nine percent of the subjects with a maximum TFI score of 7, 51% of those with a maximum TFI score of 8 and 60% of those with a maximum TFI score of 9 artificially abraded their anterior teeth. Figures 5 and 6 illustrate the appearance of anterior teeth which were artificially abraded by the children to remove fluorosis for esthetic reasons.

Dietary factors

Consumption of milk, fish and tea

Current consumption of milk tea, and fish varied from site to site. Consumption of milk ranged from a low of 1.41 half-cups per week at Site 1 to a high

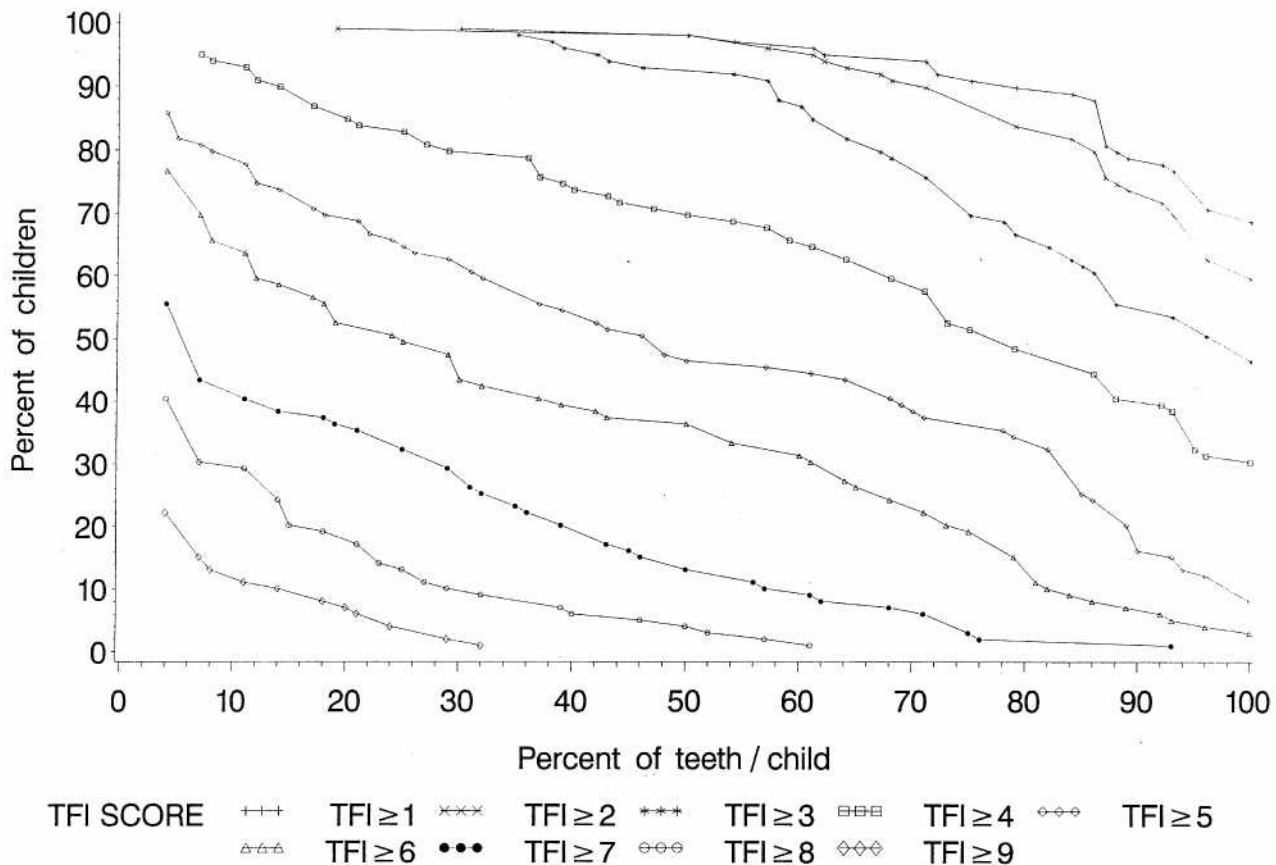


Fig. 1. Cumulative frequency distribution curves of the proportion of teeth per child exhibiting Thylstrup Fejerskov Index of Fluorosis scores 0-9: Site 2, Rundugai.

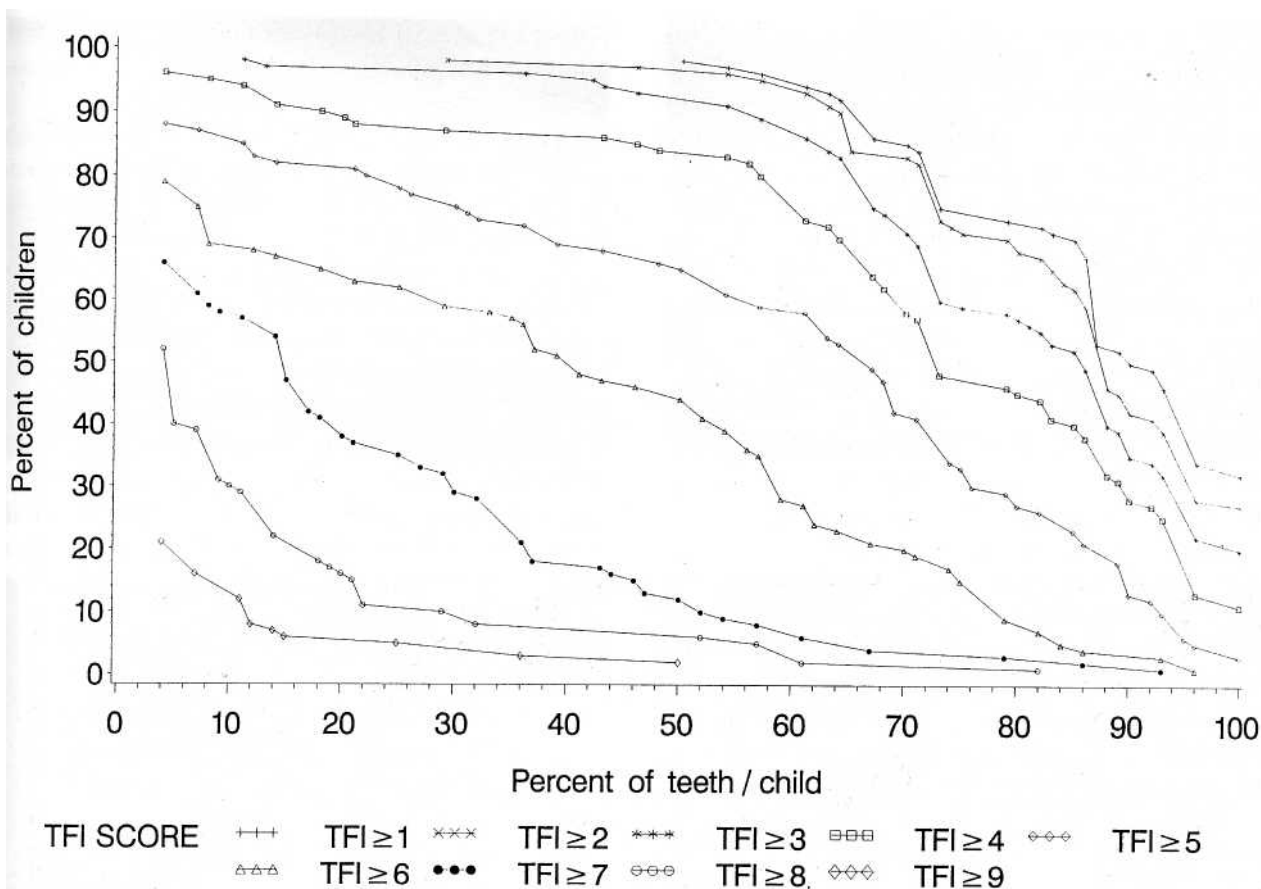


Fig. 2. Cumulative frequency distribution curves of the proportion of teeth per child exhibiting Thylstrup Fejerskov Index of Fluorosis scores 0-9: Site 3, Kibosho.

of five half-cups per week at Site 2. Seventy-four percent of the subjects at Site 1 reported that they never drank milk. Tea was used most extensively at Site 1, averaging 8.66 cups per week. Children from Sites 2 and 3 consumed a mean of 7.2 and 6.23 cups of tea per week, respectively. Fish was eaten 4.34, 6.42, and 4.24 times per month at Sites 1, 2, and 3, respectively.

Magadi

Questionnaires revealed that magadi was being used by 77%, 96% and 99% of families in Sites 1, 2 and 3, respectively. The families cooked with magadi a mean of 1.50 (±0.71); 2.24 (±1.14); and 3.04 (±0.96) times each week at Sites 1, 2, and 3, respectively. When asked if food cooked with magadi was given to babies and toddlers, 9.5% from Site 1, 88.8% from Site 2, and 100% from Site 3 answered "yes".

Magadi samples (n =139) were analyzed for fluoride content. Mean magadi fluoride concentrations were 16010±28514; 4113±2446, and 5037±1815 mg/L at Sites 1, 2 and 3, respectively. Fluoride in ma-

gadi ranged from 189 to 83 211 mg/L. Median values were 3767, 3783, and 4661 mg/L at Sites 1, 2, and 3 respectively. Ten percent of the magadi samples were re-analyzed two to four times on different days to confirm the wide range of fluoride concentrations. Four samples of magadi, two each from Sites 1 and 3, were analyzed for element composition. Element analysis revealed that some components of magadi were aluminum, iron, magnesium, manganese, strontium and titanium, with much higher concentrations, up to sevenfold, of these elements in samples from Site 3 as compared with Site 1. Element analysis determined that the samples of magadi used at Site 3 contained significantly higher concentrations of magnesium than the magadi used at Site 1 (median 490 vs 2600 mg/kg).

Meal fluoride concentration

Table 1 illustrates the results of composite meal fluoride analyses. Meals typically contained two foods, commonly including beans, rice, maize meal, spinach, plantains and, less commonly, meat. Mean fluoride in meal samples was 0.49±2.16;



Fig. 3. Dental fluorosis in a subject from Site 3; 1463 m altitude with negligible fluoride water concentration.



Fig. 5. Anterior teeth from Site 3 showing evidence of rubbing with a stone to remove disfiguration; 1463 m altitude with negligible fluoride water concentration.



Fig. 4. Dental fluorosis in a subject from Site 3; 1463 m altitude with negligible fluoride water concentration.

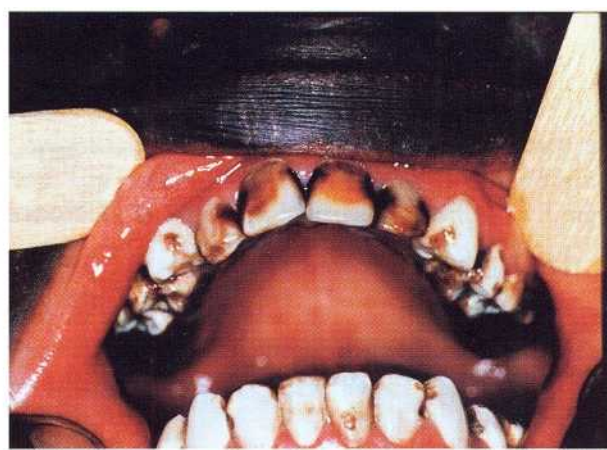


Fig. 6. Anterior teeth from Site 3 showing evidence of rubbing with a stone to remove disfiguration; 1463 m altitude with negligible fluoride water concentration.

Table 2. Percentage distribution of fluorosis scores for all surfaces — Tooth Surface Index of Fluorosis (TSIF)

| Site | Number of surfaces | Distribution of fluorosis scores (%) | | | | | | | |
|--------|--------------------|--------------------------------------|-------|------|-------|-------|-------|------|-------|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| Site 1 | 5833 | 99.30 | 0.60 | 0.07 | 0.00 | 0.02 | 0.02 | 0.00 | 0.00 |
| Site 2 | 6891 | 15.25 | 15.73 | 4.44 | 26.89 | 10.16 | 11.49 | 1.20 | 14.83 |
| Site 3 | 6796 | 9.11 | 14.89 | 4.91 | 22.63 | 11.68 | 16.10 | 4.03 | 16.64 |

Table 3. Percentage distribution of fluorosis scores for all teeth — Thylstrup Fejerskov Index of Fluorosis (TFI)

| Site | Number of teeth | Distribution of fluorosis scores (%) | | | | | | | | | |
|--------|-----------------|--------------------------------------|------|------|-------|-------|-------|-------|-------|------|------|
| | | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
| Site 1 | 2097 | 99.00 | 0.81 | 0.19 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Site 2 | 2617 | 8.99 | 2.41 | 7.26 | 16.43 | 18.27 | 14.48 | 16.62 | 9.32 | 5.43 | 2.79 |
| Site 3 | 2656 | 14.98 | 2.07 | 5.23 | 8.77 | 14.04 | 17.36 | 17.81 | 10.28 | 6.14 | 3.31 |

2.47±3.55, and 2.14±3.89 mg/L at Sites 1, 2 and 3, respectively. Meal fluoride was high in Sites 2 and 3. There was wide variation of fluoride concentrations among meals containing foods which were typically cooked with magadi such as beans and plantains. Fluoride concentration in meals containing beans ranged from 0.03 to 19.97 mg/L, in plantains 0.08 to 22.04 mg/L, and in rice 0.03 to 15.51 mg/L.

Urinary fluoride concentration

Mean urinary fluoride concentrations were 0.52±0.69; 4.43±8.38, and 1.43±1.79 mg/L for children living in Sites 1, 2, and 3, respectively. In Site 1, the mean urinary fluoride concentration was similar to the drinking water fluoride concentration. Mean urinary fluoride concentration in Sites 2 and 3 exceeded the water fluoride concentration. There was a single outlier of 71.79 mg/L fluoride at Site 2. The next highest urinary fluoride value at Site 2 was 26 mg/L. Eight of the 100 subjects from Site 2 had urinary fluoride concentrations above 10 mg/L, which is the reference value described as toxic (19). An additional five subjects had urinary fluoride concentrations of 8 to 10 mg/L.

Nutritional status

Among Tanzanian children who were the same ages as the subjects in this study, 52.7% (±14.06) from the region of Site 2 and 44.2% (±9.54) from the region of Site 3 had been malnourished by World Health Organization (WHO) standards between 1981 and 1990, which were the years when their permanent teeth would have been forming. Malnutrition is defined by WHO as <80% of the international standard weight for age. Data were provided by the Regional Maternal and Child Health Offices. Data for Site 1 were not available.

Dental caries

Caries experience was low in all three sites. Only 43 of the 284 children had DMFS >0. Mean DMFS for all sites combined was 0.52±1.52. Mean DMFS was 1.39±2.45, 0.15±0.73 and 0.19±0.61 at Sites 1, 2, and 3, respectively. No restorations were present in any of the subjects. Of those who had DMFS >0, the distribution of caries and missing teeth in relation to maximum fluorosis scores was weighted to the least and most heavily fluorosed teeth. Sixty percent of caries was detected in the least fluorosed teeth (TFI 0–1) and the next highest percentage of caries (16%) was detected in the most severely fluorosed teeth (TFI 8–9).

Seventy-one permanent teeth had 116 decayed surfaces, which were predominantly in occlusal surfaces (54.3%), 5.2% were detected on mesial surfaces, 11% on distal surfaces, 23.3% on buccal surfaces, and 7.8% on lingual surfaces.

Discussion

The disfiguring and disabling results of fluorosis are of concern to the people of Tanzania; therefore, one of their National Health Objectives targets reduction of severe endemic fluorosis. Anticipated outcomes of this research include offering recommendations for interventions which may help to alleviate problems related to fluorosis in Tanzania.

In addition to being a visible sign of excessive fluoride consumption, dental fluorosis is also of esthetic concern to Tanzanians. In Kibosho (Site 3) van Palenstein (14) reported that among the children who had fluorosis scores of TFI ≥4, there was a statistically significant relationship between the level of fluorosis and the children's responses related to feelings of distress, worry and hindered smiling because of dental fluorosis.

The fluorosis experienced by some Tanzanians does not, however, have an obvious etiology. In this study Site 3 is of particular interest, because it is an example of a location where the etiology of severe dental fluorosis is not completely understood. It would be expected that the children in Site 3, who consume water with less than 1.0 mg/L F, according to the determination of optimal fluoride concentration in drinking water, should not be experiencing severe dental fluorosis. Also, the urinary mean fluoride concentrations of the subjects in Site 3, although they were past the age of tooth formation, were within normal limits for urinary fluoride (4) and, assuming their diets have not significantly changed, do not reflect what would be expected of subjects with such severe fluorosis. The normal urinary values which co-existed with severe fluorosis found among the 12–19-year-old subjects at Site 3 in this study contrast with Mabelya and collaborators' 1997 report of observations in other locations in Tanzania (6). They found that urinary fluoride excretion of preschool children corresponded with their levels of fluorosis and the fluoride content in samples of magadi used in their villages. Mabelya concluded that use of the high fluoride-containing magadi was the major determinant of the prevalence and severity of fluoride. At Site 3, it is difficult to entirely blame high fluoride-containing magadi for the enamel distur-

bances, because excessive fluoride was not found in the urine of these children.

As expected, the subjects from Site 2, who consume water with excessive fluoride, exhibited severe dental fluorosis. However, the contrast between Site 1 and Site 3 was dramatic. Both had negligible water fluoride concentrations, yet Site 1 children had minimal fluorosis, while virtually all of the subjects at Site 3 experienced severe fluorosis. Site 1 provided a description of the expected absence of fluorosis in the absence of excessive fluoride in water in Tanzania. Site 2 enabled comparison of the data from Site 3 with a site having similar ethnic population, but experiencing fluorosis assumed to be resulting from a known, measurable fluoride source: excessive concentrations of fluoride in water. Comparisons of clinical and laboratory results from these three groups may contribute to identifying the risk factors for this surprising and unfortunate phenomenon.

Twelve water samples from Site 3 which were analyzed in 1976 at Indiana University and another set of twelve samples which were analyzed in 1978 at the Royal Dental College in Denmark were consistent with the results of the water analysis of this study; all contained <0.2 mg/L fluoride. Consequently, it was assumed that water fluoride values were similar during the time of amelogenesis of the subjects and during this study.

Several factors that were common to the subjects at Site 3 have been theoretically associated with severe dental fluorosis. Residence at high altitude has been associated with intensified enamel disturbances. Whitford & Angmar-Mansson (20) found that enamel disturbances were exacerbated in rats raised in hypobaric chambers which simulated high altitudes. They further determined that these disturbances were more severe than in animals fed the same diet and housed at low altitude. The disturbances also occurred in animals housed at high altitude, with or without the ingestion of significant fluoride. The researchers theorize that something other than fluoride may be responsible for these enamel disturbances. Alterations in acid-base balance, caused by hypobaric hypoxia during residence at high altitude, was cited as the cause of decreased urinary excretion of fluoride and therefore greater retention and utilization of fluoride. Additional research resulted in Whitford's 1997 statement, "The marked effects of hypobaric hypoxia on the quality of enamel may be due to increased magnesium" (20). On the basis of Whitford's statement regarding the potential role of

magnesium in the severe enamel defects related to hypobaric hypoxia, it may be valid to question the role of the ingestion of components other than fluoride in magadi, such as magnesium, which may play a role in causing the extreme enamel defects which were found among the high altitude population in this study.

Excessive fluoride in food may exacerbate dental fluorosis. A cooking additive used in Tanzania, locally known as magadi, was described in 1992 by Mabeya (21). The additive is especially useful in locations where cooking fuel and firewood is expensive and scarce or must be carried long distances. Magadi seasons food and also shortens cooking time for hard foods such as beans and plantains. It is put in water from the beginning of the cooking time and in some cases is absorbed entirely into the food, but may be partially poured out when the food does not entirely absorb the cooking water. This food tenderizing effect is especially important at high altitude, because water boils at a lower temperature, resulting in longer cooking time, thus consuming more fuel. The samples of magadi analyzed by Mabeya ranged in fluoride content from 36 to 9000 mg/L (6). Ten grams of magadi were typically used in cooking a meal. This evaporite mineral, harvested from the shores of alkaline lakes during the dry season, consists of sodium carbonate, sodium bicarbonate and trona. To be effective in speeding meal preparation, magadi must be in the boiling water for the duration of the cooking time; consequently, unlike table salt, it cannot be sprinkled on the cooked food of only those family members who are not in the ages when tooth development occurs.

Ninety-nine percent of the children at Site 3 reported that their mothers added magadi to the cooking pot at a mean frequency of close to three times a week. The children from this site had severe fluorosis. Seventy-seven percent of children at Site 1 said that their mothers used magadi a mean frequency of close to once each week; they had negligible fluorosis. Only 9.5% of the children from Site 1, where only negligible fluorosis existed, said that toddlers were given food cooked with magadi, while 100% in Site 3 reported that toddlers ate food with magadi. The most critical time at which the fluoride in magadi would affect the dentition is during amelogenesis. This difference in the use of magadi to cook food given to toddlers could account for the wide gap between the mean maximum fluorosis scores of 0.07 and 6.96 for Sites 1 and 3. The investigators in this study, however,

questioned the possibility of under-reporting in Site 1 regarding use of magadi in toddlers' food. Because fuel for cooking is so costly, it seemed unlikely that so many households would be cooking two meals, one with and one without magadi. Unfortunately, because of distance it was not possible to verify these data from Site 1.

Mean fluoride concentrations of food typically cooked with magadi revealed a wide range of fluoride concentrations. Analyzed meals containing plantains and beans had fluoride concentrations as high as 19.97 and 22.04 mg/L F respectively. The normal fluoride value for beans is approximately 1.70 mg/L fluoride (22). Typically, red beans are used extensively; seldom are other varieties introduced. Normal values for plantains were not available. It was assumed that meals with high concentrations of fluoride were cooked with magadi.

Although only a few samples (four) were analyzed, differences in element composition of magadi from Site 1 and Site 3 may suggest a risk factor for enamel disturbances. In Site 3 the aluminum concentration was 7.6 times as high as in magadi samples from Site 1. Iron was 54 times as high, magnesium was 5 times as high, manganese was 8 times as high, molybdenum was twice as high, strontium was 4.7 times as high and titanium was 7.2 times as high as magadi from Site 1. Although the elements were present in the magadi samples, their bioavailability was not determined. Two elements which may pose risk factors for enamel disturbances are aluminum and magnesium. Excessive aluminum ingestion is known to cause osteomalacia as a result of its ability to cause phosphate depletion (23), but the impact of aluminum on enamel has not been documented. Aluminum's known ability to interfere with calcium-phosphorous metabolism could explain the potential of interfering with mechanisms that are basic to tooth formation. It is known that magnesium has affected enamel formation in laboratory animals (24), but this effect has not yet been proved in human subjects.

According to Tanzanian Maternal and Child Health records, approximately half of the children in the regions of Sites 2 and 3 were malnourished, by World Health Organization standards, during each year from 1981 to 1990, the years when the subjects' teeth were developing. Malnutrition and other nutritional variables have been suggested as contributors to fluorosis development (7, 8). Frequent tea consumption, especially among young children, has been cited as a contributor to fluoride

bioburden (25). Children in each of the study sites consumed a mean of about one cup of tea per day at the time of the study. There was no variation in tea consumption among sites which could be correlated with fluorosis severity. Inadequate dietary intake of calcium, usually due to inadequate milk consumption, has been associated with increased fluoride-related bone changes (8). In this study, children from Site 1, where there was negligible fluorosis, drank the least amount of milk; 62 (74%) reported currently drinking no milk.

Collecting urine samples from toddlers during the ages of amelogenesis could have provided additional and potentially significant information; however, the scope and time limitations of this study did not allow for sampling that population. Urine from school-aged subjects was the only biological sample available for analysis to estimate the amount of fluoride ingested by the subjects. If acid-base changes caused by living at high altitude decreased the urinary excretion of fluoride, as suggested by Whitford (4), urine may not be the best body fluid for measuring fluoride bioburden. Unfortunately, drawing and transporting blood, which could provide a more precise measure of fluoride bioburden, was not feasible in this study.

Children from Site 3 had unexpectedly high mean urinary fluoride compared with fluoride in the water they consumed, but unexpectedly low urinary fluoride compared with their mean fluorosis scores; urinary fluoride was 1.43 ± 1.79 mg/L, water fluoride was 0.18 ± 0.32 mg/L and their mean TFI was 4.39 ± 1.52 .

As determined by Pearson correlation coefficient, when combining all sites, there were statistically significant linear relationships between food fluoride and urine fluoride ($r = 0.31$), as well as between urine fluoride and magadi fluoride ($P < 0.0001$). These findings showed that first morning urine void was an indicator of the fluoride content of food consumed the previous evening.

It was surprising to find that even in the two sites with pervasive, severe fluorosis, several children were examined who had very little evidence of enamel disturbances. Teachers verified that those children had lived there all their lives and questionnaires also verified that their families cooked with magadi. Their urinary fluoride values and meal fluoride values were similar to the children with severe fluorosis. The question of possible genetic influence surfaced when it was noted that only Site 3, the site of unexplained severe fluorosis, was tribally homogenous; only children from the Chagga tribe

attended Kibosho School. Sites 1 and 2 were heterogeneous with students from 12 or more tribes at each site. The possibility of genetic predisposition to fluoride tolerance or intolerance has not been determined in humans, but has been demonstrated in the laboratory. In 1994 Katsura et al. (26) isolated 13 fluoride-resistant mutants of the nematode *Caenorhabditis elegans*. All of the mutations were recessive and mapped to five genes. The nematodes with mutations in three of the five genes were resistant to 400 µg/mL sodium fluoride; the nematodes without these genetic mutations did not survive that fluoride dose. This research suggests the possibility of investigating human genetic variability in tolerance for fluoride or differences in response to fluoride ingestion during tooth formation.

Conclusions

An analysis of covariance model supported the research hypothesis that the three communities, at various altitudes, differed significantly in mean fluorosis scores ($P < 0.0001$). Controlling for urinary fluoride concentration and urinary fluoride:urinary creatinine ratio, we found that location appeared to significantly affect fluorosis severity. Urinary fluoride:urinary creatinine ratio had a stronger correlation than urinary fluoride concentration with mean maximum fluorosis scores ($r = 0.43$ vs $r = 0.25$).

Fluorosis at the 1463 m site on Mount Kilimanjaro was more severe than would be expected from the low water and normal urinary fluoride values which existed. Altitude; the elements, including fluoride, which are contained in magadi; and other nutritional factors may contribute to the severity of fluorosis observed. Although statistical analysis implicated lifelong residence at that location, 1436 m altitude, as a risk factor in the severe fluorosis which was observed at Site 3, it is reasonable to expect, on the basis of the evidence collected in this study, that other factors may play a part in this high prevalence of fluorosis. The differences which were observed in the populations and which could be potential risk factors for developing severe fluorosis were:

- Frequency and patterns of use of high fluoride-containing cooking additive, magadi
- Altitude of residence since birth
- Elements, other than fluoride, in magadi (which were found in higher concentrations in magadi from Site 3)
- Nutritional factors (malnutrition, tea and insufficient milk consumption)
- Genetic factors.

These study results concurred with findings of other investigators who reported that disproportionately severe fluorosis was found among residents of relatively high altitudes in developing countries (2, 21). Although short-term laboratory studies did not demonstrate uncompensated respiratory alkalosis and its related dental anomalies at simulated altitudes as low as Site 3 (1463 m), epidemiological data from human studies have verified the presence of such dental anomalies at this altitude (1, 21, 27).

Further research is indicated, including a longitudinal study beginning with very young children living at Site 3 in Kibosho. Monitoring actual fluoride ingestion from all sources, monitoring blood fluoride concentration and comparing with urinary fluoride values, and then observing the resulting tooth development could contribute important information to the study of enamel disturbances. It may also be useful to survey other developing countries to determine the distribution and extent of the use of fluoride-containing food additives in other regions that exhibit unexplained severity of dental fluorosis.

This study has been reported to Tanzanian officials and several recommendations are offered:

- Since achieving complete elimination of the use of magadi is unlikely, attempt to find and distribute quantities of magadi which are low in fluoride concentration.
- Discourage giving food cooked with magadi to young children.
- Discourage the extensive use of tea for young children in areas where fluorosis is endemic. Tea is not only non-nutritive, it is also high in fluoride.
- To the extent possible, continue efforts to improve the nutritional status of young children.

These suggestions are offered because they are reasonable and may be possible to accomplish. Even if altitude were proved to be the primary determinant in severe fluorosis, relocating people away from the villages of their ancestors to lower altitudes is an unattainable goal both from economic and cultural perspectives.

Tanzanians are experiencing the most severe consequences of fluoride toxicity: crippling skeletal fluorosis and severe dental fluorosis. Their efforts to defluoridate are commendable, but, as health officials are aware, it is an incomplete response to a complex problem in a highly rural population. It appears that fluoride toxicity in both high and low water fluoride areas of Tanzania is a problem con-

founded by several other variables. The response to this problem, therefore, should be multifactorial and should include not only continued research and defluoridation but also immediate action to formulate healthful public policy and to educate the affected people. It would be beneficial to enlist the help of Tanzanian Maternal and Child Health workers as well as dental and medical personnel to convey the educational messages which may alleviate the problems observed in this study.

Acknowledgments

This study was supported by a grant from the Oral Health Research Institute of Indiana University School of Dentistry.

The authors gratefully acknowledge that support and the outstanding cooperation of the Tanzanian Government, The University of Dar es Salaam, and the headmasters, teachers and students at the study sites.

References

1. Manji F, Bxlum V, Fejerskov O. Fluoride, altitude and dental fluorosis. *Caries Res* 1986;20:473–80.
2. Leatherwood EC, Burnett GW, Chandravejjsmarn R, Sirikaya P. Dental caries and dental fluorosis in Thailand. *Am J Public Health* 1965;55:1792-9.
3. Grech P, Latham MC. Fluorosis in Northern Region of Tanganyika. *Trans Roy Soc Trop Med* 1964;58:566–73.
4. Whitford GM. The metabolism and toxicity of fluoride. 2nd ed. Basel: Karger; 1996. p. 46–113.
5. Mabelya L. Dietary fluorides, dental fluorosis and dental caries in Tanzanian populations [PhD thesis]. University of Dar es Salaam; 1995.
6. Mabelya L, van Palenstein Helderma WH, van't Hof MA, Koenig KG. Dental fluorosis and the use of a high fluoride-containing trona tenderizer (magadi). *Community Dent Oral Epidemiol* 1997;25:170–6.
7. Massler M, Schour I. Relation of endemic dental fluorosis to malnutrition. *JAMA* 1952;44:156–65.
8. Mithal A, Trivedi N, Gupta SK, Kumar S, Gupta RK. Radiological spectrum of endemic fluorosis: relationship with calcium intake. *Skeletal Radiol* 1993;22:257–61.
9. The National Plan for Oral Health 1988–2002. The United Republic of Tanzania Ministry of Health and Social Welfare; June 1988.
10. Christie D. The spectrum of radiographic bone changes in children with fluorosis. *Radiology* 1980;136:85–90.
11. Fejerskov O, Manji F, Blum V. Dental fluorosis — a handbook for health workers. 1st ed. Copenhagen: Munksgaard; 1988. p. 9–16.
12. Horowitz H, Heifetz S, Driscoll W, Kingman A, Meyers R. A new method for assessing the prevalence of dental fluorosis — the tooth surface index of fluorosis. *J Am Dent Assoc* 1984;109:37-41.
13. American Dental Association. Council on Dental Research and Council on Dental Therapeutics. Proceedings of the Conference on the Clinical Testing of Cariostatic Agents; 1968 Oct 14–16; Chicago. p. 87–8.
14. van Palenstein Helderma WH, Mkasabuni E. Impact of dental fluorosis on the perception of well-being in an endemic fluorosis area in Tanzania. *Community Dent Oral Epidemiol* 1993;21:243–4.
15. Taves DR. Separation of fluoride by rapid diffusion using hexaamethydisiloxane. *Talanta* 1968;15:969-74.
16. Ares J. Urinary fluoride: dependence on pH, creatinine excretion and occupational exposure. *Bull Environ Contam Toxicol* 1989;42:905–10.
17. Kertesz P, Banoczy J, Ritlop B, Brody L, Peter M. The determination of urinary fluoride/creatinine ratio (Q) in monitoring fluoride intake. *Acta Physiol Hung* 1989;74:209–14.
18. Fleiss JL, Chilton NW. The measurement of interexaminer agreement on periodontal disease. *J Periodont Res* 1983;18:601–6.
19. SmithKline Beecham Clinical Laboratories. Directory of services reference guide. 1997–98. Collegeville, Pennsylvania.
20. Whitford GM, Angmar-Manson B, Sharawy MM. Fluoride and high altitude hypobaric hypoxia: effects on calcified tissues [abstract]. *J Dent Res* 1997;76:272.
21. Mabelya L, Konig KG, van Palenstein Helderma WH. Dental fluorosis, altitude, and associated dietary factors. *Caries Res* 1992;26:65–7.
22. Bell ME, Largent EJ, Ludwig TG, Muhler JC, Stookey GK. The supply of fluorine to man. In: Adler P, Armstrong WD, Bell ME, editors. *Fluorides and human health*. Geneva: World Health Organization; 1970. p. 17–59.
23. Chines A, Pacifici R. Antacid and sucralfate-induced hypophosphatemic osteomalacia: a case report and review of the literature. *Calcif Tissue Int* 1990;47:291–5.
24. Angmar-Mansson B, Whitford GM, Allison NB, Devine JA, Maher JT. Effects of simulated altitude on fluoride retention and enamel quality [abstract]. *Caries Res* 1984;18:165.
25. Levy SM, Kiristy MC, Warren JJ. Sources of fluoride intake in children. *J Public Health Dent* 1995;55:39-52.
26. Katsura I, Kondo K, Amano T, Ishihara T, Kawahami M. Isolation, characterization and epistasis of fluoride resistant mutants of *Caenorhabditis elegans*. *Genetics* 1994;136:145–54.
27. Lewis HA, Chikte UME, Butchart A. Fluorosis and dental caries in school children from rural areas with about 9 and 1 ppm F in the water supplies. *Community Dent Oral Epidemiol* 1992;20:53–4.

A Framework for Service-Learning in Dental Education

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Abstract: Service-learning has become an important component of higher education. Integrating service-learning into dental and dental hygiene curricula will foster graduates who are better prepared to work effectively among diverse populations and to function dynamically in the health policy arena. Although the phrase is familiar to dental educators, there is not a consistent understanding of what comprises this pedagogy. This article offers a framework for service-learning in dental education and describes ten components that characterize true service-learning. This framework can provide a common understanding of this form of experiential education that brings community engagement and educational objectives together. More effective programs can be built around a shared understanding of the characteristics and goals of service-learning in dental education.

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Key words: service-learning, community-engaged scholarship, dental public health, access to care, community dentistry

Submitted for publication 8/3/05; accepted 10/11/05

Experiential education is a basic feature of preparing dental professionals. Dental students master clinical skills through the experience of providing services for patients in dental school clinics with direct supervision, in combination with didactic instruction. However, in addition to mastering the art and science of dentistry, the public expects dentists to be prepared to serve diverse patients and communities and to use their knowledge to inform the development of public policy. Dental education can apply the concepts of experiential education to developing students' skills in understanding human diversity and the dynamics of community. Dental education can foster skills in influencing and shaping public policy about health issues. Dental education can cultivate graduates who have a broader understanding of health and social service agencies, thereby enabling them to become advocates for patients, family, or community members in need of help. Consequently, dental educators need to ask the question: Do dental graduates internalize an appropriate vision of their role as a health professional in the context of community? Integrating service-learning into the dental curriculum will create a deeper understanding of the dynamics, the assets, and the challenges of the community and its relationship to oral and general health. These insights can be taught most

effectively though experiential learning in partnership with the community. According to Aristotle, "What we have to learn to do, we learn by doing."¹ Therefore, to foster graduates with skills and ethics that reflect value for civic responsibility, dental education must create the opportunity for students to experience activities that will facilitate acquisition of those skills and values.

Integrating dental education into the community has far-reaching benefits, not the least of which is to enhance the understanding that dental education is a public good, not simply a private benefit for the privileged who become dental students and ultimately practicing dentists. One state, Indiana, recognized the potential of service-learning to contribute to the community good. In 2002, the Indiana State Legislature passed the following resolution: "Resolved: That the House of Representatives of the Indiana General Assembly urges the institutions of higher education in the State of Indiana, and especially those institutions that are state-supported, to utilize service learning as a central vehicle for campus-community collaboration and of engagement of those institutions, and as an important pedagogy for student learning and for nurturing lifelong citizens."

Service-learning is now a major national movement. Connecting academic study with community

service through structured reflection is widely recognized as contributing to learning that is deeper, longer-lasting, and more portable to new situations and circumstances.² Service-learning as a pedagogy is a response to concerns about the ability of higher education to make the connection between teaching technical skills and using those skills to address issues of public concern.^{3,4} For six years, Eyster and Giles studied 1500 college students from over twenty institutions across the United States who were involved in service-learning.⁵ They found that the majority reported and demonstrated that they had a deeper understanding of the subject matter and the complexity of social issues and were better able to apply material they learned in class to real problems.

The Role of Service-Learning in Dental Education

Increasingly, schools of dentistry are integrating required rotations in community health center dental clinics, hospitals, and private practices located in dental health professions shortage areas. The Robert Wood Johnson Foundation Pipeline, Practice, and Community Project funded fifteen schools of dentistry to move toward placing students in community rotations sixty days of their fourth year of predoctoral education and to pursue enrollment of underrepresented minorities. The Pipeline program and increased community-based clinical placements by other dental educational institutions is a move in right direction. With this new emphasis comes an opportunity to implement a service-learning model that will provide an even greater depth of understanding and will produce graduates with more sophisticated knowledge of the dynamics of community.

Service-learning is known by many, widely varying definitions. The first definition, published in 1979, described it as an experiential educational approach based on reciprocal learning. Since that time, the pedagogy has developed in sophistication and has grown in use and acceptance. A widely accepted definition was developed by Community Campus Partnerships for Health (CCPH), the lead organization promoting community engagement among health professional schools. In the CCPH definition, service-learning is a structured learning experience that combines community service with preparation and reflection. Students engaged in service-learning provide community service in response

to community-identified concerns and learn about the context in which service is provided, the connection between their service and their academic coursework, and their roles as citizens.⁶

Furco's model graphically explains the differences between service-learning and other types of experiential learning (Figure 1).⁷ This model places service programs on a continuum determined by its primary intended beneficiary and its overall balance between service and learning. Each program occupies a range of points on the continuum and is positioned to illustrate whether the emphasis of that type of experiential learning is focused on the learning or the service and whether the beneficiary is the provider or the recipient. Service-learning is positioned in the center to illustrate an equal emphasis of focus on learning and service, as well as equal benefits for the student and the recipient. Furco's model explains the focus on balancing service and learning, and CCPH's definition elucidates the characteristics of service-learning.

The framework for dental education proposed in this article offers a structure around which the planning, implementation, and evaluation of service-learning in the dental curriculum can be built. The framework is comprised of ten components, all of which should be present to categorize community engagement as service-learning in dental education (Figure 2). The components are described here and are illustrated in a case study in the Appendix. Through use of this framework, dental educators will be able to differentiate between service-learning and other types of community engagement. This differentiation will enable more precise understanding of the characteristics of the programs being discussed.

1. Academic Link

Service combined with learning adds value to each and transforms both.⁸ Service-learning must be an academic activity: it can be course-based, competency-based, or a structured volunteer experience. In dental education the most obvious community locations are community health center dental clinics, hospital dental clinics, and private offices in areas designated as dental health professions shortage areas (DHPSA). Predoctoral-preclinical years may be overlooked as an opportunity to begin the process of integration into community-based experiential learning. Some of the most powerful service-learning experiences occur in a nonclinical setting, where the artificial barriers of the "white coat" do

Distinctions Among Service Programs

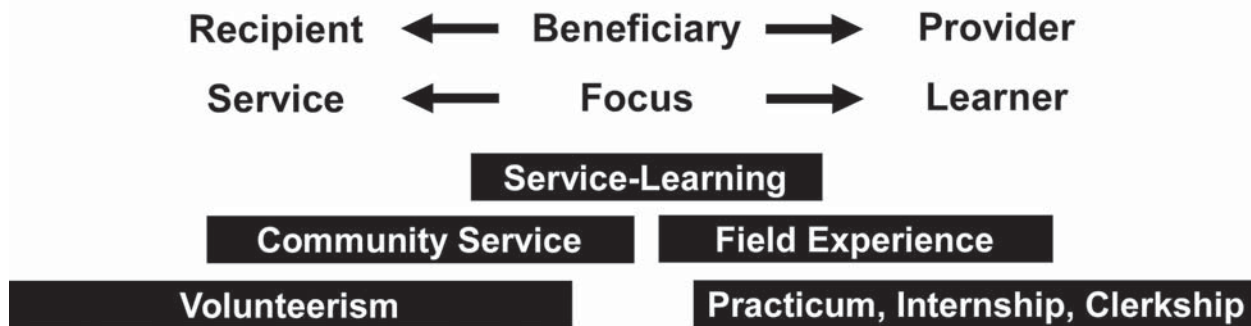


Figure 1. Distinctions among service programs

Source: Furco A. Service-learning: a balanced approach to experiential education. At: www.floridacompact.org/pdf/resources/SL-ABalanced Approach.pdf.

not interfere with communication and where students can critically examine and question what they know as they reframe their understanding of the impact of social issues on health. There are limitless potential locations for nonclinical experiences: Head Start programs; shelters for the homeless or victims of domestic violence; Special Olympics; rehabilitation centers; Women, Infants, and Children's Nutrition (WIC) centers; state or county health departments. Nonclinical and clinical assignments require a clear understanding of the role and objectives of the experience. An effective nonclinical service-learning experience can be structured so that students learn about a population by providing nonclinical service at an agency followed by planning and providing an oral health program or intervention based on the knowledge gained about that group in the first phase of the rotation.

2. Sustained Community Partnerships

In addition to clinical rotations, dental education typically sends students to community sites to provide oral health education presentations. These assignments may occur with a random approach, involving minimal preparation for engaging the par-

ticular population group, little evaluation, and scant emphasis on developing in-depth, ongoing relationships with the community agency or institution. Conversely, the assignments may be consistent with the service-learning method, in which emphasis is placed on developing a few, high-quality, equal, ongoing relationships with selected community partners. The most valuable partnerships are developed with agencies or institutions that provide direct services for populations with which dental students need to increase their level of comfort and competence. In the dental school patient pool, if there are voids in representation of certain types of disabilities or cultural groups, it may be advantageous to recruit community partners that serve those populations. Community partner agencies are willing contributors to dental students' education. They are advocates for the population they serve and are pleased to have the opportunity to influence students' education and thereby encourage more competent and compassionate care for their clients.

Community partner agencies should be actively involved in identifying the problems to be addressed by the program, and the choice of service-learning activities should be based equally on the educational needs of the students and the needs of the population to be served. The agency appoints a mentor who is

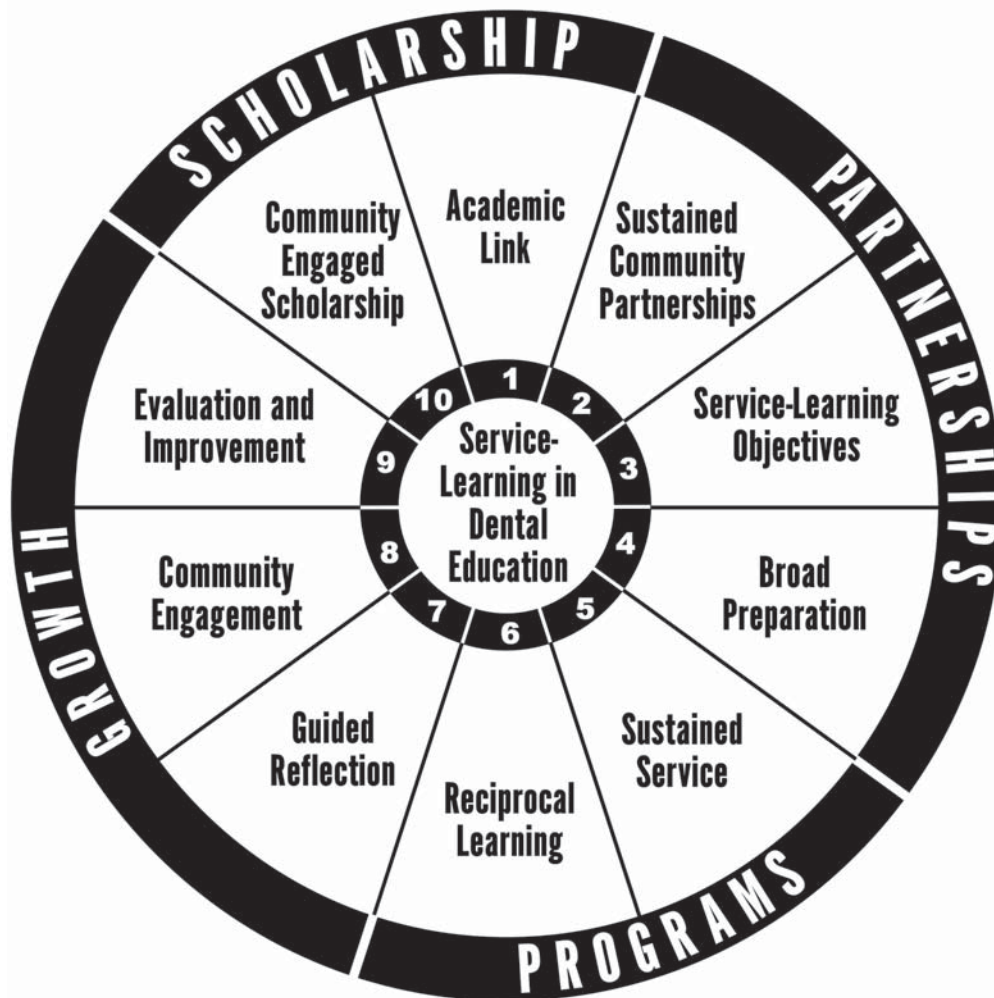


Figure 2. Framework for service-learning in dental education

the primary contact for faculty and students. The mentor can play a variety of roles depending on his or her training, time availability, and interest. The mentor should be a true partner in planning the service-learning program, providing orientation for the students, participating in evaluation of students' service, and overall program evaluation. Describing principles of effective partnerships is beyond the scope of this article, but have been outlined by Community Campus Partnerships for Health.⁹ In recognition of the partnership, some schools offer an honorary nonremunerated faculty appointment, a university library card, email account, or business cards identifying their role as a community partner

with the university. Grants resulting from partnerships should include community partners as recipients, and community partners contributing to research and publications should be listed as coauthors. When the community partner is a dentist in a safety-net clinic, offering continuing education and calibration exercises can lead to shared teaching and evaluation techniques.

3. Service-Learning Objectives

As in didactic classes, the students must understand the expectations. Faculty and community partners should jointly formulate learning and ser-

vice objectives to describe what service they will be providing and how this experience connects with their learning. Objectives are distributed to students, faculty, and community partners and are discussed prior to the service-learning experience. Both service and learning objectives should progress from actions that are clearly measurable and demonstrable (i.e., list, identify, and define) to those that are more complex and require the analysis, application, and synthesis of new material. At the highest level of complexity, students should be asked to criticize, critique, and recommend based on their interpretations of new information.¹⁰

4. Broad Preparation

Preparation for service-learning assignments goes beyond the usual site orientation that describes location and services to be performed. Broad preparation provides students with information that will help them understand the form and function of the agency or institution they will service and the people with whom they will interact. Students may be required to conduct pre-assignment research, often web-based, for information about the agency, the culture being served, demographics of the community including racial distribution and socioeconomic status, and names of legislators who represent that geographic area. Prior to beginning work, students should know, through either research or an orientation session, the mission and vision of the site, what population is being served, funding sources, governance, organizational structure, and characteristics of the population being served. If there are specific characteristics among those being served, such as a certain type of disability, students can be given additional opportunity to become more competent to interact and provide services for that population. Dental schools using problem-based or case-based learning can augment students' preparation for service-learning by building cases that direct students toward researching information about the culture, socioeconomic groups, or people with disabilities being served.

5. Sustained Service

Unlike assignments to provide an educational presentation in a classroom, service-learning involves a sustained amount of time in preparation and service. Although there is no agreed-upon minimum amount of time, some service-learning advocates cite the need for at least twenty hours of service in a single pro-

gram to achieve minimum competency. The amount of time spent in a service-learning assignment will vary according to availability of time, complexity of the program, and other related issues, but should be of sufficient duration to foster depth of understanding and opportunities for reflection. This is one of the defining characteristics that often differentiates service-learning from other community-based activities. Health fairs, classroom presentations, and single short-term programs can be beneficial learning experiences, but are not classified as service-learning by these criteria. Student leadership in planning, implementing, and evaluating such short-term programs, however, can transform the student leaders' experience into service-learning.

6. Reciprocal Learning

Teaching and learning do not always emerge from the academy. An important lesson to be gained through service-learning is that teachers are found in many places, not only in educational institutions. One of the most beneficial results of service-learning is the new-found availability of skilled teachers who have abilities not common among dental faculty members. It is important to alert students to the expectation of learning from the community partner mentors who are highly skilled in working with special populations. As volunteer teachers, they present authoritative information about issues common to the population with which they work. As volunteers, they provide effective teaching at no cost to the school. Agencies are willing to provide these services in exchange for the opportunity to influence students to become practitioners who will be competent, caring dentists for the population they have dedicated their lives to serving. This reversal of roles fosters students who are more respectful of the knowledge of people who are not in the dental or medical professions and encourages them to look to community partners for authoritative information.

7. Guided Reflection

Reflection is a central characteristic of service-learning and has been called the hyphen that links service and learning. In dental education, integration of reflection shows recognition that community-based education must not only strive to enhance the students' knowledge and clinical skills, but also facilitate their personal and professional development.¹¹ Guided reflection causes students to make the connection between their service and academic objec-

tives and fosters the exploration and clarification of complex social issues and personal values. Because the predominant proportion of students will become private practitioners, it is important to make the reflection relevant to their future plans. Reflection can help students examine their role in the community and their relationship with people of other cultures and people with disabilities. Reflection can help students examine their future role in access to care for the unfunded, the unaccepted, the inaccessible, the reluctant, and the unmotivated.

Reflection can occur in a variety of times, locations, and forms, but students report that, to be effective, reflection needs to be continuous, contextual, challenging, and connected.¹² Effective guided reflection can happen prior to, during, and following the experience. Reflection can occur alone or with student colleagues, faculty, service recipients, community partners, or a combination of these people. An effective method of reflection for dental students engaged in service-learning clinical rotations can take the form of written journaling followed by a guided group discussion session that builds on the observations written in the journals. Web-based journal entries are an efficient means of handling students' assignments. Critical incidents have also been used effectively for reflection in dental education.¹³

"What, so what, and now what?," a popular format for service-learning journaling, is a model that grew out of Kolb's theories on the experiential learning cycle.¹⁴ To respond to different students' learning styles, as described by Kolb, it is advisable to offer a variety of types of reflection exercises that include reading, writing, doing, or telling (informing, sharing information). Readings and discussion can include books, professional articles, government documents, and case studies. Reflection through writing can include portfolios, self-evaluation essays, press releases, letter to a legislator or policymaker, and drafting legislation. Reflection by doing can include conducting interviews, simulations, or role playing, creating presentations, and drafting a brochure. Telling can include focus groups, formal class discussions, teaching a class, storytelling, and individual conferences with faculty, the community partner, or a service recipient.

8. Community Engagement

Community engagement involves working in cooperation with a group or groups of people who share a characteristic, such as geographic proximity or a special interest. It is a powerful tool for promot-

ing changes that can improve people's health. It encompasses health promotion and social activism and can utilize the health policy process. In the context of this framework, community engagement is meant to include knowledge about the cultural components of the community and involvement in advocating for health policy issues that affect that community. Community engagement can foster cultural awareness and the desire and ability to become an advocate. The partnerships developed through service-learning create opportunities for students to launch or continue their lifelong venture of learning about the characteristics of different cultures. They develop understanding of the issues facing agencies and organizations that provide services for diverse population groups. A single individual providing dental services for underserved populations has limited potential for significant impact on the problem. However, the results can be more profound and affect a much larger population if addressed on the policy level.

Educational experiences that introduce systemic political or policy-related understanding and engagement can prepare dental professionals to take an active role in instigating changes with far-reaching results.¹⁵ Dental professionals are a reservoir of oral health knowledge and have the potential for shaping healthful public policy. Dental education teaches students to understand the science of dentistry and, through service-learning, that knowledge can be put into action in the political arena, thus enhancing the potential for equitable access to care, effective oral health promotion, public health action, and eventually the improvement of oral health. Skills in shaping healthful public policy are not necessarily intuitive. Incorporating specific course content related to the health policy process and creating opportunities for students to advocate and lobby for improved general and oral health policy will prepare dental students and graduates to take a leadership role in the health policy process. Through a service-learning experience, students can, for example, lobby for an organization they have served, write a letter of support to a policymaker, draft a legislative proposal, or participate in activities of organizations such as the Children's Dental Health Project.¹⁶

9. Ongoing Evaluation and Improvement

Evaluation of classroom instruction typically involves measuring students' mastery of the subject matter. In service-learning, student evaluation is

measured against the service and the learning objectives; therefore, it is important to write the objectives in terms that are quantifiable. Written reflection exercises may be evaluated, but not graded, to encourage students to be candid in writing about their perceptions of their service-learning experiences.

In service-learning, the evaluation takes place throughout the process and includes not only students, but the community partner agency, mentors, participating faculty, and recipients of the service. Because service-learning programs often involve external funding, the evaluation process can be an effective tool for demonstrating outcomes of the program and encouraging continued funding. When service-learning takes place in a safety net clinic, it is appropriate to request evaluations from the dental director, medical director, students, staff, and patients. Evaluations are useless if they are not applied to continuous quality improvement. Funding agencies often request outcomes measures that go beyond describing the process; therefore, collecting information that can verify program impact can be very effective, such as documenting fewer absences at the local school because of toothaches as a result of the students' work at the safety net clinic.

10. Opportunities for Community-Engaged Scholarship

For tenure-track faculty members, good works are not enough. A significant gap exists between the goal of health professional schools to function as community-engaged institutions and the reality of how faculty members are typically judged and rewarded, which often does not value service to the community. For service to become an area of excellence and an asset in the promotion and tenure process, it must become scholarship. The Report of the Commission on Community-Engaged Scholarship in the Health Professions defines community-engaged scholarship as "scholarship that involves the faculty member in a mutually beneficial partnership with the community. Community-engaged scholarship can be transdisciplinary and often integrates some combination of multiple forms of scholarship. For example, service-learning can integrate the scholarship of teaching, application, and engagement, and community-based participatory research can integrate the scholarship of discovery, integration, application, and engagement."¹⁷ Community-engaged scholarship applies to each of these domains: research (e.g., community-based participatory research), teaching (e.g.,

service-learning), and service (e.g., academic public health practice).¹⁸ Throughout the process of integrating service-learning into dental education, faculty should be aware of opportunities to use the experience to inform their teaching, research, and service and should persistently search for opportunities to publish in peer-reviewed journals.

Conclusions

Service-learning is a pedagogy that is well suited to dental education. It has the potential of fostering graduates who have a greater depth of understanding of the populations, institutions, and agencies that comprise their communities and practices. Taking dental students out of the classroom and into the community can create opportunities for greater understanding that culture, lifestyles, and behaviors can profoundly influence the prevalence of health, illness, and oral disease in a population. Service-learning has the ability to provide dental students and faculty with the knowledge, skills, and incentives to enter into the health policy arena and to promote healthful public policy. It can help develop students who have a broader concept of their role as a health care provider. This broader concept would include much more than being an entrepreneur in the health care industry. It would involve functioning as educators, social workers, advocates, and many other roles that make up the matrix of a socially responsible society. This framework can promote broader understanding of the characteristics and concepts basic to service-learning in dental education.

Acknowledgment

The author gratefully acknowledges the consultation of Sarena Seifer, M.D., Executive Director of Community Campus Partnerships for Health during the development of the conceptual model of the Framework for Service-Learning in Dental Education.

REFERENCES

1. Aristotle. *Nicomachean ethics II*. In: *Homebook of quotations*. New York: Dodd, Mead & Co., 1967.
2. Ehrlich T. Service-learning in undergraduate education: where is it going? *Carnegie Perspectives*, July 2005.
3. Boyer EL. *Scholarship reconsidered: priorities of the professoriate*. Princeton, NJ: Carnegie Foundation for the Advancement of Teaching, 1990.
4. Boyer EL. Creating the new American college. *Chronicle of Higher Education*, March 9, 1994.

5. Eyler J, Giles DW. Where's the learning in service learning? San Francisco: Jossey-Bass, 1999.
6. Seifer SD. Service-learning: community campus partnerships for health professions education. *Acad Med* 1998;73(3):273-7.
7. Furco A. Service-learning: a balanced approach to experiential education. At: www.floridacompact.org/pdf/resources/SL-ABalanced Approach.pdf. Accessed: July 15, 2005.
8. Honnet EP, Poulsen S. Principles of good practice in combining service and learning. Wingspread Special Report. Racine, WI: Johnson Foundation, 1989.
9. Principles of good community-campus partnerships. At: www.ccpb.info. Accessed: July 15, 2005.
10. Cashman S, Jarvis C, Hiltzman S. Curriculum development in service-learning. In: Krauel P, Krauel H, eds. 2003 CCPH 7th annual introductory service-learning institute proceedings: advancing educational innovations for improved student learning and community health. San Francisco: Community-Campus Partnerships for Health, 2003.
11. Strauss R, Mofidi M, Sandler ES, Williamson R, McMurtry BA, Carl LS, Neal EM. Reflective learning in community-based dental education. *J Dent Educ* 2003; 67(11):1234-42.
12. Eyler J, Giles DE, Schmiede A. A practitioner's guide to reflection in service-learning: student voices and reflections. Nashville: Vanderbilt University, 1996.
13. Mofidi M, Strauss R, Pitner LL, Sandler ES. Dental students' reflections on their community-based experiences: the use of critical incidents. *J Dent Educ* 2003;67(5): 515-23.
14. Kolb DA. *Experiential learning: experience as the source of learning and development*. Upper Saddle River, NJ: Prentice-Hall, Inc., 1984.
15. Colby A, Ehrlich T, Beaumont E, Stephens J. *Educating citizens: preparing America's undergraduates for lives of moral and civic responsibility*. San Francisco: Jossey-Bass, 2003.
16. Children's Dental Health Project. At: www.cdhp.org. Accessed: July 15, 2005.
17. Commission on Community-Engaged Scholarship in the Health Professions. *Linking scholarship and communities*. Seattle: Community-Campus Partnerships for Health, 2005.
18. Bringle R, Malloy EA, Games R. *Colleges and universities as citizens*. Boston: Allyn & Bacon, 1999.

APPENDIX

Case Study

This case study describes an example of a service-learning program in dental education and identifies the applicable service-learning framework components.

Nineteen fourth-year dental students enrolled in an elective called Service-Learning in Community Oral Health (component #1). They understand that this entails a year-long commitment and will involve providing comprehensive care for adults with disabilities.

Goodwill Industries, which operates a sheltered workshop for adults who are intellectually disabled, is located a few blocks from the School of Dentistry. The workshop manager is concerned that many of their clients apparently have poor oral health and no access to care (component #2). The state's Donated Dental Services is an affiliate of the National Foundation of Dentistry for the Handicapped. The 550 volunteer dentists in the state who provide free care through the Donated Dental Services program for people who are disabled and have low income are aging and retiring, and few younger dentists are taking their places as volunteers. Donated Dental Services wants dental students to become familiar with the program so they will become volunteers (component #2). Both organizations agree to enter into a partnership with the school of dentistry to attempt to improve the oral health of the clients of Goodwill Industries and to enhance the dental students' education and potential for becoming Donated Dental Services volunteers. The organizations and faculty mentors meet to draft service objectives and learning objectives (component #3).

The students receive orientation on site at Goodwill Industries from community partner mentors and faculty mentors about the assets and challenges of the population they will serve, the objectives of the program, and the mission, services, and goals of the agency (component #4). Students and mentors bring portable equipment to Goodwill Industries to assess the oral health status and treatment needs of the clients who have no access to care. Funding has been secured from a local foundation to pay the dental school clinic fees for services. An appropriate number of Goodwill clients are selected for the program consistent with the amount of funding that is available for that year. The mentors and students discuss the individual needs of the selected clients and the skill levels and clinical needs of the students and make assignments to students accordingly. Students visit with the clients at the sheltered workshop, make appointments with them directly or with the help of their family or case worker, and begin treatment.

Students continue providing treatment for patients throughout their fourth year of dental school. Following dental appointments with their patients from Goodwill Industries, students enter reflection notes in a school of dentistry intranet web-log (blog) including formulation of new learning issues that emerged from their interaction with the patients. Patients are identified only by code number on the blogs. On a monthly basis, throughout the academic year, the faculty and community partner mentors meet with the students in this program (component #5). Each session has three components: reflection, topical discussion, and ongoing evaluation. Guided reflection about the ongoing experiences of providing dental services for this population helps the students gain more insights into what they are learning and how it connects with their educational preparation for becoming a dentist (component #7). The community partner mentors, who have extensive experience working with adults who are intellectually disabled, provide presentations and lead discussions about this population. They provide a depth of knowledge about this population that would not typically be found among dental school faculty (component #6). Community partner mentors lead discussions on topics such as autism, deaf culture, handling seizure disorders, American sign language, communicating with people with disabilities, community resources for people with disabilities, and current health policy issues that affect this population (component #8). Monthly, and sometimes more frequently, students and mentors evaluate the program's progress in comparison with the stated service and learning objectives. Program revisions are made when indicated. Students' grades are determined by faculty and community partner mentors cooperatively and are based on comparison of the students' performance measured against the service and learning objectives of the program (component #9).

Data are collected throughout the year that describe many aspects of the program, the oral health of the population being served, techniques and procedures that are being developed and learned, and information on how the process is affecting students' attitudes and skills. These data are a reservoir of information for scholarly publications by the mentors and students (component #10).

Dental Public Health T720F

T720F Dental Public Health Module Syllabus, Fall Semester 2006 *Dental Public Health is a module within the T720 Dental Sciences III, Part I course*

Understanding the role of dentistry in the community, the nation, and the world.

1. General Module Information

Module Director: Karen M. Yoder, PhD, MSD
Module Credit Hours: 1.0
Course Director: Dr. David Brown
Course Credit Hours: 10.5

2. Purpose of the Module

This module will provide an introduction to dental public health with emphasis on its relationship and relevance to dentists in private practice. It will also be a gateway to several service-learning opportunities at local, state-wide and international locations.

3. Goals of the Module

This module will provide fundamental information and/or supporting information for the accomplishment of the following IUSD Institutional Competencies:

- #3. Graduates must be competent to communicate and collaborate with groups and individuals to promote oral and general health and; select strategies, resources and interventions appropriate for the prevention of oral disease in the community.
- #17. Graduates must be competent in discerning and managing ethical issues and problems in dental practice.
- #21. Graduates must be competent in performing and supervising infection control procedures to prevent transmission of infectious diseases to patients, the dentist, the staff and dental laboratory technicians.
- #24. Graduates must be competent in the use of information technology resources.
- #25. Graduates must be competent in detection, diagnosis, risk assessment, prevention, and management of dental caries.

4. Expected Outcomes

At the end of this module the student should be able to:

- Describe the dental and dental public health infrastructure in the United States
- Describe the concepts of oral health promotion
- Describe and plan community-based oral health programs
- Describe service-learning as a academic methodology and be prepared to participate in
 - Service-learning electives
 - Dental services for children who are Amish in Shipshewana

- Service-learning elective with adults who work at Goodwill Industries and are developmentally disabled
 - Homeless shelter sealant program
 - Service-learning requirements
 - SEAL INDIANA rotation
 - Health Policy Forum
- Select interventions and strategies for the prevention and control of oral diseases and promotion of oral health
- Develop and use a foundation of preventive dentistry to provide oral health services and education to people who do and do not access dental services
- Describe and evaluate dental care delivery systems including safety net programs
- Access information about surveillance systems that monitor oral health
- Evaluate dental public health literature and draw conclusions
- Communicate and develop partnerships with groups and individuals on oral health issues
- Describe means of influencing and advocating for public policy to promote oral health for all
- Compare and contrast the codes of ethics of the American Dental Association and the American Association of Public Health Dentistry

5. Learning Resources -

Required Reading:

Burt BA, Eklund SA, *Dentistry, Dental Practice and the Community*. Sixth Edition. 2005 Elsevier Publishers

Resources for classroom educational presentations:

A new American Dental Association resource:

<http://www.ada.org/public/education/teachers/smilesarts/shining.asp>

Dental Health Websites for Teachers and Students

<http://www.atlanticava.org/webandcamsites/dentalhealth.htm>

Recommended Reading:

Cassamassimo P, Holt K. Bright Futures in Practice: Pocket Guide.

<http://www.brightfutures.org/oralhealth/pdf/BFOHPocketGuide.pdf>

Oral Health in America: A Report of the Surgeon General. Executive Summary. May 2000. <http://www.surgeongeneral.gov/library/oralhealth/>

National Call to Action to Promote Oral Health

<http://www.surgeongeneral.gov/topics/oralhealth/nationalcalltoaction.htm>

Healthy People 2010 Oral Health Objectives:

<http://www.healthypeople.gov/Document/HTML/Volume2/21Oral.htm>

American Dental Association Principles of Ethics and Code of Professional Conduct
<http://www.ada.org/prof/prac/law/code/index.asp>

American Association of Public Health Dentistry Code of Ethics and Standards of Professional Conduct
<http://www.aaphd.org/default.asp?page=Policies.htm>

Fadiman, Anne. *The Spirit Catches You and You Fall Down*, Farrar, Straus and Girous Publishers, 1997
<http://www.spiritcatchesyoud.com/>

Knowledgepath: This link provides extensive links to current statistical, organizational and health policy information
<http://www.mchoralhealth.org/knwpathoralhealth.html>

6. Overview of Student Evaluation Methods

Grading Scale:

- A = 100% – 91%
- B = 90% - 81%
- C= 80% - 71%
- D = 70% - 61%
- F = 60% and below

Evaluation Components:

- 50% Attendance, participation and assignments
- 25% Mid-term examination
- 25% Final examination

Make-up exams can be arranged through the module director and will be available for students who have an official excused absence.

7. Additional Module Policies and Procedures

Faculty Contact Information

Dr. Karen Yoder
719 Indiana Avenue, Walker Plaza 204
Mobile: 260.413.7462 (preferred)
Office: 317.278.7872
Home: 260.637 6663

Dr. Mark E. Mallatt
State Oral Health Director
Indiana State Department of Health
2 North Meridian Street
Office: 317.233.7417

Attendance at classes is required. Students will verify their attendance by signing a roster at the beginning of class. Students who have not signed the roster will be recorded as absent.

Examinations will be administering via computer, so students are asked to bring their laptop to each class when an exam is scheduled.

Laptop computers may be used only for note-taking during lectures. Students using laptops for non-class related activities may be dismissed from class and counted as absent. Laptops should not be open if not being used for taking notes or fulfilling class activities.

Remediation Method:

Individual remediation will be available from the module director for students deemed to be in need of special assistance

Unprofessional Behavior:

Professional behavior is expected in all aspects of course interactions including attendance and any assessments (quizzes, exams, etc.). Any professional misconduct will be pursued via the Student Professional Conduct Council. See the DDS Student Handbook for further detail.

8. Instructional Schedule

**T720F Dental Public Health Module
Thursdays 12:30pm – 1:20pm
DS 115**

| DATES | TOPIC | LECTURER | ASSIGNMENT(S) |
|-------------|---|-----------------|--|
| August 17 | Introduction to T720F Pretest on Oncourse (not for a grade) Bring your laptop computer | Dr. Karen Yoder | Assignments In <i>Dentistry, Dental Practice and the Community</i> : Burt & Eklund text unless otherwise noted |
| August 24 | Introduction to Service-Learning and Dental Public Health | Dr. Karen Yoder | Pages 1-24 (Chapters 1,2) |
| August 31 | No class Pre-Accreditation Faculty Meeting | | |
| September 7 | Dentistry and the Community | Dr. Karen Yoder | Pages 25-63 (Chapters 3-5) |

| DATES | TOPIC | LECTURER | ASSIGNMENT(S) |
|--------------|--|------------------|--|
| September 14 | Dental practice, Financing Services & Access to Care | Dr. Karen Yoder | Pages 67-110 (Chapters 6-8) |
| September 21 | Dental Practice, Financing Services & Access to Care (cont.) | Dr. Karen Yoder | Pages 67-110 (Chapters 6-8) |
| September 28 | The Dental Workforce | Dr. Karen Yoder | Pages 111- 137 (Chapter 9) |
| October 5 | Mid-term examination through Oncourse: Bring your laptop computer | Dr. Karen Yoder | |
| October 12 | Field Experience ½ class: Amiran – Moschref | Dr. Mark Mallatt | 1:00pm arrive at school 2:30pm approximate departure time |
| October 19 | Field Experience ½ class: Nichols – Yi | Dr. Mark Mallatt | 1:00pm arrive at school 2:30pm approximate departure time |
| October 26 | Protecting the public: Infection control in dental offices | Dr. Mark Mallatt | Pages 138-153 Chapter 10 |
| November 2 | Documenting Infection Control Protocols Communicating with People with Disabilities (video) | Dr. Karen Yoder | |
| November 9 | Evaluating Dental Literature and Measuring Oral Disease in Populations | Dr. Karen Yoder | Pages 154-219 (Chapters 11-18) |
| November 16 | The Use of Fluoride in Public Health | Dr. Karen Yoder | Pages 287-293 and 307-365 (Chapters 22 and 24-26) |
| November 23 | No Class Happy Thanksgiving! | | |
| November 30 | Public Health Aspects of Fluoride and fluorosis (continued) | Dr. Karen Yoder | Pages 287-293 and 307-365 (Chapters 22 and 24-26) |
| December 7 | Final examination through Oncourse: Bring your laptop computer Covering materials following the mid-term examination: half of | Dr. Karen Yoder | |

| DATES | TOPIC | LECTURER | ASSIGNMENT(S) |
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| | the questions will be taken from PowerPoint handouts and half from the assigned chapters of the textbook. | | |
| Spring 2007 | | Dr. Karen Yoder | Pages 366- 377 (Chapter 27) will be covered in Dr. Dixon's class in Spring 2007 semester prior to beginning SEAL INDIANA rotations |



**SEAL INDIANA ROTATION
Syllabus
T840 Fall
T850 Spring**

Understanding the role of dentistry in the community, the nation, and the world

**General Module
Information**

Course Faculty:
Karen M. Yoder, MSD, PhD, Program Director
Armando Soto-Rojas DDS, MPH, Associate Director

**Purpose of the
Course/Module**

The SEAL INDIANA rotation is a part of IUSD 4th year dental student rotations. This rotation is based on service-learning methodology and includes broad preparation, and reflection to help students understand the role of dentistry in the community, the nation and the world. Dental student will serve a three-day rotation with the mobile clinic team and an additional day that will be dedicated to an Oral Health Policy Forum, in February.

All dental students are required to complete the pre-and post-rotation Oncourse exercises and reflections as part of their SEAL INDIANA rotation.

Please complete pre-rotation exercises 1 and 2 by the Friday before your rotation. Complete the post-rotation exercises 3 and 4 by Friday of the week following your rotation. A group reflection/debriefing session will be held at noon in the month following your rotation; usually the second Wednesday. You will be notified of the date and location.

**Goals of the
Course/Module**

This course will provide fundamental information for competency #3 and supporting information for competencies #17, 21, 24 and 25

Competency #3: Graduates must be competent to communicate and collaborate with groups and individuals to promote oral and general health and; select strategies, resources and interventions appropriate for the prevention of oral disease in the community.

Competency # 17. Graduates must be competent in discerning

and managing ethical issues and problems in dental practice.

Competency # 21. Graduates must be competent in performing and supervising infection control procedures to prevent transmission of infectious diseases to patients, the dentist, the staff and dental laboratory technicians.

Competency #24. Graduates must be competent in the use of information technology resources.

Competency #25. Graduates must be competent in detection, diagnosis, risk assessment, prevention, and management of dental caries.

Service-Learning Objectives

- By gathering information about the communities and the agencies to be served, the student will be able to describe the demographics of communities and learn about the missions, forms and functions of diverse social service agencies.
- By participating in SEAL INDIANA and by providing examination and preventive services in a public health setting, students will be able to demonstrate technical skills and will learn how to structure and implement dental public health programs.
- By interacting with impoverished children, their parents, teachers, school nurses, and social workers, students will be able to list issues related to disparities in access to dental care.
- While working with SEAL INDIANA, students will interact with people from various cultures and will demonstrate how to work effectively and with a greater depth of understanding about human and cultural diversity
- By reflecting on the service-learning experience with SEAL INDIANA, and expressing the reflections verbally or in writing, students will demonstrate a greater understanding of their potential role as dental care providers and advocates for change through the health policy process.

Learning Resources

-

Articles for required reading are posted in Oncourse syllabus section

- Required Reading:**
- Connors K, Seifer S. Service-learning in health professions education: What is service-learning, and why now?
 - Simonsen RJ. Pit and fissure sealant: review of the literature. *Pediatric Dentistry* 24(5)2002
 - Feigal RJ. The use of pit and fissure sealants. *Pediatric Dentistry* 24(5)2002

Learning Resources - Recommended Reading: Fadiman, Anne. *The Spirit Catches You and You Fall Down*, Farrar, Straus and Girous Publishers, 1997
<http://www.spiritcatchesyou.com/>

Learning Resources - Teaching Materials and Health Policy Dental Health Websites for Teachers and Students
<http://www.atlanticava.org/webandcamsites/dentalhealth.htm>

Knowledgepath: This link provides extensive links to current statistical, organizational and health policy information
<http://www.mchoralhealth.org/knwpathoralhealth.html>

Evaluation Components: 25% Pre-rotation Oncourse assignment
50% Attendance and performance during rotation
25% Post-rotation Oncourse assignment and reflection/debriefing session on the 2nd Wednesday of the month following rotation

Additional Course/Module Policies and Procedures Oncourse assignments and attendance are required. Any unexcused absences must be made up

Contact Information Dr. Karen Yoder, Program Director
719 Indiana Avenue, Walker Plaza 204
Mobile phone: 260.413.7462
Office phone: 317.278.7872

Dr. Armando Soto, Program Associate Director
Oral Health Research Institute
415 Lansing Street
Office phone: 317.278.6069

Ms. Jan Miller, Program Manager
719 Indiana Avenue, Walker Plaza 205
Office phone: 317.278.0750

Ms. Lynn Mills, Mobile Unit Coordinator
SEAL INDIANA Mobile Clinic
Mobile phone: 317.407.4315

**SEAL INDIANA Dental Student Pre and Post-Rotation
Assignments and Surveys
(Completed online through Oncourse)**

SEAL INDIANA Pre-rotation Assignment

1. Find the article about SEAL INDIANA that was published in the IUSD Alumni Bulletin, and is posted on www.sealindiana.org. Also, go to the IUSD intranet (Plato) and find the SEAL INDIANA calendar. Locate your rotation assignment date and the town/city where you will be assigned. What is the ratio of dentists to population in the county where you will be working. If you'll be in more than one county, choose one. If a location is not yet scheduled for your rotation date, choose your hometown (if you live in Indiana) or a city/town in Indiana that begins with the first letter of your last name. Name the county in which that city/town is located, cite the population and the ratio of dentists to population.
2. Go to www.census.gov. For your selected county, find and report what percentage of individuals are living below the poverty level.
3. At www.census.gov also find and report the racial distribution of the same county
4. Federal Poverty Guidelines are used to determine eligibility for public insurance programs such as Medicaid and Hoosier Healthwise. On the Web find the Federal Poverty Guidelines. Report the Web site address.
5. On the Web, find information about Hoosier Healthwise. Write a sentence describing the program, briefly list eligibility guidelines, and report the Website address.
6. On the Web, find information about Head Start programs. Write a sentence describing Head Start and report the Website address
7. As a dental professional you will have the potential of influencing policy decisions related to oral and general health. Knowing how to find and contact your legislators is an important part of that process. Go to www.congress.org. Find the names of the federal and state senators and representatives for the county/city/town where you are scheduled to work. List their names and roles.
8. Go to http://www.mchlibrary.info/KnowledgePaths/kp_oralhealth.html#introduction. Choose one link and write a sentence about why the information in that link is interesting/important.

9. Respond to this scenario: A teacher in the Title I school where you are working with SEAL INDIANA was disappointed that a particular child's parents have not signed the consent for sealants. The teacher tells you that the child has missed school several times because of problems with his teeth. The teacher asks that one of the SEAL INDIANA team members telephone the parents to discuss the non-participation of the child. Respond to the following three questions as if you were given this task...

A. On the telephone with the parents, how would you approach the subject of non-participation?

B. List three hypothetical responses that the parents might use to explain their non-participation

C. Choose one of these hypothetical responses and explain how you might respond to it.

SEAL INDIANA Post-Rotation Assignment

1. Talk Back - Reflection: Think about your SEAL INDIANA rotation and write the equivalent of one single spaced page using the following format: "What" (what did you do), "So What" (how does it connect with your learning and life goals), "Now What" (how could this impact your future beliefs, attitudes and actions)

A. WHATdid you do (past tense)

B. SO WHAT....how does it connect with your learning? (present tense)

C. NOW WHAT...How will it influence your attitudes and actions? (future tense)

2. Create two learning issues from your experience with SEAL INDIANA. They may be related to clinical subjects, public health, health policy, or any other aspect of this rotation.

3. Influencing public policy is an important part of the role of health professionals. In your pre-rotation assignment you identified governmental officials who represent the people of the county where you worked during your rotation. Choose one of the policymakers/legislators that you identified (local, state, or federal). Compose a brief letter, addressing it specifically to the policymaker, and describe the work you did with SEAL INDIANA. Request that the policymaker support programs that improve access to oral health services (be specific). Propose policy changes or new policies that you believe would be useful. Feel free to be creative with this assignment. Your letter may be chosen to send to a policymaker (with your permission, of course). Yes, spelling and grammar are important

4. Did your work with SEAL INDIANA help you to see and understand disparities in access to dental care? Please explain.
5. What did you learn that may help you become more responsive to the community where you will practice?
6. Briefly describe a significant moment/event that was related to your rotation:
7. What was the event, moment or incident (use past tense for this section)
8. Why is this event important?(present tense)
9. How will it affect your future actions (future tense)
10. Returning to the scenario of the pre-rotation exercise, explain how your conversation with the parents would change after your rotation. Here's the scenario: A teacher at the Title I school you are visiting as part of the SEAL INDIANA program was disappointed that a particular child's parents have not signed the consent for sealants. The teacher tells you that the child has missed school several times because of problem with his teeth. The teacher asks that one of the SEAL INDIANA staff or students telephone the parents to discuss the non-participation of the child. What approach would you take now?
11. Please name any staff or faculty member who was especially helpful?
12. What are the strengths of the SEAL INDIANA program and the rotation?
13. What are the weaknesses of the SEAL INDIANA program and the rotation...and how can they be strengthened?
14. How would you rate your overall experience with your SEAL INDIANA rotation?
 - (1) Excellent
 - (2) Very Good
 - (3) Good
 - (4) Adequate
 - (5) Poor

Pre and Post-rotation surveys (the same survey is completed prior to and following the experience to assess potential changes)¹

First we would like to know some information about you

What is your age group?

- (1) 20 - 24
- (2) 25 - 29

(3) 30 - 34

(4) 35+

What is your gender?

(1) Male

(2) (2) Female

What program?

(1) Dentistry

(2) Dental Hygiene

(3) Dental Assisting

(4) Other

What is your racial background?

(1) African American

(2) Asian American

(3) Caucasian/white

(4) Hispanic American

(5) Native American

(6) Other

Have you ever participated in service-learning (including broad preparation, community partnerships and reflection) before this rotation?

(1) Yes

(2) No

Next we would like to gain your perspective about the service-learning rotation in which you are participating

Community service is an important part of learning about community oral health needs.

(1) Strongly Agree

(2) Agree

(3) Neutral

(4) Disagree

(5) Strongly Disagree

More can be learned about community oral health in the classroom rather than in community sites.

(1) Strongly Agree

(2) Agree

(3) Neutral

(4) Disagree

(5) Strongly Disagree

Participation in SEAL INDIANA should be a voluntary activity rather than a course requirement

- (1) Strongly Agree
- (2) Agree
- (3) Neutral
- (4) Disagree
- (5) Strongly Disagree

Service-learning makes dental professionals more aware of the roles of health professions in disciplines other than dentistry

- (1) Strongly Agree
- (2) Agree
- (3) Neutral
- (4) Disagree
- (5) Strongly Disagree

Pre-rotation Web-based exercises helped me become more knowledgeable about communities and government programs

- (1) Strongly Agree
- (2) Agree
- (3) Neutral
- (4) Disagree
- (5) Strongly Disagree

I will continue involvement in community-service after graduation

- (1) Strongly Agree
- (2) Agree
- (3) Neutral
- (4) Disagree
- (5) Strongly Disagree

I believe that the work done by SEAL INDIANA benefits the community

- (1) Strongly Agree
- (2) Agree
- (3) Neutral
- (4) Disagree
- (5) Strongly Disagree

Service-learning helps students become more aware of the needs of the community

- (1) Strongly Agree
- (2) Agree
- (3) Neutral
- (4) Disagree
- (5) Strongly Disagree

As a dental professional, I have a responsibility to serve the community and do my part to help reduce disparities in access to dental care.

- (1) Strongly agree
- (2) Agree
- (3) Neutral
- (4) Disagree
- (5) Strongly Disagree

Next we would like to know the influence of service-learning on your future professional work

Participating in service-learning in the community helps to define personal strengths and weaknesses

- (1) Strongly Agree
- (2) Agree
- (3) Neutral
- (4) Disagree
- (5) Strongly Disagree

Performing work in the community helps to clarify career/specialization choices

- (1) Strongly Agree
- (2) Agree
- (3) Neutral
- (4) Disagree
- (5) Strongly Disagree

Finally, we would like some personal opinions about service-learning

A good relationship with service-learning instructors and staff occurs because of, and through the community work

- (1) Strongly Agree
- (2) Agree
- (3) Neutral
- (4) Disagree
- (5) Strongly Disagree

The SEAL INDIANA rotation fosters becoming more comfortable working with people different from myself

- (1) Strongly Agree
- (2) Agree
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The SEAL INDIANA rotation and other IUSD sponsored community service programs are appropriate ways to repay a small portion of the money that is contributed to my education by taxpayers

- (1) Strongly agree
- (2) Agree
- (3) Neutral
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Service-learning makes people more aware of their own biases and prejudices

- (1) Strongly Agree
- (2) Agree
- (3) Neutral
- (4) Disagree
- (5) Strongly Disagree

Participating in community service helps to enhance leadership skills

- (1) Strongly Agree
- (2) Agree
- (3) Neutral
- (4) Disagree
- (5) Strongly Disagree

Participating in the SEAL INDIANA rotation is a valuable part of my education

- (1) Strongly Agree
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¹ Adapted from *Methods and Strategies for Student Assessment* < www.ccpb.info >