Successful Implementation of Community Water Fluoridation via the Community Diagnosis Process

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Abstract

Objectives: *This paper describes the community diagnosis process and how it was used to implement community water fluoridation in Tennessee.* ***Methods:*** *Public health dental staff developed a survey instrument to collect community-specific data on the oral health status of schoolchildren. Key survey findings were presented to county health councils who were determining and prioritizing the health needs of their communities.* ***Results:*** *Community-specific data showed higher caries levels in children without access to an optimally fluoridated community water supply. Presentation of local survey findings to county health councils resulted in fluoridation being a high-priority health issue in several counties. With health council support, opposition to fluoridation by utility district officials was overcome when decision makers were challenged with local survey findings. The community diagnosis process resulted in the successful fluoridation of six community water systems serving a total of 33,000 residents.* ***Conclusions:*** *The community diagnosis approach was successful in implementing community water fluoridation in geographic areas historically opposed to this public health measure. The success of these fluoridation initiatives was attributed to: (1) current, community-specific assessments of children's oral health; (2) identification of communities with disparate oral health needs, problems, and resources; and (3) effective presentation of community-specific oral health survey data to community leaders, stakeholders, and decision makers. [J Public Health Dent 2001;61(1):28-33]*

Key Words: fluoridation, community diagnosis, oral health survey, caries prevalence.

In March 1951, Milan became the first city in Tennessee to add trace amounts of fluoride to its community water supply for the prevention of dental caries. Before the end of that decade, water fluoridation had spread to an additional 40 cities and communities across the state. In 1964, recognizing the need for financial incentives to induce smaller communities to fluoridate, a national pilot program was implemented in Tennessee in which 50 percent of the initial fluoridation cost was provided by state funding (1).

The Tennessee Department of Health continues to conduct an active statewide fluoridation program through promotion, training, and financial assistance to initiate, upgrade, and maintain community water fluoridation. Because of the program's success, 96 percent of all Tennesseans on community water systems are served water containing optimal levels (~1.0 ppm) of fluoride (2). Currently, 367 water systems in Tennessee distribute optimally fluoridated water to 4.7 million people (3).

Tennessee is divided into seven rural and six metropolitan public health regions. In the rural, 15-county East Tennessee region, four public utility districts were unwilling to fluoridate the water they supply to surrounding communities and distribute to consecutive water systems. Recently, public health dentists were successful in persuading utility district officials with long-standing opposition to fluoridation to begin adjusting the fluoride level in the water they produce and distribute. This paper describes: (1) the community diagnosis process instrumental to implementation of water fluoridation in four rural counties in Tennessee, (2) the survey design used to collect community-specific data on the oral health status of children 5–11 years of age, and (3) the caries levels observed for children living in fluoridated versus fluoride-deficient communities (<0.3 ppm) in Tennessee.

Methods

Community Diagnosis. The Tennessee Department of Health has made a strong commitment to strengthening the performance of the public health system in performing the core functions of public health (4)—assessment, policy development, and assurance—to improve the overall health of Tennesseans. The assessment function of public health involves monitoring and surveillance of local problems, assessment of needs, and identification of resources to address these needs. The department's goal to improve the assessment function of public health resulted in the initiation of the community diagnosis process (5-7) in 1995. Through the community diagnosis process, the Department of Health has developed working relationships with regional and county health councils to assist communities throughout the state in finding solutions to health problems.

In Tennessee, community diagnosis

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is a community-based, community-owned process designed to: (1) analyze the health status of a community; (2) assess attitudes toward community health issues; and (3) identify priorities, establish goals, and determine a course of action to improve the health status of the community (8). This process links local and regional health departments with members of the community to identify, prioritize, and report to state-level programs each county's health problems and solution strategies.

Community diagnosis serves health planning and advocacy needs at the community level. Community-based health planning assists local citizens and community leaders to: (1) identify their health care needs; (2) examine the social, economic, and political realities affecting the local delivery of health care services and programs; (3) determine what they want and can realistically achieve in a health care system to meet their needs; and (4) develop and mobilize an action plan based on analysis and planning. Using health assessment data and community input, policy recommendations are developed through this process. Community diagnosis provides community leaders and stakeholders with information that fosters better planning, promotion, advocacy, and coordination of prevention and intervention strategies at the local level.

Not every public health agency is independently capable of doing the research and data collection required by the community diagnosis process. For this reason, the central office of the Department of Health took the lead in developing a cooperative venture with communities and local health departments throughout the state. The Office of Community Development was created and designated as the lead agency to organize county health councils and facilitate the community diagnosis process. Community development staff have assisted all 95 counties in Tennessee in the formation of local health councils.

When a county begins the assessment and planning process, community development staff contact key individuals in the county for the purpose of arranging a meeting to outline a plan of action. This local initiating group has a good understanding of the community in which they live by knowing the perceived needs, problems, and barriers to progress in their county. These people have the ability and resources to address concerns and bring about change. The initiating group includes the director of the local health department, chairperson of the board of health, county executive or other local officials, local hospital administrator, and others deemed appropriate.

The initiating group identifies representatives from civic organizations, small businesses, school systems, local government, health professions both physical and mental, government agencies, and general consumers to serve on the county health council. A health council is a broad-based group consisting of 15–20 members representative of the county in terms of geography, race, profession, and institutional factors. A health council can organize and structure itself to the extent desired by its members. The council functions as a community advisory body to the Department of Health and, only with prior approval from the department, has legal authority to act on its behalf.

In using the community diagnosis process, it is important that the identification of a health problem be built upon a picture of the community. Description of the health status of a county provides a view of what sets its communities apart or what makes them similar to the state and surrounding areas (5). The health status of a community can be determined largely through the use of quantitative surveillance data. Understanding the existing health problems in a community requires an extensive set of primary and secondary data on the current health status, available health resources, economy, and demographics of the community. Community-specific data can reveal problem areas that need further consideration by the county health council.

In addition to collecting all available secondary health data for the county, primary data may be collected to provide detailed information on specific problems or populations. Sources of primary data used in the community diagnosis process in Tennessee include disease surveillance surveys, community surveys, and behavioral risk factor surveillance. A community survey of stakeholders is conducted to provide a profile of perceived health care needs and problems facing a county. The stakeholders represent a cross-section of the county and include both users and providers of health services. A community survey is not a scientific, random sample of a county. Its purpose is to obtain subjective data from a cross-section of residents about health care needs and services in the county. Results of community surveys are tabulated, analyzed, and presented to the health council by community development staff.

A county health council reviews all available data to determine the health issues of primary concern and availability of programs and services to address those issues. The community diagnosis process compels local health councils to make judgments regarding what is good, bad, adequate, or inadequate about the health status and resources in their geographic area. Once information from the community diagnosis process is thoroughly reviewed, the council identifies key health issues. To direct resources wisely, equitably, and efficiently, a health council must establish priorities among a multitude of problems. Each issue is prioritized objectively according to magnitude, severity, and effectiveness of intervention.

After a county health council has prioritized health problems that need to be addressed, the council attempts to determine why a problem exists and what corrective actions need to be taken. Health council members examine interacting factors and identify links that currently contribute to the problem. They identify barriers to resolving the problem and resources to confront the problem. Funding to implement initiatives that address the priority issues identified by the councils for their communities may be available through various businesses, foundations, government agencies, and grants.

Community priorities and defined interventions are summarized in a community diagnosis document that serves as a building block for future assessment and planning activities, a public relations tool, or as a spinoff document for grant applications. The community diagnosis process serves both health planning and advocacy needs at the community level via health council leadership to ensure that documented health problems are addressed.

Oral Health Needs Assessment. As early as 1954, public health dentists in Tennessee collected data on dental caries prevalence and dental treatment needs of schoolchildren (9). Subsequent statewide oral health surveys were conducted in 1974, 1979, and 1988 (10-13). Those surveys were designed to collect data using basic oral health indices. Findings from those surveys have been used on a statewide level to monitor disease trends, plan and evaluate disease prevention programs, and administer dental care programs.

In 1995 public health dental staff and community development staff recognized the need for current, community-specific data to educate health council members about oral health needs in their communities. An oral health needs assessment was piloted in one rural public health region. The survey was designed with a well-defined purpose—to collect data on dental caries prevalence and dental treatment needs for presentation to county health councils as they prioritized the health concerns for their communities.

Public health dental staff developed a survey instrument (14) based on the Association of State and Territorial Dental Directors' (ASTDD) "Assessing Oral Health Needs: Seven-Step Model" (15). The survey instrument, written using Epi-Info software, permitted a rapid assessment of caries experience, caries distribution by tooth surface morphology, dental treatment needs, sealant presence, and incisor trauma for each child. A detailed edit program was written to check for errors during data entry, perform automatic coding of entries, and skip parts of the questionnaire if certain conditions were met. This was the first oral health survey conducted in Tennessee that utilized direct data entry into a laptop computer and presented findings for a comparative oral health index.

From November 1996 to May 1997, dental staff conducted an oral health survey of 5–11-year-old children enrolled in public schools in 62 communities. Communities were selected for inclusion in the survey based on the following factors: (1) fluoridation status of the community water system; (2) socioeconomic status of the community, measured by the proportion of children participating in the federally subsidized school lunch program; (3) geographic location (urban or rural) within the county; and (4) school enrollment.

The communities surveyed in this geographic area of Tennessee had stable population bases with no appreciable fluctuations of residents. In these communities, almost all children who lived in the community attended the community elementary school. Approximately 93 percent of all children enrolled in grades K–6 (grades K–5 in the latter part of the school year) in the selected communities were examined. Very few children were excluded due to unwillingness to participate, absence from school, or objections from parents. Therefore, this survey was considered to be a census of children aged 5–11 years residing in the communities.

Permission to conduct the school-based oral health assessment in each community was obtained from the school system superintendent and school principal. Children participated in the survey as they would in any health screening, without individual parental consent. Departmental policy required parental consent only if selected individuals in a classroom, grade, or school were examined (16). If school personnel deemed individual parental consent necessary specifically for this survey, these schools were excluded as potential survey locations. At the request of the examiner, many school administrators provided parents with written notification prior to the survey.

One public health dentist, experienced in conducting oral health surveys, examined a total of 17,256 schoolchildren. This examiner had received training and calibration in a previous oral health survey (12,13) in which similar methods and criteria were used. Intraexaminer calibration was not measured in the current survey.

The examinations took place in the schools using a portable dental chair (A-dec, Inc.) and Rolux® fiber-optic portable dental light. Instruments were limited to #4 front-surface dental mirrors. No radiographs were made, and no additional diagnostic procedures were performed. Caries experience was measured using the dfs (decayed and filled primary tooth surfaces) and DMFS (decayed, missing, and filled permanent tooth surfaces) indices. The diagnostic criteria for these measurements were comparable to those originally adopted by the Caries Measurement Task Group, Conference on Clinical Testing of Cariostatic Agents, sponsored by the American Dental Association in 1968 (17). The main exception to these diagnostic criteria is that caries in this survey was diagnosed by clinical visual examination only; there was no tactile component in the detection of caries (18,19).

Results

The public health dentist who served as the examiner for the survey analyzed the raw data and made presentations to county health councils. The data were analyzed using Epi-Info to produce lists, frequencies, crosstabulations, and means (20). For the purpose of the community diagnosis process, the analysis did not control for the effects of confounding variables. The unadjusted community-specific data was understandable to health council members and of practical value for their use in identifying problems and establishing priorities for their communities.

An important health concern in several counties was the lack of an optimally fluoridated community water supply to segments of the population. In four counties (Anderson, Morgan, Scott, and Union), six nonfluoridated community water systems served a total population of 33,000 people (Table 1). The presentations to health councils in these counties focused on survey findings showing a difference in caries levels among children residing in fluoridated and fluoride-deficient communities (Table 2). Decreases in caries levels were not limited to fluoridated communities located within the geographic boundaries of these four counties. Comparable reductions in caries levels were also observed in nearby fluoridated communities in adjacent counties (Table 3).

Discussions relating to caries levels and dental treatment needs in children as well as the efficacy, safety, cost, and effectiveness of water fluoridation resulted in unanimous health council support in the four counties. These health councils made the lack of optimally fluoridated water a high-priority (top five) health concern.

The public health dentist and representatives from the local health council met with utility district board members regarding fluoridation. These

TABLE 1
Community Water Systems in Anderson, Morgan, Scott, and Union Counties, TN, 1997

County	Population*	Community Water System	Date Fluoridation Implemented	Population Served†	
				Fluoridated	Fluoride-deficient
Anderson	71,429	Clinton Utility Board	1957	14,118	—
		Norris Water Commission	1969	1,840	—
		Oak Ridge Dept. of Public Works	1953	29,788	—
		Anderson County Utility Board	1989	7,981	—
		North Anderson County Utility District	—	—	10,045
		Lake City Water Department‡	—	—	2,158
		Total population served	—	53,727	12,203
Morgan	18,494	Wolfe Branch Utility District§	1960	2,504	
		Sunbright Utility District¶	—	—	3,395
		Plateau Utility District	—	—	4,521
		Total population served	—	2,504	7,916
Scott	19,788	Oneida Water Commission	1983	9,975	
		Huntsville Utility District	—	—	8,896
Union	15,913	Maynardville Water Department	—	—	3,982

*1997 population estimates; source: Tennessee Department of Heatlh, Division of Assessment and Planning.
†1998 population estimates; source: Tennessee Department of Environment and Conservation, Division of Water Supply.
‡Nonfluoridated consecutive water system supplied by North Anderson County Utility District.
§Fluoridated consecutive water system supplied by Harriman Utility Board (Roane County).
¶Nonfluoridated consecutive water system supplied by Plateau Utility District (Morgan County), Huntsville Utility District (Scott County), and Cumberland Utility District (fluoridated) (Roane County).

TABLE 2
Unadjusted dfs and DMFS Scores and Percent of Children with Caries-free Primary or Permanent Dentitions, by County and Community Fluoridation Status, TN, 1997

County	Community Fluoridation Status	Primary Dentition*			Permanent Dentition†		
		Number Examined	Mean dfs (SE)	% Caries-free	Number Examined	Mean DMFS (SE)	% Caries-free
Anderson	Fluoridated	494	5.48 (0.39)	45.3	647	0.56 (0.06)	81.0
	Fluoride-deficient	452	8.24 (0.53)	35.1	597	0.78 (0.09)	77.7
Morgan	Fluoridated	148	4.15 (0.53)	45.9	189	0.74 (0.13)	78.8
	Fluoride-deficient	685	7.49 (0.38)	31.8	857	1.28 (0.08)	66.7
Scott	Fluoridated	395	6.40 (0.48)	35.2	431	0.70 (0.11)	82.6
	Fluoride-deficient	425	11.01 (0.65)	30.1	494	1.16 (0.13)	71.3
Union	Fluoridated	—	—	—	—	—	—
	Fluoride-deficient	478	10.25 (0.62)	34.1	598	1.19 (0.11)	72.4

*Children aged 5–9 years.
†Children aged 5–11 years.

utility district boards of directors had the ability to authorize fluoridation and formally request financial assistance from the Department of Health for implementation. Board members resided in the geographic area served by the utility and were appointed by a local authority, which could be the utility district board of directors or a local government official.

Presentations to utility district board members were divided into two sessions. The first meeting focused on the findings of the local oral health survey. Emphasis was placed on the differences in children's caries levels based on the geographic area in which they resided and the availability of fluoridated water. The presentation at the second meeting focused on community water fluoridation being the most efficacious, efficient, and cost-effective method of preventing dental caries and its resultant costly treatment. During these discussions, there was no organized opposition to the community fluoridation initiatives.

The board members of North Anderson County Utility District, Plateau Utility District, Huntsville Utility District, and Maynardville Water Department voted unanimously to request state funds to implement fluoridation.

TABLE 3
Unadjusted dfs and DMFS Scores and Percent of Children with Caries-free Primary or Permanent Dentitions in Neighboring Communities, by Community Fluoridation Status, TN, 1997

Community	Community Fluoridation Status	Primary Dentition* Number Examined	Primary Dentition* Mean dfs (SE)	Primary Dentition* % Caries-free	Permanent Dentition† Number Examined	Permanent Dentition† Mean DMFS (SE)	Permanent Dentition† % Caries-free
Adjacent to Anderson Co.	Fluoridated	369	5.88 (0.46)	43.6	451	0.68 (0.90)	79.8
	Fluoride-deficient	380	10.42 (0.70)	32.6	476	1.19 (0.13)	71.2
Adjacent to Morgan Co.	Fluoridated	502	5.46 (0.39)	43.8	665	0.81 (0.08)	76.1
	Fluoride-deficient	425	11.01 (0.65)	30.1	494	1.16 (0.13)	71.5
Adjacent to Scott County	Fluoridated	177	6.15 (0.72)	44.1	195	0.59 (0.12)	78.5
	Fluoride-deficient	248	8.23 (0.71)	29.8	311	1.28 (0.15)	69.8
Adjacent to Union County	Fluoridated	461	5.68 (0.43)	42.7	612	0.58 (0.07)	82.5
	Fluoride-deficient	425	10.93 (0.70)	32.2	563	1.05 (0.09)	71.4

*Children aged 5–9 years.
†Children aged 5–11 years.

Their decisions also resulted in the fluoridation of two consecutive water systems: Lake City Water Department and Sunbright Utility District.

Discussion

In Tennessee, the only requirements for implementation of fluoridation are the presence of a treatable, centralized water supply and approval by appropriate decision makers. Although state funds to offset the initial cost of fluoridation had been available to water systems for many years, this financial incentive was not enough to convince several utility district officials to implement fluoridation. In addition, findings from state and national oral health surveys describing trends in dental caries prevalence and patterns had not persuaded these decision makers.

The use of local data presented as understandable and comparable indices enabled health council members and utility district officials to make well-informed decisions regarding fluoridation. Long-standing opposition to fluoridation was overcome when officials were challenged with local findings that showed disproportionate levels of disease and treatment needs in children without access to an optimally fluoridated community water supply. Through the community diagnosis process, health council members and utility district board members realized they were stakeholders in improving the oral health of children in their communities.

As part of a community assessment process, an effort should be made to identify and remain constantly aware of obstacles that may inhibit efforts to implement and perform community diagnosis. Rather than viewing the barriers negatively, those involved in the community diagnosis process should take a proactive position to develop alternative strategies to overcome identified barriers. Barriers resistant to the process fall within two categories (although there is overlap): organizational barriers and barriers existing within a community (8).

Organizational barriers may include inadequate commitment, resistance to change, lack of understanding, failure to remain proactive, and failure to realize that changes required to address some health problems may be controversial. Most importantly, staff must assess and deal with community perceptions and values. County health council membership must include primary stakeholders within the community who have the power to make the process of assessment, planning, and implementation successful because they perceive it to be in the community's best interest.

No complete listing of community barriers and obstacles to the process is possible because of the uniqueness of communities. In general, many community leaders may think they do not know enough about health issues to deal with them or provide effective leadership and planning. There may be a lack of a shared vision by community leaders as to what the realities are and what can realistically be achieved. Long-standing conflicts among communities within a county or antipathy from health care providers can undermine the process. Perceptions by a community or county health council of community health problems supported by subjective data or with little or no data may take resources away from problems that are supported by objective, community-specific data. Also, pressure may be exerted from special interest groups on a community to deal or not deal with specific problems and interventions.

Since 1951, Tennessee has chosen to implement community water fluoridation through an educational process rather than by legislative mandate. Most recently, public health dental staff have demonstrated the success of a "community diagnosis" approach to implementing water fluoridation in geographic areas historically opposed to this public health measure. This success was attributed to: (1) current, community-specific assessments of children's oral health; (2) identification of communities with disparate oral health problems, needs, and resources; and (3) presentation of community-specific oral health findings in an understandable way to community leaders, stakeholders, and decision makers.

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