

THE EFFECT OF A DENTAL HEALTH EDUCATION PROGRAM ON
THE DENTAL HEALTH KNOWLEDGE OF INNER-CITY AND
NON-INNER-CITY ELEMENTARY AGE CHILDREN

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COLLEGE OF NURSING

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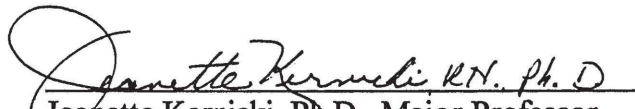
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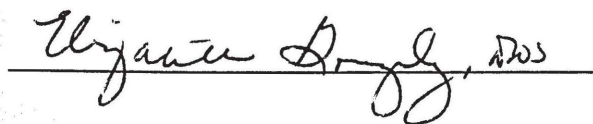
To the Dean of Graduate Studies and Research


I am submitting herewith a dissertation written by Joan Ferrier Mahon entitled "The Effect of A Dental Health Education Program on the Dental Health Knowledge of Inner-City and Non-Inner-City Elementary Age Children." I have examined this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in nursing.


Jeanette Kernicki, Ph.D., Major Professor

We have read this dissertation and
recommend its acceptance:






Dean of Graduate Studies and Research

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DEDICATION

To my parents, Alice and Joseph Ferrier, ever present in mind, body, and spirit.

To my husband, Jim Mahon, a constant source of light and joy in my life.

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There are so many individuals, family and friends, who supported and encouraged this effort, and I am grateful to each and everyone:

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ABSTRACT

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The purpose of the study was twofold: (1) To compare pre and posttest dental health knowledge of elementary school children enrolled in an inner-city and non-inner-city school; and (2) To evaluate the effect of a comprehensive dental health education program on the dental health knowledge level of upper elementary school children in an inner-city and non-inner-city school. Neuman's Systems Model was the conceptual framework for this study.

The research design was a quasi-experimental pretest posttest two-group design conducted with 156 upper elementary school children of one inner-city and one non-inner-city in a large public school system. A convenience sample of intact classes of 4th and 5th grade children was randomly assigned to either the experimental or control groups. Two instruments were administered: the Demographic Data Sheet and the Dental Health Knowledge Questionnaire, an 18-item multiple choice test used for both pretesting and posttesting. Internal consistency reliability was assessed at 0.68 for

the pilot study and 0.57 for this study using Cronbach's alpha for the total group.

Content validity was verified and approved by a panel of experts (elementary educators, health curriculum specialist, dental hygienist, and elementary school nurses). Descriptive statistics were used to summarize demographic data of the total sample. The statistical analysis used was a three-factor ANOVA with repeated measures on one factor.

Findings suggested that there was a difference in dental health knowledge after all students received either a comprehensive or regular dental health education program. Although both the inner-city and non-inner-city children improved as a result of the dental health program, the outcome for the non-inner-city children was a greater improvement in dental health knowledge. The findings also indicated that the effect of the treatment group on the improvement from the pretest to posttest dental knowledge was the same for the regular program as it was for the comprehensive program. Further investigation revealed a significant two way interaction between the treatment group and time (pretest and posttest). Both experimental and control groups improved, but there was greater improvement in the experimental group of children who received the comprehensive dental health program.

Conclusions include: (1) that a comprehensive dental health education program can be an effective means of increasing knowledge for both inner-city and non-inner-city elementary age school children; and (2) that the Neuman Model is effective in designing primary prevention interventions to retain client system stability.

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CHAPTER 1

INTRODUCTION

"Oral health is essential to the general health and well-being of all Americans and can be achieved by all Americans," according to the Surgeon General's 2000 report (U.S. Department of Health and Human Services [DHHS], 2000, p. 1). Disparities in the oral care of many children, however, do persist due to lack of knowledge or available resources. The Surgeon General viewed the lack of oral health of children as a significant public health problem and urged community leaders to broaden an awareness and use of common preventive practices such as brushing teeth with fluoride tooth paste, flossing teeth, and good nutritional habits. According to the Secretary of Health and Human Services, Donna Shalala, there are safe and effective methods of oral health promotion, disease prevention, and good nutritional habits that even children of elementary school age can adopt.

Poor dental health is a common problem among elementary aged students, particularly those with limited financial resources. A dental health screening program in a large Southwestern inner-city elementary school revealed that 53% of 3rd grade students ($N = 99$) had dental caries with 15% of those students having conditions requiring urgent care (abscesses, caries) (Personal communication, D.Block, January

26, 2000). Most children in the dental screening program were uninsured. Generally, uninsured children are 2.5 times less likely to receive dental care than those with insurance coverage. Also, children from families without dental insurance are 3 times as likely to have dental needs compared to their insured peers (DHHS, 2000). The single most common disease of childhood that is not self-limiting or amenable to a course of pharmacotherapeutic means, for example, antibiotics, is dental caries (Edelstein, 1995; Personal communication, W. Gray, April 30, 1999).

Primary and secondary health prevention programs are a part of the school nurse's practice. Additionally, students coming to the school nurse's office for other than dental health problems demonstrated dental caries in their primary and secondary dentition. Time lost from school for dental problems encompasses more than 51 million school hours lost each year (DHHS, 2000). Providing one-on-one primary prevention in the form of health education is time-consuming and not measurable in terms of dental health knowledge and changes in dental health practices of elementary-age children. Therefore, one method to measure the dental health knowledge of elementary-age children is to provide a dental health intervention using various approaches to learning. Comparing dental health knowledge of students from inner city and non-inner-city schools may help identify knowledge differences between students of different economic backgrounds.

Problem of Study

The purpose of the study was twofold: (1) to compare pre and posttest dental health knowledge of elementary school children enrolled in an inner-city school and a non-inner-city school; and (2) to evaluate the effect of a comprehensive dental health educational program on the dental health knowledge level of upper elementary school children enrolled in an inner-city and non-inner-city school.

Rationale for Study

There is a paucity of studies reported in dental health knowledge and practices of elementary age children. The Surgeon General's (DHHS, 2000) report on oral health identified disparities in oral health in children. Socioeconomic factors, lack of community fluoridation programs, lack of access to dental care, and lack of knowledge in utilizing common preventive practices contribute to disparities in oral health.

Poor, racial, and ethnic minority children suffer the worst oral health (DHHS, 2000). One out of four children in the United States is born into poverty; those children living below the poverty level have more severe and untreated tooth decay (DHHS, 2000). Of the nation's 100 poorest counties, 84 are in the South. Thirty-four of those counties are predominantly African-American; 12 are Hispanic; and 38 are White (Children's Defense Fund, 1998). Southern child poverty is generally highest in the inner cities of metropolitan areas. Nearly one out of three Southern children who lived in inner cities (about 31%) were poor in 1996 compared to 16% of Southern non-

inner-city children (Children's Defense Fund, 1998). The public health infrastructure for oral health is insufficient to address the needs of disadvantaged groups, and the integration of oral and general health programs is lacking (DHHS, 2000).

The broadened meaning of oral health parallels the broadened meaning of health as expanded by the World Health Organization (WHO, 1975) to mean a complete state of physical, mental, and social well-being, and not just the absence of disease. Oral health, too, must include well-being and is a critical component of general health (DHHS, 2000). In children, dental caries is the single most common chronic disease of childhood; tooth decay is five times more common than asthma and seven times more common than hay fever (DHHS, 2000).

Primary prevention of dental disease is possible utilizing appropriate health interventions in the areas of diet, healthy snacks, and oral hygiene for elementary age children. School nurses are in a position to increase awareness of dental health knowledge not only with children but also with faculty, families, and community populations with a focus on primary prevention. Also, nurses can develop reliable and valid measures of oral health outcomes that presently do not exist and need to be developed, validated, and incorporated into clinical practice and health educational programs (DHHS, 2000).

Conceptual Framework

In this study, Neuman's (1995) Systems Model (Appendix A) was used as the conceptual framework. Neuman used both inductive and deductive strategies to develop the model. The latter were derived from de Chardin's (1955) philosophic beliefs about the wholeness of life, Marxist philosophical views of the oneness of man and nature (Cornu, 1957), Gestalt and field theories of the interaction between person and environment, von Bertalanffy's (1968) general systems theory of the nature of living open systems, Selye's (1950) conceptualization of stress, and Caplan's (1964) interpretation of levels of prevention. The focus of the Neuman Systems Model is on the wellness of the client system in relation to environmental stress and reactions to stress. The ideal is to achieve optimal system stability or wellness (Neuman, 1995). The client system, which can be an individual, a family or other group, or a community is a composite of five interrelated variables (Figure 1). In this study, the client represents a group of 4th and 5th grade upper elementary age students from one inner-city and one non-inner-city school.

In the Neuman model the five interrelated variables are physiological, psychological, sociocultural, developmental, and spiritual. The physiological variable refers to the structure and functions of the body. The psychological variable refers to mental processes and relationships. The sociocultural variable refers to system functions that relate to social and cultural expectations and activities. The developmental variable refers to those processes related to development over the

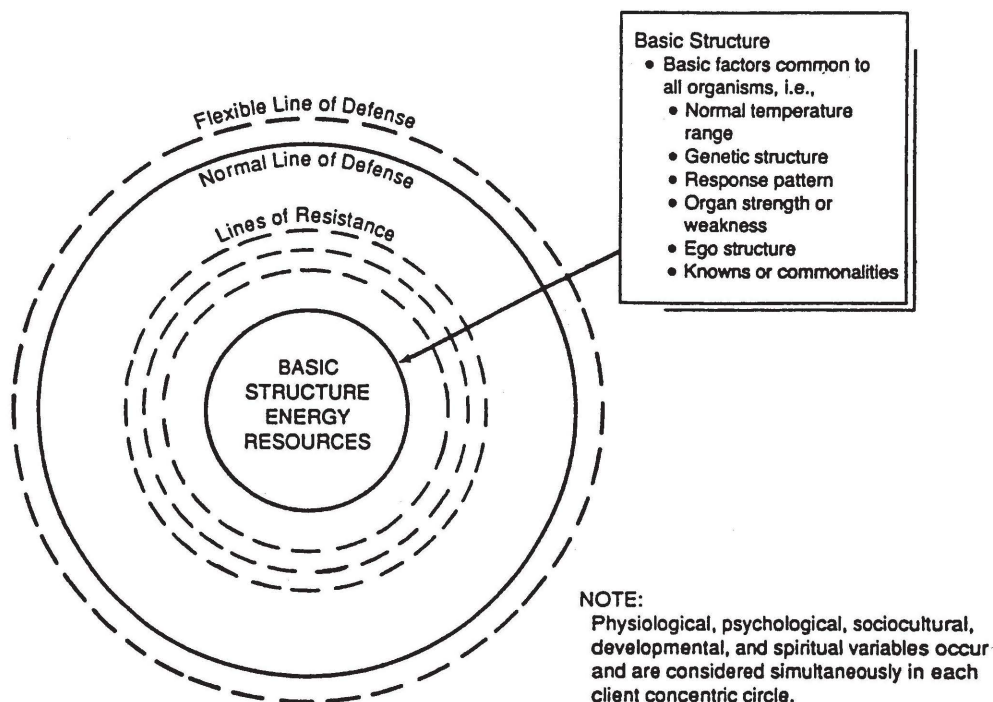


Figure 1. Neuman's (1995) Model of Client/Client System. From The Neuman Systems Model (3rd ed.), by Betty Neuman, 1995. Reprinted with permission of the author.

lifetime. The spiritual variable refers to the influence of spiritual beliefs on a continuum from complete unawareness or denial to a consciously developed high level of spiritual understanding (Neuman, 1995).

The client system (4th and 5th grade students) is depicted as a central core, which is a basic structure of survival factors common to the species, surrounded by three concentric circles (Figure 2). The flexible line of defense is the outermost circle; this line is a protective buffer for the client's normal or stable state that prevents invasion of stressors and keeps the client system free from stressor reactions

or symptoms. In the study, dental health knowledge was that knowledge that strengthens the flexible line of defense leading to an increase in the potential for wellness or client system stability. The normal line of defense lies between the flexible line of defense and the lines of resistance; this line represents the client's normal or usual state of wellness. The lines of resistance are the innermost part of the concentric circle; these lines are involuntarily activated when a stressor invades the normal line of defense. The lines attempt to stabilize the client system and foster a return to the normal line of defense.

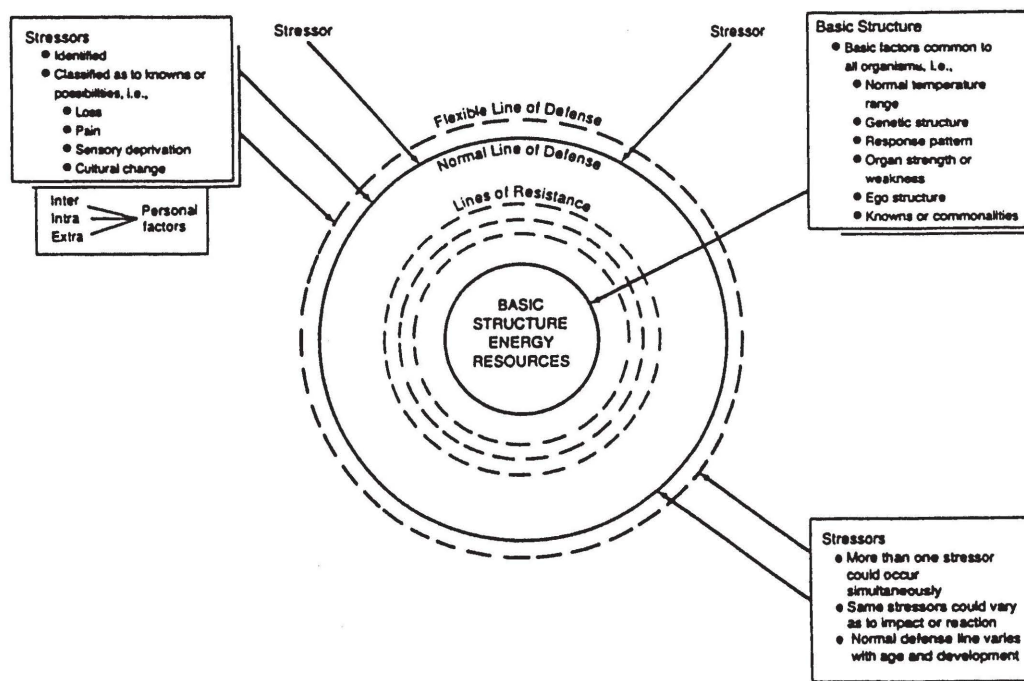


Figure 2. Neuman's (1995) Model of Environment. From The Neuman Systems Model (3rd ed.), by Betty Neuman, 1995. Reprinted with permission of the author.

Nursing practice in the Neuman model is directed toward facilitating optimal wellness through retention, attainment, or maintenance of client system stability. The three steps in the nursing process, according to Neuman (1995), are nursing diagnosis, nursing goals, and nursing outcomes. Nursing diagnosis is formulated on the basis of assessment of the variables and lines of defense and resistance making up the client system. Nursing goals are negotiated with the client for desired prescriptive changes to protect variances from wellness. Nursing outcomes are determined by evaluation of three types of prevention-as-intervention modalities.

These modalities are primary, secondary, and tertiary prevention. Primary prevention is the action required to retain client system stability (Figure 3); this mode is selected when the risk of, or hazard from, a stressor is known but a reaction has not yet occurred. Interventions attempt to reduce the possibility of the client's encounter with the stressor or strengthen the flexible line of defense to decrease the possibility of a reaction when the stressor is encountered. Primary prevention includes health promotion and maintenance of wellness. In the study, primary prevention (dental health education program) promoted client system stability (dental health knowledge), which was the proposition tested from the Neuman model. The dental health education program as a primary prevention intervention is the action required to promote dental health knowledge in the 4th and 5th grade students by teaching the concepts of brushing, flossing, and choosing healthy snacks. Primary prevention of

dental disease is possible utilizing appropriate health interventions in the areas of diet, choosing healthy snacks, and oral hygiene for elementary children.

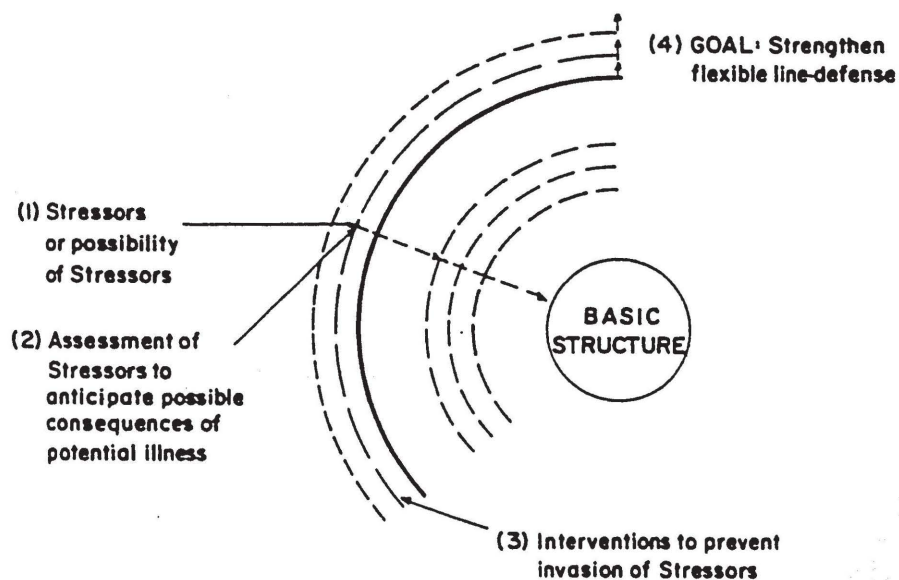


Figure 3. Neuman's Format for Primary Prevention as Intervention Mode. From The Neuman Systems Model (3rd ed.), by Betty Neuman, 1995. Reprinted with permission of the author.

Fawcett (1995) suggested the following guidelines (Table 1) for utilizing the Neuman model in nursing research. Selected examples from this study will offer examples from the text of how the model guided this research.

Table 1

Guidelines for Constructing Neuman Systems Model-Based Studies

Guidelines	
1.	Explain that the Neuman Systems Model is the underlying guide of the study.
2.	Discuss the Neuman Systems Model in sufficient breadth and depth so that the relationship between the model and the purpose of the study is clear.
3.	State the linkages between the relevant Neuman Systems Model concepts and the study variables.
4.	State the linkages between the relevant Neuman Systems Model propositions and the study aims and/or hypothesis.
5.	Ensure that the methodology reflects the Neuman System Model: <ul style="list-style-type: none"> * Select study subjects from a population that is appropriate for the focus of the Neuman Systems Model. * Select instruments that are appropriate measures of Neuman Systems Model concepts. * Select statistical techniques that are in keeping with the focus of the Neuman Systems Model.
6.	Include conclusions regarding the empirical adequacy of the theory and the credibility of the Neuman Systems Model in the discussion of the study findings.

Note. From The Neuman Systems Model (3rd ed.), by Betty Neuman, 1995. Reprinted with permission of the author.

The information shown in Figure 4 presents an example of how the Neuman Systems Model is utilized in the development of conceptual-theoretical-empirical structures.

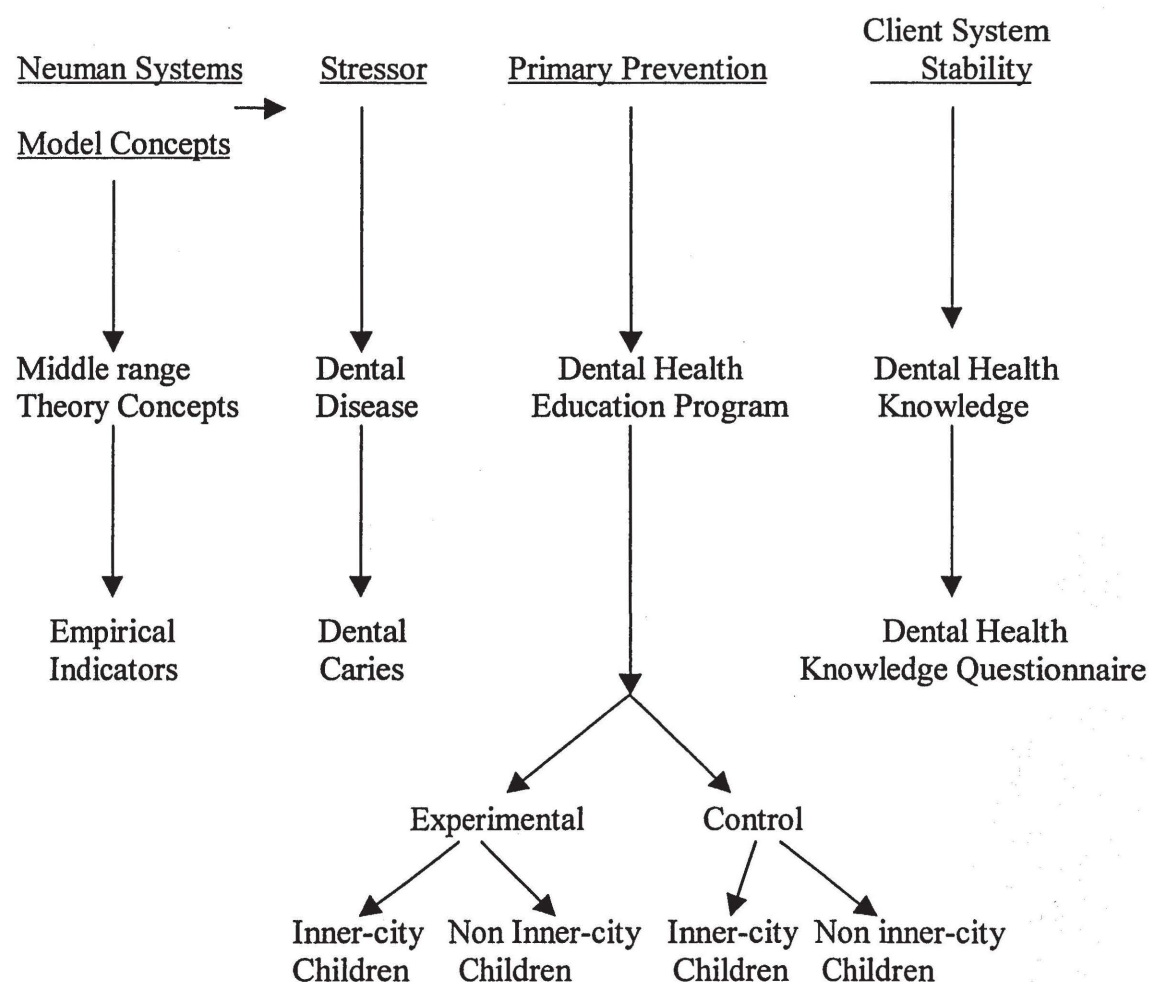


Figure 4. Example of Theory Testing and the Neuman systems Model. Adapted from *The Neuman Systems Model* (3rd ed.), by Betty Neuman, 1995, p. 469, as proposed by J. Fawcett. Used with permission of author.

Assumptions

The following assumptions are based on Neuman's (1995) Systems Model:

1. Each individual client has evolved a normal range of response to the environment that is referred to as a normal line of defense or usual wellness/stability state.
2. When the cushioning, accordion-like effect of the flexible line of defense is no longer capable of protecting the client against an environmental stressor, the stressor breaks through the normal line of defense.
3. Implicit within each client system is a set of internal resistance factors known as lines of resistance which function to stabilize and return the client to the usual state of wellness (normal line of defense).
4. The client, whether in a state of wellness (system stability) or illness, is a dynamic composite of the interrelationship of variables: physiological, psychological, sociocultural, developmental, and spiritual.
5. Primary prevention relates to general knowledge that is applied to client assessment and intervention in identifying possible or actual risk factors associated with environmental stressors. The goal of health promotion is included in primary prevention.
6. The client as a system is in dynamic, constant energy exchange with the environment.

Research Questions

The following research questions were proposed for the study:

1. Is there a difference in dental health knowledge between the pretest and posttest scores of upper elementary grade school children who have received a dental health education program?
2. Is there a difference between the dental health knowledge of inner-city and non-inner-city upper elementary grade school children before and after a dental health education program?
3. Is there a difference between the pretest and posttest dental health knowledge scores of those inner-city and non-inner-city upper elementary age school children who received the comprehensive dental health education program compared to those who received the regular dental health education program?

The independent variable for this study was the type of dental health education program (primary prevention), whereas the dependent variable was dental health knowledge (client system stability).

Definition of Terms

The following conceptual and operational definitions were used in the study:

1. Dental health knowledge. Conceptually defined, that knowledge that strengthens the flexible line of defense leading to an increase in the potential for wellness and client system stability (Neuman, 1995). Operationally defined,

those dental health concepts in the areas of brushing, flossing, and choosing healthy snacks that will be measured by the Dental Health Knowledge Questionnaire before and after the educational intervention.

2. Dental Health Education Program. The conceptual definition is that area of primary prevention that is selected when the risk or hazard from a stressor is known but a reaction has not yet occurred. Primary prevention (dental health education program) is the action required to retain client system stability (Neuman, 1995). The operational definition is: (a) the 13-minute dental health videotape shown to those upper elementary grade school children in the regular (control group) dental health education program, and (b) the 13-minute dental health videotape shown to those upper elementary grade school children in the comprehensive (experimental group) dental health education program. In addition, students in the comprehensive dental health education program received a discussion and demonstration of tooth brushing and flossing using a tooth model as well as a discussion and demonstration of healthy snack choices.
3. Upper elementary grade school children. Conceptually defined, those students who are enrolled in the 4th and 5th grades of a Southwestern inner-city and non-inner-city public school district. Operationally defined, those students who will meet the inclusion criteria and are in the 4th and 5th grade of an inner-city and non-inner-city school district.

4. Inner-city school. The conceptual definition is that school that is in an older part of a city, densely populated and usually deteriorating, inhabited mainly by poor, often minority, groups (Webster's New Universal Unabridged Dictionary, 1996). The operational definition is that school that is in an older part of a city, densely populated and usually deteriorating, inhabited mainly by poor, often minority, groups as measured by the number of students on free or reduced lunch.
5. Non-inner-city school. Conceptually defined, that school that is not in an older part of a city and is not densely populated, not deteriorating, not inhabited mainly by poor, not often minority, groups. Operationally defined, that school that is not in an older part of a city and is not densely populated, not deteriorating, not inhabited by mainly poor, not often minority groups as measured by the number of students that are not on free or reduced lunch.

Limitations

A limitation of this study was that the sample was a convenience sample of upper elementary grade school children from inner-city and non-inner-city school districts, thus limiting the generalizability to all elementary age students.

Summary

Healthy People 2010 (Office of Disease Prevention, 2000) is a statement of the national health objectives designed to identify the most significant preventable threats

to health and to establish national goals to reduce these threats. One major goal is to eliminate health disparities in the focus area of oral health. Too, the Surgeon General's (DHHS, 2000) first report on oral health viewed the lack of positive oral health in children as a public health problem.

Dental health promotion and disease prevention measures can be taught to elementary age children. These measures include personal daily oral hygiene and choosing healthy snacks. This study measured and compared the dental health knowledge of upper elementary grade school inner-city and non-inner-city students before and after receiving a regular or comprehensive dental health education program. Neuman's (1995) Systems Model was the conceptual framework for this study.

School nurses are in a position to increase awareness of dental health knowledge not only with children but also with faculty, families, and community populations with a focus on primary prevention. Also, nurses can develop reliable and valid measures of oral health outcomes that presently do not exist.

CHAPTER 2

REVIEW OF THE LITERATURE

Oral health is integral to the general health and well-being of all Americans. Children, specifically, experience dental caries, one of the most common chronic diseases of childhood. The Surgeon General (DHHS, 2000) reported that dental caries are more than five times as common as asthma and seven times more common than hay fever. Needless pain and suffering, lost school days, and increased costs of oral care are the result of untreated caries (Office of Disease Prevention, 2000). A lack of knowledge about the basic oral hygiene measures and healthy nutrition has been suggested by the Surgeon General (DHHS, 2000) as contributing factors in the prevalence of the dental caries experienced in children.

Determining whether or not there was a difference in dental health knowledge of elementary school children enrolled in an inner-city and a non-inner-city school before and after receiving a comprehensive or regular dental health education program was the focus of the current study. This chapter includes a discussion of the literature related to the problem of the study. The review of the literature is divided into five sections. The first section discusses the scope of the problem. The second section describes barriers to improving oral health. The third section addresses prevention as intervention concepts as well as dental health knowledge studies. The fourth section

delineates nutrition and oral health. The fifth and last section discusses collaborative partnerships for improving health knowledge in children.

The review of the literature was guided by the variables of Neuman's (1995) Systems Model--primary, secondary, and tertiary prevention as intervention for an individual. Providing a dental health education program for children is considered primary prevention and may be associated with increases in dental health knowledge. This study is focused on teaching a dental health education program that includes basic oral hygiene that 4th and 5th grade inner-city and non-inner-city children can perform to increase their knowledge of dental health. Increasing children's knowledge of dental health will presumably strengthen their ability to provide basic primary prevention methods of dental care and promote wellness levels by decreasing potential stressors that lead to oral disease (i.e., dental caries) (DHHS, 2000; Office of Disease Prevention, 2000).

Scope of Oral Health Problem

Despite improvements in oral health over the past 50 years, disparities remain in selected populations classified by income, age, and race/ethnicity (DHHS, 2000; Office of Disease Prevention, 2000). For example, individuals living below the poverty level have more dental decay than those families of higher income (DHHS, 2000). The dental caries seen in individuals below the poverty level are more likely to be untreated than caries experienced in those living above the poverty level

(Vargas, Crall, & Schneider, 1998). More than one-third (36.8%) of children living in poverty aged 2 years through 9 years have one or more untreated decayed primary teeth compared to 17.3% of non-poor children (DHHS, 2000).

Dental caries is the single most common disease of childhood (DHHS, 2000; Edelstein & Douglas, 1995; Vargas et al., 1998). In a sample of 6- to 12-year-old children reported by Vargas et al., 24.9% had at least one primary tooth with untreated caries. Racial and ethnic minorities use fewer dental health services than their non-minority families (Vargas et al., 1998). Poor Mexican-American children in the 2 years through 9 years age group had more primary teeth affected by dental caries (a mean of 2.4 decayed or filled teeth) compared to poor non-Hispanic black children (mean 1.5) and non-Hispanic white children (mean 1.9). Mexican-American children from lower-income households aged 2 years to 5 years were more likely than their African-American and non-Hispanic white counterparts to have one or more decayed primary teeth (Vargas et al., 1998).

By 2050, the estimate by the Council on Economic Advisors (1998) is that 50% of the United States population will be Asian, non-Hispanic black, Hispanic, and American Indian. Research is needed to develop precise measures of health and disease to explicate cultural differences among population groups to develop interventions focused on eliminating disparities in oral health (DHHS, 2000).

The oral health status of children is measured by the presence of dental conditions. Dental caries are the most common condition of childhood that is not self-

limiting or amenable to a course in pharmacotherapeutics (Edelstein & Douglas, 1995). Holt, Roberts, and Scully (2000a) confirmed that most tooth loss in children is due to caries, while most tooth discoloration is due to poor oral hygiene, diet, or habits. Caries are characterized by a painless white spot resulting from the decalcification of tooth enamel that evolve into a brownish or black cavitations (Holt et al., 2000a).

Sanchez and Childers (2000) suggested that early dental intervention (e.g., infancy) may prevent subsequent oral disease (caries). Tooth development begins in utero at about 28 days, and mineralization of the primary dentition begins in utero at about 14 weeks (Holt et al., 2000a). Fitzsimons, Dwyer, Palmer, and Boyd (1998) suggested that there is a gap in dental care and guidance from pregnancy to 36 months of age. The American Academy of Pediatric Dentistry (AAPD) (1997) recommended that parents take infants for an initial oral examination within 6 months of the eruption of the first primary tooth and by no later than 1 year old. By the age of 1 year, infants begin to establish an oral environment that places them at risk for dental caries (Mouradian, Wehr, & Crall, 2000; Sanchez & Childers, 2000). Infants acquire bacteria from their mothers during 19 to 31 months of age (Sanchez & Childers, 2000). Earlier acquisition of the bacterial infection is linked with certain risk factors such as sibling caries, maternal caries, feeding habits, dietary habits, fluoride exposure, and oral hygiene practices (Sanchez & Childers, 2000). To reduce the incidence of dental caries, parents should be counseled about proper feeding practices during infancy and the preschool years (Sanchez & Childers, 2000). Despite the assertions of Sanchez and

Childers, an estimated 25% of children aged 2 had never visited the dentist in 1986 (Jack & Bloom, 1988). By age 5, 75% of children had seen a dentist, and 89% of 7 year olds had received a dental examination (Jack & Bloom, 1988).

Sanchez and Childers (2000) suggested that despite the AAPD recommendations, it is difficult to achieve uniformity among health care professionals about timing and provision of preventive oral education as well as who should provide the information. Finally, primary care physicians working with other health care professionals (e.g., school nurses) may be instrumental in ensuring that parents receive information on the prevention of oral disease in infants and young children in a primary prevention manner before oral disease has been acquired (Sanchez & Childers, 2000).

Barriers to Improving Oral Health

Oral health care in children has been described as a major unmet health need (Newacheck, Hughs, Hung, Wong, & Stoddard, 2000). Disparities exist in the oral health of children due to barriers in accessing health care and lack of insurance (Mouradian et al., 2000; Sochalski & Villarruel, 1999). The Surgeon General has called for a national oral health plan to eliminate disparities in oral health of all Americans (DHHS, 2000).

Barriers in accessing oral health care for children include being poor and being of a racial or ethnic minority (Vargas et al., 1998). Children living in poverty often have inadequate nutrition, health care, and resources to encourage wellness. Brennan

and Spencer (1999) confirmed that potential inequality in service patterns with respect to cultural factors exist within a group of underprivileged clients. Despite this, Fiscella and Franks (2000) argued that income inequality and biomedical morbidity are not associated. Dental decay is a frequent ailment of poor children; they are four times as likely to miss school for dental-related problems as middle- and upper-class children (Allukian, 2000; Brown, 1994). The rate of untreated dental disease among children aged 2 to 5 is approximately five times that of high-income children (Allukian, 2000).

Newacheck et al. (2000) analyzed 4 years of National Health Interview Survey data from 1993 to 1996. The analysis included 97,206 children less than 18 years old. Included also were measures of unmet dental needs obtained from an adult member of the household responding for the child. Bivariate and multivariate analyses assessed the degree to which unmet needs were related to socioeconomic and demographic characteristics of the child and family. Results suggested that 7.3% (4.7 million) children of the United States experienced at least one unmet health need with dental care being the most prevalent. Near poor and poor children were about three times as likely to have unmet needs as non-poor children. Uninsured children were also three times more likely to have an unmet need as privately insured children. The authors concluded that despite the nation's wealth, unmet health needs remain prevalent among children in the United States. To reduce the prevalence of unmet needs for health care, the authors suggested that a combined public policy that addresses financial and nonfinancial barriers to care be required.

According to Peterson, Niessen, and Lopez (1999), treatment needs are greatest among minority and lower socioeconomic classes of children. Robison, Rosier, and Weintraub (1998) reported that Medicaid reimbursement levels to dental health care providers is low, resulting in low provider participation and accessibility for clients. By modifying current Medicaid procedures to eliminate prior approval and increasing reimbursement for dental procedures, an increased use in dental services by low-income community members may ensue.

Distribution of dental providers across geographic areas contributes to the consumers' ability to obtain oral health care and therefore affects their oral health status (Peterson et al., 1999). The Dental Health Provider Shortage Areas (DHPSA) system measures available dental health professionals across a designated area in an effort to measure the degree of shortage experienced by residents. The United States Department of Health and Human Services designates a DHPSA as having greater than 5,000 clients to 1 dentist (Peterson et al., 1999).

Peterson et al. (1999) analyzed the amount and types of dental morbidity in Texas public school children reported during an average school week by school nurses ($N = 1,083$). The authors examined whether children of DHPSAs have a more or less compromised oral health status as compared to those from non-DHPSAs. Fifty percent of the nurses surveyed were from elementary schools, 14.4% from middle schools, 11.6% in high schools, and 12.6% in all grades. Peterson et al. found that dental morbidity accounted for 3.5% of all health problems reported to school nurses. The

authors found no difference in the oral health status of children in DHPSA versus non-DHPSA communities. In addition, different types of dental morbidity affect different grade levels. For example, elementary school students are more likely to be affected by dental caries, toothaches, and loose teeth, while high school students suffered problems with orthodontic appliances. The authors concluded that the incidence of children suffering from dental problems and subsequent absenteeism could be minimized by regular oral health screenings (Peterson et al., 1999).

Inadequate Medicaid reimbursement of dentists was a major barrier that prevented more than 5,000 children in Moore County, North Carolina from accessing dental care (Mycek, 2000). As a result, First Health, a North Carolina company with operating hospitals, established a partnership with Moore County schools in an effort to increase the health presence in schools and specifically dental health. School nurses became employees of First Health. Mycek confirmed that this close relationship between providers and educators has led to a number of improvements in dental care. When dentists of the area were surveyed by First Health, none felt equipped to manage single-handedly the high-risk, low reimbursement members of the community. As a result, First Health opened a dental clinic in Moore County serving children up to age 18 who are Medicaid-eligible or uninsured. The program that includes a child dental education component was funded by grants from foundations (e.g. Kellogg, Duke Endowment, and Kate B. Reynolds Foundations). Due to the overwhelming success of the first clinic, First Health has opened two more clinics in North Carolina that,

combined, have served more than 10,000 children to date (Mycek, 2000).

The largest source of public expenditure for oral health services for children is Medicaid (Sochalski & Villarruel, 1999). In addition, states are required by law to provide dental care to children who are enrolled in the Early and Periodic Screening, Diagnosis, and Treatment Program (EPSDT). The mission of this program is to provide dental care to all Medicaid-eligible children from birth to 21 years of age. Services covered in this program are annual dental examinations, prophylaxis and fluoride treatment, dental sealants, and those emergency, preventive, and restorative services needed to prevent irreversible damage to the teeth or supporting structures.

Robison et al. (1998) examined a state Medicaid dental program for children in North Carolina in order to gain insight into the demographics of enrollment and patterns of use, types of treatment rendered, relationship between treatment and need, and an epidemiological survey of treatment received through Medicaid in North Carolina from 1984 to 1992. The authors found that children in the Medicaid-eligibility category tended to be young, female, non-white residents in urban areas who were enrolled in the free or reduced lunch program and had mothers with less than a high school education. With respect to use of dental services, 46% of children utilized services for 1 year, 40% used services for 2 to 3 years, and only 14% accessed service for 4 years or more. Diagnostic procedures were the most common (40%) followed by equal rates of restorative and preventive care (both 24%). Thirty-one percent of the children visited a dentist within one year after the survey. Of the 129 subjects between

the ages of 5 and 9 years who were identified as needing treatment, 59 children ultimately received treatment through the Medicaid program within 2 years. As a result, the North Carolina Medicaid program was modified in 1992 by dropping the need for prior approval and increasing reimbursement for dental procedures to increase the use of dental services. The authors cautioned that the results of their study cannot be generalized to other state programs since Medicaid policies regarding service limitations, eligibility, and reimbursement for dental procedures vary from state to state (Robison et al., 1998).

Similarly, Herz, Chawla, and Gavin (1998) examined the impact of Medicaid services on the well-child visits and immunization rates in children residing in four states, California, Georgia, Michigan, and Tennessee, during 1989 to 1992. Access to preventive services affects the efficacy of these programs. The Early Periodic Screening, Diagnosis and Treatment (EPSDT) program was established to promote better access to preventive care for Medicaid-enrolled children. The authors found that, although the rates of preventive dental care visits were low, they were higher among children with well-child visits. Well-child visits are a vehicle by which children gain access to dental services.

Oral Health Education

Dental health education is considered to be an integral part of dental health services. Brown (1994) defined health education as any combination of learning

experiences designed to facilitate voluntary adaptations of behavior conducive to health. In addition, health promotion is a combination of health education and health advocacy (Brown, 1994). Educational interventions for children have varied from the simple provision of information to the use of complex programs involving psychological or behavioral change techniques. Dental education programs focus on increasing the knowledge of, attitude towards, intention to, belief about, and positive behavior towards the use of dental services to promote oral health.

Primary prevention of periodontal diseases relies on the child understanding the importance of, and performing regular, thorough removal of dental plaque with a toothbrush, supplemented by other aides such as floss, tooth picks, and chlorohexidine mouth rinses. In addition, fluoride supplements, dental sealants, and encouragement of healthy diets are an imperative part of health education activities (Brown, 1994).

Although health promotion and education are integral components of approaches to dental care, questions regarding the effectiveness and availability of these strategies are stumbling blocks to the formulation of clear policy interventions. With respect to efficacy, Kay and Locker (1996) and Baranowski and Stables (2000) argued that the lack of success of dental health education activities may be due to poor research methodology utilized to design and evaluate the interventions. Barriers to school health education programs are categorized as political (e.g., a lack of or limited administrative/governmental support or funding) or personal (e.g., transportation and the number of health care professionals assigned to a designated area). Moreover,

Porter, Coyte, Barnsley, and Croxford (1999) suggested that economic incentives impact the practice patterns of dentists, which has implications for policies regarding provider payment systems.

Refugees and immigrants have the most risk for poor dental health because they may not have practiced regular, preventive measures such as tooth brushing in their native countries due to cultural norms or poverty. In fact, toothpaste and brushes, let alone fluoride and clean water, are unobtainable luxuries in many of these communities (Yehieli & Koch, 1999a). In addition, their literacy level in English may be so low that it adversely affects their ability to comprehend preventive information. According to Yehieli and Koch (1999a), literacy is a key predictor of health. Yehieli and Koch suggested a lesson plan based on the dental health curriculum, *Bright Smiles, Bright Futures* to instruct elementary immigrant children in schools about dental hygiene. The curriculum includes topics such as plaque, proper brushing techniques, and proper nutrition. The program enlists visual aides, interactive activities, repetition, and hands-on practice to teach elementary immigrant children about proper dental health, while simultaneously strengthening their English language skills. Highlights of the program feature student volunteers dressed in tooth costumes to demonstrate the importance of brushing, the Mr. Clean Mouth model, and the free toothbrushes with which all children brush their own teeth at the end of the lesson. Finally, after one month of regular brushing at school, students are permitted to take their toothbrushes home to continue the learned habit (Yehieli & Koch, 1999a).

Sheikh and Horowitz (1999) argued that Yehieli and Koch's program fails to address the benefits of fluoride toothpaste and the importance of health literacy among immigrants. Specifically, health literacy involves a basic fundamental knowledge of oral health to allow individuals to maintain a healthy status in their mouths. In addition, Sheikh and Horowitz asserted that the Bright Smiles, Bright Futures curriculum is deficient in addressing eating sweet and sticky foods. Although these foods may be detrimental to an individual's oral health, the duration that one of these substances remains in the mouth is equally or more important in determining its negative effects. Moreover, the program fails to enforce washing of hands before brushing. Sheikh and Horowitz concluded that by using fluoride and heeding the other suggestions outlined, in conjunction with the Bright Smiles, Bright Futures Program, individuals attempt to maximize their chances of having a healthier oral cavity.

Questions arise regarding the effectiveness and costs of dental health educational programs. Prevention programs presumably reduce disease, in general, and therefore lower the demand for health services and resultant costs. Kay and Locker (1996) reviewed available evidence regarding the effectiveness of dental education programs published between 1982 and 1994 ($N = 143$). Each paper was scored by two independent researchers according to validity criteria (e.g., random allocation to groups, blinded examiners, baseline measures for control and experimental group, etc.). Kay and Locker suggested that the quality of evidence reported in the literature pertaining to dental health education is poor and needs to be standardized to be reliable.

The majority of studies failed to use a randomized, controlled trial design. The combination of qualitative and quantitative review techniques showed that dental health interventions have a small positive, but temporary effect on plaque accumulation (e.g., reduction of plaque index = 0.37; 95% CI -0.29-0.59), while there was no discernible effect on caries increment. Moreover, dental health education programs did not increase knowledge levels of participants. As the integrity of the data reported regarding dental health education effectiveness is compromised, a negative impact on the perception of dental health education programs follow. For example, although data exist regarding the positive impact dental education has on dental health and lifestyles overall, the clinical significance may be minimal as compared to the cost of the program. Kay and Locker concluded that, if data from these studies are to be considered valid, studies on dental health education with respect to efficacy need to be revamped to include elements defined by rigorous scientific standards in evaluation research.

Similarly, Brown (1994) reviewed the research ($N = 57$) in dental health education from 1988 to 1992 that evaluated the effectiveness of interventions to alter individual's behavior related to dental health. Contrary to Kay and Locker's (1996) review of the validity of the data from studies such as these during this period, Brown presented a consensus regarding the impact of dental health education on behaviors, attitudes, and oral health measures. Brown found that dental health education results in improvements in objective measures of dental health behaviors and oral health

measures; however, there is limited success in changing attitudes toward dental issues and gains in knowledge are confined to the short-term. In addition, self-reported positive behavior changes in plaque control measures (e.g., flossing or brushing) were more common among females. Brown suggested that sealant programs need to target high-risk communities and continue to play a role in public dental health activities.

Brown (1994) reported that water fluoridation is one of the most successful, cost-effective public health disease prevention programs ever initiated. Sheikh and Horowitz (1999) confirmed that the use of fluorides is the single, most-effective method to prevent tooth decay in children. Fluorides protect against dental caries by inhibiting mineral loss, promoting remineralization of decalcified enamel, and reducing the formation of plaque acids (Sanchez & Childers, 2000; Sheikh & Horowitz, 1999). Water fluoridation, in particular, has been shown to reduce the prevalence of caries by one-half (Holt et al., 2000b). In addition, it has the potential to benefit all age groups across socioeconomic strata. Despite these advantages, Allukian (2000) reported that 38% of U.S. communities with public water do not have fluoridation.

In areas where water is not fluoridated, fluoride supplements in the form of drops or tablets are prescribed, and children must be educated to the benefits of taking them. As the systemic fluoride is incorporated into the dentin and enamel of unerupted teeth in infants, they become more resistant to acid demineralization. In addition, fluoride accumulates in plaque, where it decreases microbial acid production and enhances enamel remineralization. Due to the fact that enamel formation begins at

birth for permanent dentition and is complete by the time an infant is 11 months of age in the primary dentition, parents should receive early supervision and counseling regarding the use of fluoride (Sanchez & Childers, 2000).

Dental Health Knowledge

There is a paucity of studies reported in dental health knowledge of elementary age children in the United States. Oliveira, Narendran, and Williamson (2000) concurred that there are limited studies that evaluate the dental health knowledge of elementary age children. In an earlier study, Walsh (1985) conducted a field experiment to assess the effects of a school-based dental health education program on knowledge, attitudes, and behavior of 854 boys and girls, 12-14 years old enrolled in a San Francisco middle school. The students were randomly assigned into experimental and control groups. The experimental group completed a written test that related to factual dental health knowledge, home care dental practices, and attitudes to dental health before and after an education intervention. The control group completed the written test at similar times to the experimental group but received no educational intervention. The findings indicated a significant increase in knowledge for the experimental group ($p = < 0.001$) as compared with the control group. The educational intervention resulted in no significant differences between the experimental and control subjects related to attitudes; there was a significant positive change in attitude within the experimental group ($p = < 0.01$) from pretest to posttest. Also,

there was a significant increase in frequency of tooth brushing ($p = <0.01$) and dental flossing ($p = <0.01$) with girls in the experimental group.

Russell, Horowitz, and Frazer (1989) examined the oral health knowledge and practices of 284 6th grade students using a quasi-experimental design to test differences between two groups: children who had completed a 4-year program referred to as the National Preventive Dentistry Demonstration Program (NPDDP) and a control group of children who had not participated in the NPDDP. The children who completed the 4-year NPDDP program received dental examinations as well as school-based fluoride and sealant programs. Based on incidental learning theory, the research question was whether or not the dental knowledge and practices of students were consistent with the preventive programs taught at school. The reported study was not connected with the NPDDP. A school nurse-administered questionnaire was received from 284 students 16 months after the NPDDP ended. Results indicated that students in all groups reported similar dental practices; there were no practical differences found among the groups relating to knowledge of the use and benefits of fluoridation. Students who received sealants were more knowledgeable about the use and purpose of sealants. Data suggested that even though students in five of the six NPDDP groups had received the preventive program, they lacked understanding and awareness of procedures (i.e. sealants, fluoride) and their value in preventing oral disease. Students were unable to discriminate between methods for preventing dental caries and periodontal disease. The conclusion was that education relating to the purpose and value of preventive

programs should be an integral part of the delivery of such services.

Watanabe, Okada, Tashiro, and Takaesu (1993) examined the cognitive abilities regarding dental health terms, specifically dental plaque, of primary and junior high school children. An interview of 112 students was completed to assess knowledge of the etiology of dental caries and the meaning of selected dental health terms. Results suggested that most school children had difficulty understanding the correct meaning of dental plaque and oral bacteria. The authors concluded that factors interfering with correct understanding of dental plaque need to be examined.

Leavy (1992) evaluated an oral health education program for inner-city 1st grade students. The purpose of the study was to delineate what outcome changes were associated with the Bright Smile, Bright Futures curriculum. Two experimental and two comparison classrooms were chosen from two District of Columbia Public Schools. Students were pretested and posttested using an instrument designed to measure oral health knowledge, attitudes, and behaviors that were addressed in the curriculum. Students' tooth brushing skills were evaluated at posttest. The hypotheses were that children who were exposed to the curriculum would (1) increase their oral health knowledge, (2) increase positive attitudes toward oral health, (3) have more positive oral health behaviors, and (4) increase their tooth brushing skills compared to those children who were not exposed to the curriculum. Findings suggested that those students who received the curriculum had more significant increases in their dental health knowledge than their counterparts who did not receive the curriculum. Two

behaviors discriminated who received the curriculum from those who did not: dental visits and tooth brushing frequency. The author concluded that those students who were exposed to the Bright Smiles, Bright Futures curriculum were more skilled at brushing their teeth than those who were not exposed to the curriculum.

Peng, Petersen, Fan, and Tia (1997) described the oral health status and oral health behavior of urban Chinese children and the effect of socio-behavioral risk factors on dental caries experience. A cross-sectional survey of 12-year-old children was conducted including urban and periurban groups. Data were collected by clinical examinations and the use of self-administered questionnaires given in the classroom by teachers and dentists. The sample consisted of 698 children (362 boys and 336 girls); 448 children were from the central city and 250 children were from the periurban areas. Results indicated that the mean DMFT (Decayed, Missing, Filled Teeth) (World Health Organization, 2001) of the children was 0.77 and decayed teeth constituted most of the caries index. About 65% of the children had gingival bleeding and tartar. Forty percent brushed their teeth twice a day and 46% had seen a dentist within the past year. Children living in the central city and with a higher education level among their mothers showed higher percentages of positive attitudes toward dental care, use of fluoridated tooth paste, and tooth brushing at least twice a day compared to those living in a periurban area and with a lower education level among their mothers. The multiple linear regression of dental caries experience revealed that the most important factors were the independent variables of consumption of sugary drinks/foods, location,

and dental visits. The authors suggested that the study demonstrated that systematic oral health promotion programs for children in China are urgently needed.

Hamilton and Coulby studied 11-year-old children ($N = 6,329$) in Northeastern Ontario using a supervised self-complete questionnaire and a clinical exam. The purpose of the study was to gather baseline data on caries and periodontal knowledge, self-reported oral health behaviors and source of knowledge, and oral health status. Results indicated that the children had poor knowledge of caries preventive methods such as water fluoridation, dental sealants, and choice of snack foods. Children confused plaque and calculus. Seventy-three percent of the children indicated that they brushed twice a day; 88% used tooth paste; 42% stated that they flossed at least two times per week, and 84% claimed an annual dental visit. Children with the best knowledge stated that the school and the dentist were the sources. High knowledge was associated with good oral health habits ($p = < .001$) and low DMFT (Decayed, Missing, Filled Teeth) ($p = < .001$). Good habits were not related to DMFT score ($p = .1095$). Findings suggested the need to reinforce preventive health education, investigate the cultural status of the student, as well as investigating the status on oral health knowledge and the efficacy of different health education programs delivered by various sources.

Oliveira et al. (2000) investigated the oral health knowledge, attitudes, and preventive practices of 3rd grade school children in Harris County, Texas. The examiners collected data on dental caries, periodontal disease, and fluorosis from 1,031

children. The cross-sectional study was investigated by means of a self-administered bilingual questionnaire. Results suggested that 58% of the children reported fairly adequate oral hygiene habits and 48% reported fairly adequate oral health knowledge. Fifty-nine percent of the children reported adequate dietary pattern. Those children with inadequate oral health knowledge were twice as likely to have cavities compared with those children with adequate knowledge (OR = 2.05, 95% CI = 1.29, 3.28). The mean combined DMFT/dft scores of those children with inadequate knowledge were significantly higher than the mean for children with adequate knowledge ($t = 2.6$, $p = < 0.009$). The authors concluded that there is a need to improve oral health knowledge and preventive practices among the 3rd grade children.

Irigoyen, Maupome, and Mejia (1999) reported on the caries experience in the permanent dentition among Mexico City elementary school children (6 to 12 years old). The authors undertook a comparative analysis of dental caries experience and dental treatment needs of children of different socioeconomic status (public school attendance versus private school enrolled). Socioeconomic criteria utilized was that the family income was high enough for the child to attend private school compared to a public school. The sample included 4,048 6- to 12-year-old children (47.2% females) who were examined using the World Health Organization caries criteria. Of the sample, 546 children attended private school and 3,502 attended public school. The random sample of elementary schools was selected from a list provided by the Ministry of Education that included private and public schools. Data were analyzed using means

and standard deviations that were computed for the treatment needs and dental caries. To compare mean caries indexes, Students' t tests were utilized. The chi square test was used to compare proportions.

Results indicated that the proportion of caries-free 12-year-old children was 28.6% in the private schools and 9.5% in the public schools ($p = < 0.01$). In 12-year-old children, DMFT was 2.78 ($SD = 2.9$) in the private schools and 4.64 ($SD = 3.2$) in the public schools ($p = < 0.001$). Public school children had higher treatment needs ($TN = 83\%$) compared with private school children ($TN = 27.6\%$) ($p = < 0.001$). Irigoyen et al. (1999) concluded that dental caries and treatment needs were higher in children of lower socioeconomic status. The authors suggested that the findings may be due to differences in dietary patterns and toothpaste.

Recommendations were that preventive health promotion and treatment programs should be developed to improve the oral health status of children of Mexico City.

Vigild, Skougaard, Hadi, and Halling (1999) assessed whether it was possible to implement an oral health program in Kuwait following guidelines from the Danish Child Oral Health Service to improve the oral health of children 6 to 10 years old from 1986 through 1997. The program was initiated by the Minister of Health in the school-based setting. The interventions received by the children included bi-weekly tooth brushing instructions with fluoridated toothpaste/fluoride rinsing, fissure sealing, oral health education, and restorative treatment of dental caries. The children were examined each year before school started using the World Health Organization (WHO)

criteria for dental caries. Results demonstrated that the average participation rate was 94%. The percentage of caries-free children increased from 64% in 1987 to 78% in 1990. Because of the Gulf War, the percentage of caries-free children dropped to 71% in 1992 but increased to 79% in 1997. The authors concluded that the guidelines for Danish Child Oral Health Service are adaptable to Kuwait children. The authors found that the regularly scheduled oral health education for parents and teachers improved the acceptance of the program for the children during school hours. Finally, the oral health of the children improved.

Petersen, Danila, and Samoila (1995) described the oral health behavior, knowledge, and attitudes of children (1st grade), mothers, and schoolteachers in Romania in 1993. A total of 322 mothers of 1st grade children (responses, 89%) and 97 teachers (responses, 86%) participated in the study. Data from mothers and children were collected by highly structured personal interviews by dentists; the teachers responded to self-administered questionnaires. Most mothers knew about the causes of dental caries; however, fewer were aware of the harmful effect of hidden sugar. Most of the mothers were aware of how important tooth brushing is, but salt was recommended by 32% of the mothers to prevent periodontal disease. The children (37%) brushed their teeth at least twice a day; 26% of the children had their teeth cleaned by their mothers daily. Sugar was taken mostly with milk and sugar, breakfast cereals with sugar, biscuits, and sweets. The teachers wanted to become involved in oral health education because they were aware of the poor dental conditions in the

children. The authors recommended that training teachers should be focused on improving their knowledge in oral health. School-based oral health promotion programs, according to the authors, are urgently needed.

Lang, Woolfolk, and Faja (1989) surveyed 404 teachers (62% response rate) from urban and rural areas to determine their sources of information about oral health knowledge and attitudes related to dental disease prevention. Dental offices (82%) were most frequently cited sources of information followed by books and magazines. According to the teachers, tooth decay prevention was the most important reason to practice good oral hygiene. Regular dental visits and reducing intake of foods with sugar were rated higher by the teachers for preventing caries than fluoridated water and fissure sealants. Findings suggested that teachers' knowledge about oral health and methods of prevention is not complete, not accurate in selected instances, and not varying significantly by geographic location.

Nutrition and Oral Health

Nutrition is an essential component of health promotion, but it is often a poorly utilized factor of preventive dentistry. Mycek (2000) indicated that children with dental conditions may suffer nutritionally as a result of pain when eating or drinking. On the other hand, adequate nutrient intake is essential for the growth, development, and maintenance of the oral tissues. Individuals who have a high-risk nutritional status have compromised oral health. Sanchez and Childers (2000) indicated that, in addition

to poor oral hygiene, poor dietary habits are associated with the development of caries in infants and children. Sugars, especially non-milk sugars in items other than fresh fruits and vegetables, are the major dietary causes of caries. Holt et al. (2000b) asserted that dietary advice should begin by recommending appropriate infant and weaning practice. For example, drinks other than milk and water should not be given in feeding bottles and should be confined to main meals. In addition, children should cease using bottles by 1 year, while weaning foods should be free of or have very low sugar content other than those sugars present in fresh milk and raw fruits or vegetables (Holt et al., 2000b).

The Camden Health Improvement Learning Collaborative (Weech-Maldonado & Merrill, 2000) is similar to the Healthy People Program. The former is focused on improving the health status of individuals in four economically depressed communities within Camden County, New Jersey where the health care access is limited and the infant mortality rate is more than twice the statewide rate and three times higher than the Healthy People 2000 goal. It is composed of representatives from local health care providers, public agencies, religious organizations, and neighborhoods whose primary goal is to improve the health status of the community by involving and empowering residents. Weech-Maldonado and Merrill assessed the Collaborative with respect to historical development; political, institutional, and social context; planning process; organization and structure; and performance. Initiatives implemented by the Collaborative includes health awareness and leadership training, wellness and health

promotion programs, family wellness education programs, a nutrition program, and outreach vans. Specifically, the Camden City Nutrition Program, offered in English and Spanish, involves weekly educational sessions, a supermarket tour, a cooking demonstration, and information on healthy snacks. A few sessions are focused on children's health and nutrition, blood pressure and cholesterol screening and education, sugar and nutrition, and healthy holiday eating. The "neighborhood living room" (NLR), staffed by a social worker or case manager and a neighborhood host, is a storefront that allows members of the at-risk community to access health education, counseling, screening, referrals, and information services. Currently, the Collaborative is attempting to develop a performance evaluation system, which they refer to as SMART (specific, measurable, appropriate, realistic, and timely), that can monitor progress in meeting community health goals. For the program to be successful, Weech-Maldonado and Merrill indicated that the Collaborative must build trust among the participants and with the communities served; it has the potential to improve awareness, health care access, and community health empowerment in low-income or inner-city communities.

Health education centers are committed to helping young people gain insight into how the human body works, thus elevating self-worth and personal responsibility. Dinger, Ogletree, and Johnson (2000) evaluated a general health program designed for grades 2 and 3, "A Healthy Adventure." This program introduces children to cells, organs, body systems, and nutrition information. The teaching methods utilized in this

program include animated displays, audiovisual presentations, group interaction, Systems Man, and Transparent Anatomical Manikin. In an effort to evaluate the program, Dinger et al. studied 3rd graders ($N = 168$) who participated in the program. The "Healthy Adventures Test" was administered to assess the students' knowledge of body systems and nutrition pre- and post program. The authors found that posttest scores differed significantly ($p = 0.0001$) in groups who were exposed to the program versus those who were omitted from the program and provided with a traditional curriculum. Post hoc testing revealed that, ideally, a combination of curricular materials, the "Healthy Adventure" program, and a comprehensive school education program should be offered to elementary school youth (Dinger et al., 2000).

Optimum oral health care and nutrition during pregnancy, infancy, and childhood are essential components for the growth and development of teeth and the oral cavity. Fitzsimons et al. (1998) indicated that current dental health education and prevention programs are deficient in addressing the oral health status of these individuals. The authors suggested that pregnant women can maintain their health through proper diet, good oral hygiene, and appropriate use of fluoride. In addition, a nutritious diet during pregnancy is essential for the optimal oral development of the fetus. In addition to a healthful diet, infants need fluoride supplements and regular teeth cleaning once teeth begin to erupt. The authors proposed that the reason the relationship between nutrition and dental health is often overlooked during this critical

time is due to the lack of training of dietitians and pediatricians regarding preventive or oral health recommendations and dental counseling skills. Fitzsimons et al. concluded that dietitians should provide the required information to and foster positive dietary and dental health attitudes among parents and other care givers to promote a healthful start during the early months of life when contact with dental health professionals is limited.

Boyd and Dwyer (1998) asserted that dental hygienists have the capacity to identify patients at nutritional and oral health risk, help them attain optimal oral and general health, and improve their overall quality of life. In addition, potential barriers to the availability of nutrition education services in the dental office include the ignorance of dental patients as to the significance of nutrition and food habits to their oral health. Boyd and Dwyer offered guidelines on nutrition screening, assessment, and intervention, tools used, the rationale for determining who is at high nutritional and oral health risk, and the referral of patients to other health professionals for more complex nutritional needs. General physical appearance may identify any abnormal findings such as overall appearance, weight-height ratio, condition of skin/hair/nails, and functional ability, which may result from nutritional deficiency. Moreover, determining problems with dexterity and mobility is crucial to determining whether a child has adequate nutrition and can perform oral hygiene routines. Nutrition assessment may include a 3-day food record sent home with the patient to fill out and send back to the dental office (Boyd & Dwyer, 1998).

Taylor, Serrano, Anderson, and Kendall (2000) asserted that findings from the

oral examination and dietary evaluation should be considered when dentists determine the appropriate treatment plan and subsequent nutritional counseling for a particular child. Nutritional counseling should include the U.S. Department of Agriculture's (USDA) Food Guide Pyramid and the Dietary Guidelines for Americans (Boyd & Dwyer, 1998). These guidelines were designed to promote health by enhancing caries protection (Table 2). Boyd and Dwyer (1998) concluded that the dental office, and specifically dental hygienists, can play an important role in the nutritional screening, assessment, and educational intervention to assist young patients in attaining and maintaining optimal oral and general health.

By improving nutrition-related knowledge, skills, and behaviors, children are empowered to lead healthy lifestyles. The United States Department of Agriculture/Extension Service (USDA/ES) attempted to solicit the aid of others to address the nutrition needs of individuals who are eligible for the Special Supplemental Food for Women, Infants, and Children (WIC). The goal of the nutrition education initiative was to develop, deliver, and evaluate community-based nutrition education activities in an effort to improve nutrition-related behaviors that lead to healthier lifestyles for targeted populations. Taylor et al. (2000) evaluated a nutrition education program, La Cocina Saludable, by using a knowledge, skills, and behavior pretest, posttest, and 6-month follow-up survey on the educators as well as the participants. Based on the State of Change Model (Prochaska & DiClemente, 1983), the program attempts to explain

Table 2

Dietary Guidelines for Nutrition

Guidelines

Eat a variety of foods.

Balance the food you eat with physical activity--maintain or improve your weight.

Choose a diet with plenty of grain products, vegetables, and fruits.

Choose a diet with reduced fat, saturated fat, and cholesterol.

Choose a diet moderate in sugars.

Select a diet moderate in sugars and salt.

Limit eating events to three per day.

Reduce snacking. If you need to snack, limit snacks to fresh fruit, vegetables, popcorn, and dairy products.

Cariogenic foods (i.e., crackers, donuts, pretzels, candy, soda, juice) should be consumed with meals.

When oral hygiene does not follow a meal or snack, end with a dairy product (e.g., cheese or milk) or rinse mouth thoroughly with water.

Discourage eating snacks prior to going to bed, unless followed by a thorough brushing or flossing.

Drink water between meals and with snacks.

Eat or drink at least two to four servings of dairy products per day.

Note: Adapted from Boyd & Dwyer, 1998.

how people intentionally change their behavior. Specifically, La Cocina Saludable is aimed at a low-income, Hispanic population and utilized Hispanic grandmothers (abuelas) or grandmother figures who were highly respected by the community as peer educators. Educational materials of the program focused on five units: (1) make it healthy, (2) make it fun, (3) make a change, (4) make it safe, and (5) make a plan; and each unit included an experiential and behavioral learning activity designated for that particular unit. Taylor et al. found that pre- and posttest scores ($n = 80$) differed significantly, which reflected an increase in the knowledge and skills of nutrition issues as a result of the nutrition education program. The authors concluded that the program met the Hispanic community's needs, thus initiating dietary changes that promote good health, in general (Taylor, 2000).

According to DiSogra and Glanz (2000), nutrition promotion strategies should be creative, inexpensive, and widely disseminated to be successful. The 5-A-Day For Better Health Project, instituted by the National Cancer Institute (NCI), is an innovative, nutrition program that encourages children to be the advocates for policies that promote eating more fruits and vegetables. The authors report on the 5-A-Day virtual classroom and its impact on children's health education. This internet-based nutrition program stimulates children to suggest ways the President of the United States could encourage elementary school children to consume more fruits and vegetables. This program is based on the social action theory, which dictates that interventions such as group activities, youth empowerment, and activation strategies can lead to a positive

change in behavior through increased problem-solving capacity, active problem solving, and social action. In 1997, children were asked, "If you were President, how would you get children to consume more fruits and vegetables?" The total participation for this initiative was 2,600 students, 20% of whom were aged 5 to 7, 63% were aged 8 to 10, and 15% were 11 years or older. The most frequently mentioned idea for encouraging children to eat fruits and vegetables was to pay or reward them. The next three suggestions included utilizing presidential influence to motivate children, stressing the health value of fruits and vegetables, and insuring that fruits and vegetables are served in school lunches. Some suggested that the President serve as a role model and eat fruits and vegetables with the children (DiSogra & Glanz, 2000). Similarly, Allukian (2000) asserted that creative leadership, incentives, oral health literacy, and sufficient resources will be needed for federal government interventions to promote oral health. DiSogra and Glanz concluded that information technology offers a plethora of opportunities to utilize the Internet as a catalyst for learning, discussion, problem solving, and social action for promoting healthful lifestyles (DiSogra & Glanz, 2000).

Process Evaluation

Although it is infrequently conducted, process evaluation is an essential component of evaluating the impact of health promotion interventions. Baranowski and Stables (2000) evaluated the results of nine 5-A-Day projects. Their evaluation aided

in explaining some of the weaker aspects of program performance, why process indicators occasionally declined over time and varied by demographic characteristics, and how some process measures were related to mediating variables and program outcomes. The authors asserted that the most reliable data come from randomized studies. Process evaluation capitalizes on the variability in implementation to make inferences about the effectiveness of project components. Moreover, indicators of process enable investigators to determine which components of their intervention were related to outcomes and which were not. In their extensive review of 5-A-Day programs by process evaluation, Baranowski and Stables found that there needs to be an increased consistency in the concepts that guide the methods and interpretation of data. Like Kay and Locker (1996), Baranowski and Stables indicated that the reliability of methodology and data needs consistently to be addressed, because unreliable data have the potential to structure future reality (Baranowski & Stables, 2000).

Collaborative Partnerships

Health professionals have the ethical responsibility to disseminate information regarding health promotion and disease prevention to the whole population in an effort to promote dental health education at the community and client level (Brown, 1994; Kay & Locker, 1996). Wyatt and Novak (2000), Peterson et al. (1999), and Adams and Scheuring (2000) concurred that collaborative partnerships successfully implement

dental health education programs that positively benefit children. Wyatt and Novak defined a collaboration as an integrated, skill-based, shared decision-making model based upon mutual respect and effective communication (Wyatt & Novak, 2000). Since children spend the majority of their time in school settings, many of their health needs are identified and met through school health programs. Collaborative partnerships among international, national, state, and local levels can be instrumental in meeting the increased needs of America's children. The Centers for Disease Control (CDC) currently supports 15 states in coordinated school health programs and provides \$47 million in funding for specific education programs (Wyatt & Novak, 2000). Health promotion programs are a result of the collaboration among participating agencies (e.g., schools and dental clinics), the program implementers (e.g., classroom teacher, school nurse, dental hygienist), a proximal target person (e.g., the child), and a distal target person (e.g., the parent or care giver) (Baranowski & Stables, 2000).

Share The Care (STC) is a Children's Dental Health Initiative that is a public-private partnership among the County of San Diego Health and Human Services Agency, the San Diego County Dental Society, and the San Diego County Dental Coalition. The STC program targets limited-resource families and provides access to dental care and education for children preschool age to 19 years. Services offered by STC include free or reduced-cost emergency dental care to alleviate pain, child education and early preventive services in special neighborhood-based programs, and information and education to parents and providers in an effort to foster understanding

of the need for ongoing preventive dental care. Children are screened for financial eligibility and urgent dental need and subsequently referred by school nurses and other health care providers to dentists who render emergency treatment in their offices on a charitable basis. Moreover, dental hygienists and dentists collaborate to sponsor community school-linked sealant clinics. STC provides emergency referral to over 500 children and preventive treatment to an additional 500 children annually. The program's success is evaluated by assessing the number of children referred and the type and value of dental treatment. According to Yamagata (2000), STC has filled the missing link in dental care in San Diego County.

School nurses play a crucial role in identifying children with oral health problems and in need of dental care. In fact, school nurses trained to perform oral examinations on a regular basis identify more dental problems than school nurses who do not perform oral examinations annually. Peterson et al. (1999) recommended that school nurses and dental professionals work together to develop interventions to reduce dental morbidity and improve the oral health of children.

Similarly, Adams and Scheuring (2000) portrayed the school nurse as a health consultant bridging the gap between the education and health realms. The authors assessed the impact that university nursing faculty and students' collaboration with public schools has on the healthy outcomes of elementary school children. The school of nursing worked with school personnel and the school nurse to form a community advisory board to identify the health needs and community resources in a rural county

school system. The Council on Collegiate Education for Nursing actively supports school health by encouraging partnerships between nursing education programs and public school health (Wyatt & Novak, 2000).

The school nurse, the school of nursing consultant, and nursing students began an electronic tracking system for two rural schools and implemented a database for managing the school health system. In addition, nursing students were assigned to participating teachers and presented classes on dental care, nutrition, and hygiene to K-5 classes. Resources for the classes were obtained from grants, toothpaste companies, and personal hygiene product companies. For a health fair, the county public health department provided access to a medical and dental van for children's tours, while a local supermarket provided healthy snacks. Adams and Scheuring (2000) indicated that benefits from this collaboration were not only derived from students from these schools in an at-risk, rural community, but also by the nursing students. The K-5 students had an increased awareness of health education while the nursing students were preparing for their roles as potential school nurses. The authors concluded that the measure of the program's success will be the improved health in the elementary children as seen over time.

Wyatt and Novak (2000) concurred with Peterson et al. (1999) and Adams and Scheuring (2000) that collaborative partnerships are a critical element to school health programs. Wyatt and Novak reviewed exemplary collaborative school health partnerships; international, national, and regional commitments to the children and

school health; common barriers to school health programs; and strategies to promote collaborative school health programs. WHO established that partnerships are the keys to improve policies, curricula, and training programs related to health promotion. In addition, WHO teamed up with the CDC to coordinate individuals responsible for health promotion and school health. Collaborative projects implemented by the CDC to promote health within the school setting include: (1) coordinated school health programs, (2) research to classrooms, (3) school health program guidelines, policy, and study, and (4) comprehensive school health education. Components of a school health program are: health education, physical education, health services, nutrition services, health promotion for staff, counseling, psychological health, a healthy school environment, and parent/community involvement. Obstacles to providing dental health education to low-income communities are both political (e.g., funding, governmental/administrative support) and personal (e.g., transportation, availability of health care professionals). Strategies to promote school health program collaboration combine the efforts of teachers, administrators, staff, and health care providers into a program coordinated with the remainder of the community service system. This approach limits fragmented care and creates a safety net for overlooked problems such as emotional and social concerns. Wyatt and Novak (2000) concluded that collaborative efforts are essential in the planning, implementation, and evaluation phase of the school health program.

In an attempt to improve the oral health status of children in the Mar Vista

Garden (MVG) housing development, a dental health campaign sponsored by the University of Southern California was implemented. The program was designed to be culturally and linguistically relevant in areas of dental health screening and education. The first part of the program is a 2-hour, dental health education workshop with an agenda that includes preventive strategies such as flossing, control of baby bottle tooth decay, routine exams, sealant, fluoridation, and tooth brushing time. In addition, the on-grounds preschool partnered with nursing students and a local dentist on this project. Nursing students compiled a resource that detailed information such as the types of treatment provided, the local languages spoken by dentists and assistants, payments accepted, and options for free dental services. In turn, the social services department was available to sign people up for insurance options. Moreover, MediCal and Healthy Families representatives participated to explain options for service. The implementation of the program was the result of a collaboration among the children's center, housing authority/community housing project, nursing school, local dentist, and the Smile Network. The program was evaluated by: (1) the number of adults and children screened and educated, (2) the media attention devoted to the baby bottle syndrome, (3) the number of referrals for service, (4) the relevance of resource guides and education, and (5) the convenience of the program. Although the results regarding the evaluation of the program are not available currently, it was suggested that the coalition of agencies and individuals is instrumental to the success of the program's implementation (Schneiderman, 1999).

Public policy is an essential component of effective health promotion practice. Health-promoting schools (HPS) define linkages between health and education and include students, families, teachers, administrators, and community partners as key stakeholders in program development (Nader, 2000). Currently, HPS have not taken root in the United States, although it is endorsed and supported by WHO. Stewart, Parker, and Gillespie (2000) reviewed the health education policies in Australian HPS and found, primarily, that there was no succinct definition of what a HPS was. As a result of this confusion, health promotion and health education policies were met with an increased resistance and skepticism. In effect, this discrepancy and lack of communication contributed to the disintegration of whatever collaborations and partnerships between the health and education sectors that may have materialized, which indirectly affects the efficacy of the health promoting program (Stewart et al., 2000). Rowling and Rissel (2000) asserted that, despite the continuing difficulty of defining HPS, there will be a lack of research evidence to support the effectiveness of HPS, which influences the perception of health and education in general. St. Leger and Nutbeam (2000) called for a more substantial body of research regarding effective teaching, learning, assessment, curriculum, and school organization in order to inform and enrich practice in school health.

Collaborations between public and private agencies, such as schools, local health care providers, religious organizations, and communities, are an underutilized yet cost-effective way to increase the availability of health care services to and improve

health care awareness among members of low-income communities (Adams & Scheuring, 2000; Allukian, 2000; Fitzsimons et al., 1998; Peterson et al., 1999; Weech-Maldonado & Merrill, 2000; Wyatt & Novak, 2000). The outreach and education efforts of the public health sector are designed to find and enroll children and parents in education programs about preventive dental health practices and the appropriate utilization of dental services. In particular, effective response to dental health needs in the state requires broad commitment by school and government administration to a long-range plan for coordinated school health education programs. Currently, most school-based health centers do not have dental components and 44% of community health centers do not have a dental program (Allukian, 2000).

School health educators have the opportunity to play a key role in promoting dental well-being not only among at-risk children, but with all students and their families as well (Yehieli & Koch, 1999b). School nurses who are aware of dental health as a component of overall child health must work with school health educators to address this issue (Adams & Scheuring, 2000). Although cost-effective education and preventive measures for oral diseases and conditions are available, they are being underutilized currently. Some authors indicated that this under utilization is due to barriers that do not allow low-income inner-city and rural communities to access dental services conveniently. An estimated 20 million children annually are at substantial risk of pain and disfigurement because they lack access to appropriate preventive and reparative services (Milbank Memorial Fund, 1999). Barriers to dental care may

include the availability of educators and providers and/or financial or social issues. Eighty percent of children on Medicaid have not had a preventive dental visit, 38% of children in rural counties have no dentist, and 62% do not have a dental hygienist (Allukian, 2000). Given these facts, Peterson et al. (1999) argued that there is no difference in the oral health status of children in areas where dental health professionals' availability is compromised. The mission of Healthy People 2000 is to increase the availability of oral health screening, education, referral, and follow-up programs for essential diagnostic, preventive, and treatment services (Peterson et al., 1999). DiSogra and Glanz (2000) asserted that information technology increasingly can provide access for all individuals to health care information and education. In addition, children's access to dental care and preventive education can be improved by simplifying the interaction between dentists and public agencies as well as by increasing the reimbursement to providers (Herz et al., 1998; Milbank Memorial Fund, 1999; Milgrom, Hujoel, Grembowski, & Fong, 1999; Robison et al., 1998).

As organizations continue to take the initiative to design successful dental health education strategies and policymakers consider the oral health status of children a priority when implementing legislation and allocating funding, children's oral health and education should undoubtedly be benefitted. The Children's Dental Health Preservation Act is an example of the commitment that the federal government has initiated to identify children who are at risk of developing cavities, providing dental services to low-income children, and training health care professionals, children and

parents on oral disease prevention (Congress of the United States, 2000). In addition, the Children's Dental Health Improvement Act of 1999 imposes guidelines on dental expenditures, accountability, and oral health promotion and disease prevention efforts (American Dental Education Association, 2000).

Summary

Oral health is integral to the general health and well-being of all Americans (DHHS, 2000). Children, specifically, are prone to dental caries, one of the most chronic diseases of childhood (DHHS, 2000). Determining whether or not there was a difference in dental health knowledge of 4th and 5th grade elementary school children enrolled in an inner-city and non-inner-city elementary school before and after receiving a comprehensive or regular dental education program was the focus of the current study.

The literature related to the scope of the problem, barriers to improving oral health, dental health education and dental health knowledge studies as well as nutrition and oral health and collaborative partnerships for improving oral health knowledge in children were reviewed. The review of the literature was guided by concepts relevant to the Neuman (1995) Systems Model.

Although few studies exist on dental health knowledge of elementary age children in the United States, the major findings of international studies suggested that oral health promotion programs are urgently needed (Peng et al., 1997; Petersen et al.,

1995). The status on oral health knowledge of children and the efficacy of different programs, according to Hamilton and Coulby (1991), need to be investigated. Irigoyen et al.(1995) state that children with lower socioeconomic status have an increased risk of dental caries.

CHAPTER 3

PROCEDURE FOR COLLECTION AND TREATMENT OF DATA

The research design for this study was a quasi-experimental, pretest-posttest two-group design to measure and compare the effect of a dental health educational program on the dental health knowledge of inner-city and non-inner-city upper elementary grade school children before and after receiving a regular or comprehensive dental health educational program. According to Woods and Catanzaro (1988), quasi-experimental designs are those designs in which the researcher does not randomly select or assign the participants for an intervention but does manipulate the independent variable and have control groups to enhance the internal validity of the findings.

Upper elementary grade school children (4th and 5th grades) from one inner-city and one non-inner-city school were randomly assigned by class to experimental and control groups. The experimental groups of inner-city and non-inner-city upper elementary grade school children received a comprehensive dental health education program presented by the researcher. The comprehensive dental health program consisted of a 13-minute videotape in addition to a discussion and demonstration of tooth brushing and flossing using a tooth model and healthy snack choices. The control groups of inner-city and non-inner-city upper elementary grade school children

received the regular dental health education program consisting of a 13-minute videotape presented by the researcher. The independent variable was the type of dental health educational program, and the dependent variable was dental health knowledge.

Setting

The study was conducted with upper elementary grade school children of an inner-city and a non-inner-city public school in two communities of a large school system located in the Southwestern part of the United States. The educational program was conducted in the classrooms of the randomly assigned experimental and control groups of selected schools.

Population and Sample

The target population for this study consisted of inner-city and non-inner-city upper elementary grade school children from a large city in Southeastern Texas enrolled during the school year 2000-2001. The accessible population (Woods & Catanzaro, 1988) were those inner-city and non-inner-city upper elementary grade school children who attended two selected schools in the Near North Side of the city and Houston and met the following inclusion criteria:

1. Able to verbally understand English or read English.
2. Able to participate in a dental health education program in the classroom.

3. Age 9-11 years.
4. Willingness to participate in the study.

A nonprobability convenience sample was used to obtain the control and experimental groups. Each group consisted of boys and girls currently enrolled in the 4th and 5th grades. The classes were randomly assigned to either the experimental or control groups. The minimum sample size for the total study was 124 students, as determined by power analysis using Cohen's (1988) criteria and power tables when using an ANOVA with an alpha of .05, an effect size of .30, and a power level of .80.

Protection of Human Subjects

The guidelines of the Institutional Review Board at Texas Woman's University (TWU) were followed to assure protection of the study participants. Study approval was obtained from the TWU Institutional Review Board and the Research Department of the Houston Independent School District (Appendix B).

Potential risks of study participants included the loss of confidentiality and loss of classroom time. To reduce the risk of loss of confidentiality, code numbers were used on the Demographic Data Form and the Dental Health Knowledge Questionnaire, and data were reported in the aggregate. The researcher kept a separate list identifying the student's name with the code number. The list and the data were placed in a locked file. All forms of data were destroyed upon completion of the study. To reduce risk of loss of usual classroom time, the Dental Health Education program was a part of the

personal hygiene curriculum which was currently in effect.

Instruments

Two instruments were administered to each participant in the study: the Demographic Data Sheet "Questions About You" and the Dental Health Knowledge Questionnaire (Appendix C). The Demographic Data Sheet contained six questions asking for information about age, sex, race, grade in school, frequency of dental visits, and seen by a regular dentist. This information was used to describe the sample.

The Dental Health Knowledge Questionnaire is an 18-item, multiple choice test used for both pretesting and posttesting. A score of one is given for correct responses and a score of zero is given for incorrect responses. To obtain a composite score for knowledge, the items were summed. The questionnaire authors (Texas Department of Health, 1990) field tested the instrument, and there is a history of selected use in the school systems (Personal communication, D. Prachyl, July 26, 2000). However, there is no written documentation of reliability and validity being established in a formal manner. For this study, reliability and validity were established during the pilot study. Internal consistency reliability was assessed at 0.68 for the pilot study and 0.57 for this study using Cronbach's alpha for the total group. The content validity was verified and approved by a panel of experts (elementary educators, health curriculum specialist, dental hygienist, and elementary school nurses).

Data Collection

Data collection began after study approval was obtained. Initially, the researcher introduced herself to the students and provided explanation of the nature of the study. During this meeting, the students received the consent forms (Appendix D), took the forms home to be signed by their parents or legal guardians, and then returned the signed consents to their classroom teacher. After obtaining informed consent from each parent, a further explanation of the study was given to the students followed by the pretest before randomly assigning them to the experimental and control groups. There were experimental and control groups at both the inner-city and the non-inner-city schools. Both groups completed the pretest at their designated school. Following the pretest, the experimental group received the comprehensive Dental Health Education program (primary prevention) (Appendix E). The latter consisted of a 13-minute videotape in addition to a discussion and demonstration of tooth brushing and flossing using a tooth model and healthy snack choices. The control group at each school received the regular Dental Health Education program, a 13-minute videotape. Following the intervention, the posttest was given to the experimental and control groups at each school. Time for completion of the pretests and posttests was 40 minutes. The educational intervention for the control group was 20 minutes (total participation time was 60 minutes) and 50 minutes for the experimental group (total participation time was 90 minutes).

Pilot Study

A pilot study of the methodology and instruments was completed during the fall of 2000, using a convenience sample of 12 upper elementary age children (4th and 5th grades) meeting the study's inclusion criteria of being able to verbally understand English or read English, able to participate in a dental health education program in the classroom, age 9-11 years, and willing to participate in the study. The subjects were selected from one inner-city and one non-inner-city school.

A quasi-experimental, pretest-posttest two-group design was used to measure and compare the effect of a dental health educational program on the dental health knowledge of upper elementary grade school children before and after receiving a regular or comprehensive dental health educational program. Using a table of random numbers, potential subjects were chosen from class lists in the inner-city (5th grade) and non-inner-city (4th grade) schools. Two instruments, the Demographic Data Sheet "Questions About You" and the Dental Health Knowledge Questionnaire (Appendix C) were given to the students by the school nurses in the inner-city and non-inner-city schools.

A panel of experts reviewed the 20-item Dental Health Knowledge Questionnaire for importance of the item, quality of the item, and difficulty of the item (Appendix F). Means were calculated for each question based upon the recommendations of the panel of experts. Upon their recommendations, minor changes

in language and deletion of two items were made for the final version of the Dental Health Knowledge Questionnaire (Appendix C).

Demographic data collected on the subjects included information concerning age, sex, race, grade in school, frequency of dental visits, and seen by a regular dentist. The following sections summarize this information.

Age, Sex, Race, Grade in School

The sample had an age range of 3 years, with a minimum age of 9 (17%) years to a maximum age of 11 (33%) years with 50% aged 10 years. The mean age for the sample was 10.17 years ($SD = 0.72$). Half of the sample was male (50%), and half of the sample was female (50%). With respect to race, 6 of the children identified themselves as Hispanic (50%) and 6 as White (50%). No children identified themselves as Asian, Black, or Other. Half of the sample was in 4th grade (50%) and half was in 5th grade (50%).

Regular Dentist and Frequency of Dental Visits

Regarding having a regular dentist, 7 (58.3%) students in the pilot sample had a regular dentist and 5 (41.7%) did not. Seven (58.3%) of the sample were seen during the past 6 months by a dentist, and five (41.7%) were seen by a dentist during the past year.

Findings

SPSS software was used for statistical analysis. A score of one was given for correct responses, and a score of zero was given for incorrect responses to the Dental Health Knowledge Questionnaire. To obtain a composite score for knowledge, the items were summed. The statistical analysis used was a 3-factor analysis of variance (ANOVA) with repeated measures on one factor. The factors defined were: Time (pretests and posttests), Location (inner-city and non-inner-city), and Treatment Group (experimental and control).

Findings for Research Question 1:

The first research question this pilot study addressed was: Is there a difference in dental health knowledge between the pretest and posttest scores of upper elementary grade school children who have received a dental health education program? Findings indicated that the overall mean posttest scores ($\underline{M} = 11.75$, $\underline{SD} = 3.44$) were significantly higher ($\underline{F}(1,8) = 16.32$, $p = .004$) than the mean pretest scores ($\underline{M} = 8.33$, $\underline{SD} = 2.31$) which indicated there was a difference in dental health knowledge after all students received either a regular or comprehensive dental health education program.

Findings for Research Question 2:

The second research question the pilot study attempted to answer was: Is there a

difference between the dental health knowledge of inner-city and non-inner-city upper elementary grade school children before and after a dental health education program?

Findings suggested there was no significant difference ($F(1,8) = .48, p = .510$)

between the dental health knowledge of the inner-city and non-inner-city children after all the children received either a regular or comprehensive dental health education program.

Findings for Research Question 3

The third research question the pilot study asked: Is there a difference between the pretest-posttest dental health knowledge scores of those inner-city and non-inner-city upper elementary age grade school children who received the comprehensive dental health educational program compared to those who received the regular dental health educational program? The findings indicated there was no significant ($F(1,8) = .48, p = .510$) three-way interaction among time (pretest vs. posttest), location (inner-city vs non-inner-city), and treatment group (experimental vs. control). Those findings meant that the effect of the treatment group (experimental--comprehensive educational program vs. control--regular educational program) on the improvement from pretest to posttest dental health knowledge was the same for inner-city and non-inner-city children. The findings also suggested that the effect of location (inner-city vs. non-inner-city) on the pretest to posttest dental health knowledge was the same for the regular (control) program as it was for the comprehensive (experimental) program.

A significant ($F(1,8) = 9.33, p = .016$) treatment group (experimental vs. control) by time (pretest vs. posttest) interaction occurred which meant that the effect of time was different depending on the treatment group. To identify where the differences occurred, post hoc paired t tests employing the Bonferroni correction were performed. Alpha was adjusted to .025 for each pairwise comparison. The mean pretest and posttest scores were significantly different ($t(5) = -7.01, p = .001$) for the experimental group. The mean knowledge score increased from 8.00 to 14.00 for the experimental group who had received the comprehensive dental health education program. There was no significant difference ($t(5) = -.616, p = .565$) in pretest (8.67) and posttest (9.50) mean dental health knowledge scores among the control group who had received the regular dental health education program. The dental health education program made a greater difference in dental knowledge with those children who received the comprehensive educational program compared to those children who received the regular program.

Treatment of Data

Descriptive statistics were used to summarize the demographic data of the total sample. Age was interval level data and was described utilizing ranges, means, and standard deviations. Sex, race, and having a regular dentist were nominal level data and were described utilizing frequency distributions and percentages. Grade in school and frequency of dental visits were ordinal data and were described utilizing frequency

distributions, percentages, and medians.

The statistical analysis used was a 3-factor ANOVA with repeated measures on one factor. Munro (1997) suggested that an ANOVA can be used when the research involves a comparison of groups on a particular measure. The differences between groups and within groups can be analyzed using an ANOVA that considers variations across all groups at once (Munro, 1997). To complete an ANOVA the independent variable must be at the nominal level (Munro, 1997). The following assumptions for the ANOVA were met for the study (Munro, 1997).

1. The dependent variable (dental health knowledge) is continuous and normally distributed.
2. The groups are mutually exclusive (independent of each other).
3. The groups should have equal variances. Homogeneity of variances was assessed using a Bartlett's Box F on the one-way program.

Summary

The empirical literature documented the paucity of studies that have examined dental health knowledge. A quasi-experimental, pretest-posttest two-group design measured and compared the effect of a dental health educational program on the dental health knowledge of inner-city and non-inner-city upper elementary grade school children before and after receiving a regular or comprehensive dental health educational program. Neuman's (1995) Systems Model served as the conceptual

framework. The sample for the study was the accessible population of upper elementary grade school children (4th and 5th grades) in one inner-city and one non-inner-city school. Two instruments, the Demographic Data Sheet "Questions About You" and the Dental Health Knowledge Questionnaire, were administered to each participant in the study. Results were analyzed using statistical methods appropriate to the level of data.

CHAPTER 4

ANALYSIS OF DATA

This chapter presents the results of a dental health education program on dental knowledge of 4th and 5th grade elementary age school children. The purpose of the study was twofold: (1) to compare pretest and posttest dental health knowledge of elementary school children enrolled in an inner-city school and a non-inner-city school, and (2) to evaluate the effect of a comprehensive dental health educational program on the dental health knowledge level of upper elementary children enrolled in an inner-city and non-inner-city school. This study was a quasi-experimental, pretest-posttest two-group design. The independent variable was the type of dental health education program (primary prevention), and the dependent variable was dental health knowledge (client system stability). Demographic variables and scores are presented in descriptive terms. The findings related to the three research questions are described. Analysis of the data was completed using the Statistical Package for the Social Sciences (SPSS) version 10.

Description of the Sample

The sample was comprised of 4th and 5th grade elementary age school children 9 to 11 years old who attended an inner-city and a non-inner-city public school in a large southwestern city. Both inner-city and non-inner-city schools included an

experimental and control group. The researcher approached each classroom of students at the inner-city school and explained the nature of the study. During that meeting, students received consent forms to be taken home for parental or legal guardian signatures to be returned to the classroom teacher. After consent approval was obtained, a further explanation of the study was given to the students followed by the pretest before randomly assigning the classes to the experimental or control group. At the non-inner-city public school, letters with the consent forms designed by the researcher were sent home in the students' weekly folders by the classroom teacher. The school nurse at the non-inner-city school presented the pretest to the classes after consent forms were returned by the parent or legal guardian. A training session on how to present the pretest was given by the researcher to the participating school nurse. Both inner-city and non-inner-city students completed the pretest at their designated schools. One week following the pretest, the experimental groups at both schools received the comprehensive Dental Health Education program from the researcher. The comprehensive program consisted of a 13-minute videotape in addition to a discussion and demonstration of tooth brushing and flossing using a tooth model and healthy snack choices. Similarly, one week following the pretest, the control groups at both schools received the regular Dental Health Education program, a 13-minute videotape. Following the intervention, the posttest was administered by the researcher and the school nurse at the non-inner-city school to the experimental

and control groups. The researcher presented the intervention and the posttest to the inner-city experimental and control groups.

The overall sample of 156 students consisted of 82 (53%) male and 74 (47%) female students. The age range of the students was 3 years, with a minimum age of 9 years (22%) to a maximum age of 11 years (32%) and a mean age of 10 years. Ethnically, there were 15 (10%) Asians, 36 (23%) African-Americans, 40 (26%) Caucasians, 58 (37%) Hispanics, and 7 (4%) Others who attended either the 4th or 5th grades in a public elementary school. Seventy-five children (48%) were in the 4th grade, whereas 81 (62%) were in the 5th grade.

Of the sample, 112 (72%) children had a regular dentist, 69 (44%) had seen a dentist within the past 6 months, 75 (48%) had seen a dentist within the past year, and 12 (8%) reported that they had never seen a dentist (Table 3). Data analysis included examining demographic characteristics of each group.

Socioeconomic information was obtained by identifying the lunch status of the student (i.e., free/reduced or pay). The inner-city school had 75 students (93%) on free/reduced lunch and 6 (7%) lunch paying students. The non-inner-city school had 7 students (9%) on free/reduced lunch and 68 (91%) lunch paying students (Figure 5).

The experimental group (comprehensive dental health education program) of inner-city children consisted of 41 students (51%), whereas the control group (regular dental health education program) of inner-city children included 40 students (49%) with 56 Hispanics (69%) comprising the largest ethnic group. In the inner-city

Table 3

Demographics of Overall Sample, Inner-City and Non-Inner-City Children

Variable	Overall N = 156		Inner-city n = 81		Non-Inner-city n = 75	
	<u>n</u>	%	<u>n</u>	%	<u>n</u>	%
<u>Age</u>						
9 years	35	22	19	24	16	21
10 years	71	46	39	48	32	43
11 years	50	32	23	28	27	36
<u>Gender</u>						
Female	74	47	38	47	36	48
Male	82	53	43	53	39	52
<u>Ethnicity/Race</u>						
Asian	15	10	0	0	14	19
Black	36	23	20	25	16	21
Hispanic	58	37	54	67	4	5
White	40	26	2	2	38	51
Other	7	4	5	6	3	4
<u>Grade</u>						
4 th	75	48	41	51	34	45
5 th	81	52	40	49	41	55
<u>Have a dentist</u>						
	112	72	44	54	68	91
<u>Seen dentist</u>						
Past 6 months	69	44	27	33	42	56
Past year	75	48	46	57	29	39
Never	12	8	8	10	4	5

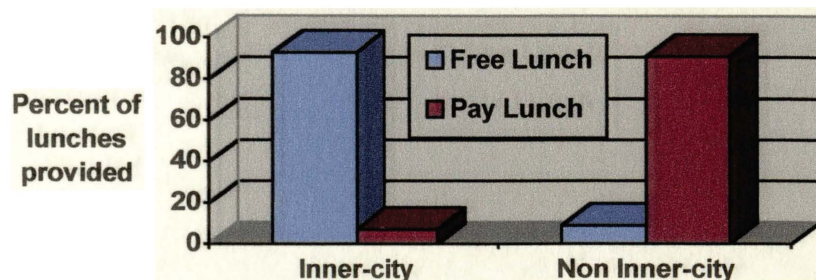


Figure 5. Percentage of Inner-City and Non-Inner-City Students on Free/Reduced Lunch or Pay

experimental group, ages ranged from 9 to 11 years with 10 (24%) 9 year olds, 21 (52%) 10 year olds, and 10 (24%) 11 year olds. The inner-city control group students' ages ranged from 9 to 11 years with 9 (22%) 9 year olds, 19 (48%) 10 year olds, and 12 (30%) 11 year olds. Both experimental and control groups of inner-city children included 75 students (93%) qualified for free or reduced lunch.

The experimental group (comprehensive dental health program) of non-inner-city children consisted of 39 students (52%), whereas the control group (regular dental health education program) of non-inner-city children contained 36 children (48%) with 41 white children (55%) comprising the largest ethnic group. In the non-inner-city experimental group, ages ranged from 9 to 11 years with 10 (26%) 9 year olds, 16 (41%) 10 year olds, and 13 (33%) 11 year olds. The non-inner-city control group's ages ranged from 9 to 11 years with 6 (17%) 9 year olds, 16 (44%) 10 year olds, and

14 (39%) 11 year olds. Both experimental and control groups of non-inner-city children included 7 students (9%) qualified for free or reduced lunch.

Dental Health Knowledge Questionnaire Scores

Dental health knowledge questionnaire mean scores for the pretest and posttest means and standard deviations of dental health knowledge of inner-city and non-inner-city experimental and control groups are summarized in Table 4. A score of one was given for correct responses and a zero was given for incorrect responses to the Dental Health Knowledge Questionnaire. To obtain a composite score for knowledge, the items were summed. The statistical analysis used was a 3-factor analysis of variance (ANOVA) with repeated measures on one factor. The factors were: Time (Pretests and Posttests), Location (Inner-City and Non-Inner-City), and Treatment group (Experimental and Control).

Findings

Research Question 1

The first research question addressed was: Is there a difference in dental health knowledge between the pretest and posttest scores of upper elementary grade school

Table 4

Pretest and Posttest Means and Standard Deviations of Dental Health Knowledge of Inner-City and Non-Inner-City School Children (N=156)

Group	Inner-City					Non-Inner-City				
	<u>n</u>	<u>Pretest</u>		<u>Posttest</u>		<u>n</u>	<u>Pretest</u>		<u>Posttest</u>	
		<u>M</u>	<u>[SD]</u>	<u>M</u>	<u>[SD]</u>		<u>M</u>	<u>[SD]</u>	<u>M</u>	<u>[SD]</u>
Control	40	10.0	[2.9]	10.1	[3.2]	36	11.2	[2.7]	12.6	[2.0]
Experimental	41	10.3	[2.4]	12.1	[3.0]	39	12.2	[2.3]	14.5	[2.1]

children who have received a dental health education program? This question was examined using a 3-factor ANOVA with repeated measures on one factor to identify differences in Dental Health Knowledge scores before and after the Dental Health Education program (regular and comprehensive).

Findings indicated that the overall mean posttest scores (M = 12.30, SD = 3.06) were significantly higher ($F(1,152) = 54.74, p = < .001$) than the mean pretest scores (M = 10.88, SD = 2.69) (Figure 6). These findings indicated that there was a difference in Dental Health Knowledge after all students received either a regular or comprehensive dental health education program.

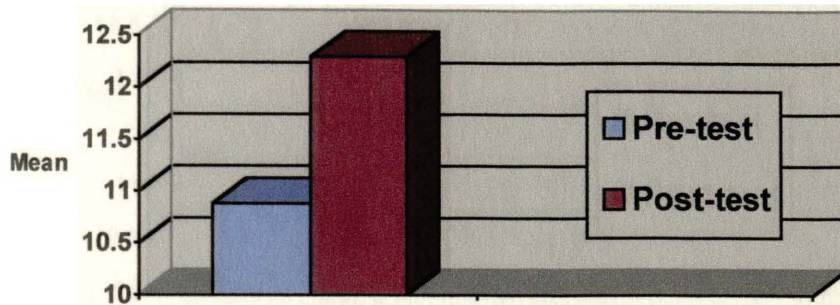


Figure 6. Means for Total Sample Pretest and Posttest Scores

Research Question 2

The second research question that this study attempted to answer was: Is there a difference between the dental health knowledge of inner-city and non-inner-city upper elementary age grade school children before and after a dental health education program? A 3-factor analysis of variance (ANOVA) with repeated measures on one factor was used to examine the research question. A statistically significant difference between the means of all pretests of inner-city ($\underline{M} = 10.14$, $\underline{SD} = 2.64$) and all pretests of non-inner-city ($\underline{M} = 11.69$, $\underline{SD} = 2.51$) students compared to the means of all posttests of inner-city ($\underline{M} = 11.11$, $\underline{SD} = 3.27$) and non-inner-city ($\underline{M} = 13.59$, $\underline{SD} = 2.21$) students occurred (Figure 7). There was a significant ($F(1,152) = 5.64$, $p = .019$) interaction between the time (pretest vs. posttest) and the location (inner-city vs. non-inner-city) which meant that the improvement in the pretest and posttest mean scores of the inner-city children was not the same as the improvement in

the pretest and posttest mean scores of the non-inner-city children. The effect of where the children live (inner-city vs. non-inner-city) did make a difference in their dental health knowledge.

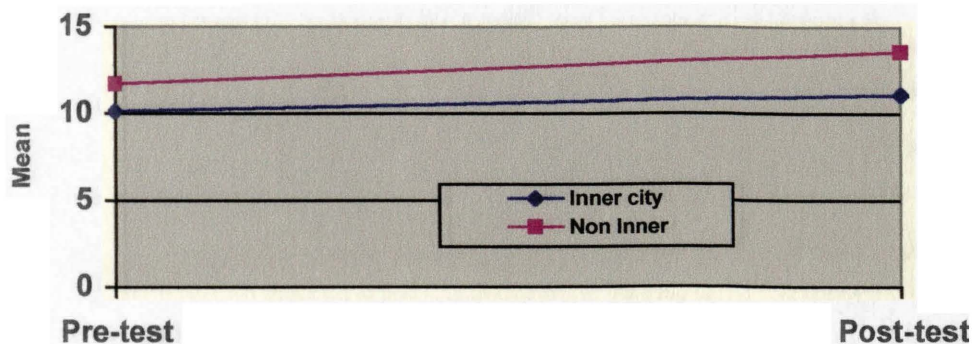


Figure 7. Means of Pretest and Posttest for Inner-City and Non-Inner-City Students

To identify where the difference occurred, post hoc paired t tests using the Bonferroni procedure were performed to analyze differences in pretest and posttest mean scores for the inner-city and non-inner-city children. Alpha was adjusted to .025 for each pairwise comparison. The inner-city children significantly ($t(80) = 3.211$, $p = .002$) improved their mean scores from 10.14 ($SD = 2.64$) to 11.11 ($SD = 3.27$). Similarly, the non-inner-city children significantly ($t(74) = -7.48$, $p < .001$) improved their mean scores from 11.69 ($SD = 2.51$) to 13.59 ($SD = 2.21$).

In addition, the standardized effect size was computed for the inner-city and non-inner-city children. The effect size for the non-inner-city children (0.86) was greater than the effect size for the inner-city children (0.36). Although both the inner-city and non-inner-city children improved their scores after receiving the educational

program (regular and comprehensive) intervention, the improvement (i.e., effect size) was larger for the non-inner-city children.

Research Question 3

The third research question asked: Is there a difference between the pretest and posttest dental health knowledge scores of those inner-city and non-inner-city upper elementary age school children who received the comprehensive dental health education program compared to those who received the regular dental health education program? The findings indicated that there were no significant ($F(1,152) = 1.58, p = .211$) three-way interactions among time (pretest vs. posttest), location (inner-city vs. non-inner-city), and treatment group (experimental vs. control). These findings indicated that the effect of the treatment group (experimental--comprehensive educational program vs. control--regular educational program) on the improvement from pretest to posttest dental health knowledge was the same for inner-city as it was for non-inner-city children. The findings also suggested that the effect of location (inner-city vs. non-inner-city) on the pretest to posttest dental health knowledge was the same for the regular (control) program as it was for the comprehensive (experimental) program.

However, further investigation revealed a significant two-way interaction between the treatment group (experimental and control) and time (pretest and posttest). Disregarding location, the effect of the increase in mean scores (difference

between the pretest and posttest) for students receiving the experimental (comprehensive dental health program) intervention was different than the increase for students receiving the control (regular dental health program) intervention.

For post hoc testing of the simple main effects, two paired t tests were performed to test the difference in pretest and posttest scores for the experimental (comprehensive program) and the control (regular program) group. The experimental (comprehensive) group significantly ($t(79) = -8.4, p = <.001$) improved their mean scores from 11.2 ($SD = 2.51$) to 13.3 ($SD = 2.84$). Similarly, the control (regular) group significantly ($t(75) = -2.3, p = .022$) improved their mean scores from 10.6 ($SD = 2.84$) to 11.3 ($SD = 2.96$).

The standardized effect size was computed for the experimental and control groups. The effect size for the experimental (comprehensive) (.94) group was greater than the effect size for the control (regular) (.27) group. Although both groups significantly improved their scores after receiving the comprehensive or regular dental health education program, the improvement (i.e., effect size) was greater for the comprehensive program.

Summary of the Findings

A presentation of the major findings of this study in relation to three research questions has been described. Findings supported research questions one and two. Research question 1 addressed: Is there a difference in dental health knowledge

between the pretest and posttest scores of upper elementary age school children who have received a dental health education program? There was a difference in dental health knowledge after all students received either a comprehensive or regular dental health education program. Research question 2 asked: Is there a difference between the dental health knowledge of inner-city and non-inner-city upper elementary age grade school children before and after a dental health education program? Although both the inner-city and non-inner-city children improved as a result of the dental health education program, the outcome for the non-inner-city children was a greater improvement than for the inner-city children. Research question 3 addressed: Is there a difference between the pretest and posttest dental health knowledge scores of those inner-city and non-inner-city upper elementary age school children who received the comprehensive dental health education program compared to those who received the regular dental health education program? These findings indicated that the effect of the treatment group on the improvement from pretest to posttest dental health knowledge was the same for inner-city as it was for non-inner-city children. The findings also suggested that the effect of location on the pretest and posttest dental health knowledge was the same for the regular program as it was for the comprehensive program. However, further investigation revealed a significant two-way interaction between the treatment group (experimental and control) and time (pretest and posttest). Both experimental and control groups improved, but there was

greater improvement in the experimental group of students who received the comprehensive dental health program.

CHAPTER 5

SUMMARY OF THE STUDY

Lack of oral health knowledge in children is viewed as a significant public health problem by the Surgeon General. "Oral health is essential to the general health and well-being of all Americans and can be achieved by all Americans" (U. S. Department of Health and Human Services, 2000, p.1). Disparities do exist in the care of many children due to lack of knowledge or available resources. Time lost from school for dental problems generates more than 51 million school hours lost each year (U.S. Department of Health and Human Services, 2000). Providing one-on-one primary prevention in the form of health education is time-consuming and not measurable in terms of dental health knowledge and changes in dental practices of elementary age children. This study measured the effect of a dental health education program on the dental health knowledge of inner-city and non-inner-city upper age elementary children. The chapter discusses the findings, reviews the literature related to the findings, and offers conclusions and implications for nursing and recommendations for further study.

Summary

Examining the effect of a dental health education program on the dental health knowledge of inner-city and non-inner-city fourth and fifth grade elementary children

was the purpose of the study. The Neuman Systems Model provided a framework for the study. Neuman's conceptual framework incorporates primary prevention (dental health education program) promotes client system stability or wellness (dental health knowledge) and lessens the impact of potential stressors (dental disease/caries) strengthening the individual's protective buffer.

Discussion of the Findings

The first research question posed whether or not there was a difference in dental health knowledge between the pretest and posttest scores of upper elementary grade children who have received a dental health education program. The findings supported a significant difference on the post-test scores of the children after they had received a dental health education intervention. The dental health knowledge levels were higher. International studies (Irigoyen, Maupome, and Mejia, 1999; Vigild, Skougard, Hadi, and Halling, 1995; and Petersen, Danila, and Samoila, 1995) have indicated that dental education programs carried out in public or private schools over time with an emphasis on health promotion and disease prevention can improve the oral health knowledge of children. Kay and Locker (1996) reviewed available evidence regarding effectiveness of dental health programs published between 1982 and 1994. Contrary to this study, those studies reviewed by Kay and Locker, although not the same, found that dental health programs did not increase knowledge levels of participants. Part of the reason suggested by Kay and Locker is that the evidence

reported in the literature is of poor quality and needs to be standardized to be reliable.

The second research question asked if there was a difference between the dental health knowledge of inner-city and non-inner-city upper elementary age children before and after a dental health education program. The Surgeon General (2000) suggests that disparities still exist in oral health care of children. The findings of this study suggested a statistically significant difference between the dental health knowledge of inner-city and non-inner-city children before and after the students received either a comprehensive or regular dental health education program. Although both groups of children increased their dental health knowledge, the improvement in the pretest and posttest scores of the students from the non-inner-city school was greater than the children from the inner-city school.

Socioeconomic status can be a variable affecting the dental health of school children. Free /reduced lunch status of school children generally designates those pupils from families of marginal economic states. Vargas et al. (1998) suggest that barriers to oral health knowledge include being poor and of a racial or ethnic minority. Children living in poverty often have inadequate resources to encourage wellness. However, Baranowski and Stables (2000) argue that the lack of better knowledge outcomes for oral health in children may be due to poor research methodology utilized to design and evaluate interventions.

There are limited studies in the United States identifying the effect of an

educational intervention on the oral health knowledge of children (Russell, Horowitz, and Frazier, 1989; Oliveira, Narendran, and Williams, 2000).

The third research question asked if there was a difference between the pre-post dental health knowledge scores of those inner-city and non-inner-city upper elementary age school children who received the comprehensive dental health education program compared to those who received the regular dental health education program. The study findings suggested that there were no significant three-way interactions among time (pretest vs. posttest), location (inner-city vs. non-inner-city), and treatment group (experimental vs. control). However, further analysis revealed a significant two-way interaction between the treatment group (experimental and control) and time (pretest and posttest). Although both the experimental and control groups improved their scores after receiving the comprehensive or regular dental health education program, the students who received the comprehensive dental health program showed more improvement than the students who received the regular dental health program. In Walsh's (1985) earlier study of the effects of school-based dental health education on knowledge, attitudes, and behavior of adolescents, the findings indicated a significant increase in dental knowledge for the experimental group who received a dental health education intervention compared to the control group who did not receive the intervention during the study.

Children like adults have different learning styles, therefore, health professionals have a responsibility to disseminate information about health promotion and disease prevention to the diverse population of children, parents, teachers, and community partners in dental health (Kay and Locker, 1996). Since children spend much of their time in school settings, all individuals coming in contact with the children need to work collaboratively in health promotion programs (Baranowski and Stables, 2000).

Conclusions and Implications of the Study

Based on the findings of this research study, the following conclusions have been drawn:

1. A comprehensive dental health education program can be an effective means of increasing knowledge for both inner-city and non-inner-city elementary age school children.
2. Availability of financial resources of the parents influences the level of knowledge regarding dental health.
3. Students having greater knowledge about dental health make greater gains in knowledge of brushing, flossing teeth, and choosing healthy snacks.
4. The Neuman Systems Model is effective in designing primary prevention (dental health education program) interventions to retain client system stability (dental health knowledge).

While the findings of this study cannot be generalized beyond this sample,

based on the conclusions, the following implications are presented:

1. School nurses should use various methods of instruction (i.e. videotape, discussion, demonstration) in designing culturally appropriate dental health education interventions to increase the dental health knowledge of 4th and 5th grade school children.
2. Dental health knowledge was measured with an educational intervention. Knowledge can be imparted in many ways, but the accumulation of knowledge alone does not insure changes in attitudes or practices in children. School nurses observe children daily and can design interventions to not only meet the knowledge needs of children but also to monitor attitudes and practices in collaboration with teachers, parents, and other dental health professionals.

Recommendations for Further Study

Based upon the conclusions of the present study, the following are proposed:

1. School nurses should foster through further study primary prevention (dental health education intervention) and secondary prevention (dental health screening) to reduce the potential and actual stressors of dental disease/caries by measuring dental health knowledge differences between prevention interventions.
2. Further research in developing and testing an instrument for reliability in measuring oral health knowledge and practices in upper elementary age children by school nurses is recommended.
3. The study should be replicated using the dental health educational program

intervention in the upper elementary age population to identify reliability of the findings.

4. Time-series studies that measure dental health knowledge with actual dental health practices of the elementary age children should be undertaken.

5. Delineation of cultural and socioeconomic variables of elementary age children should be pursued to develop interventions that focus on eliminating disparities in oral health.

6. There is further need to investigate the association between oral health and nutrition in children since children with a high risk nutritional status may have compromised oral health.

7. Children are generally influenced by parents in terms of oral health knowledge and practices; future studies need to include both children and parents in the study population.

8. Similarly, teachers affect the health knowledge that elementary school children receive, therefore, inclusion of this specific group is essential in future studies related to teacher perceptions of dental health knowledge.

9. School nurses must collaborate with the community of health professionals and educators in identifying projects in dental health education and practices.

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Journal of School Health, 69, 299.

APPENDIX A
NEUMAN SYSTEMS MODEL

February 22, 2001

Dr. Betty Neuman
P.O. Box 77
Watertown, Ohio 45787

Dear Dr. Neuman:

I am writing to request permission to use selected illustrations from your model in explaining the use of the model in guiding my dissertation entitled "The Effect of a Dental Health Education Program on the Dental Health Knowledge of Inner-city and Non Inner-city Elementary Age Children". I am a doctoral candidate in nursing at Texas Woman's University College of Nursing in Houston, Texas and spoke with you by telephone about my continued interest in using your model in my school nursing practice.

Specifically, I would like to use seven illustrations of your model from the third edition (1995) of The Neuman Systems Model:


1. Figure 1-4, Client/client system, Page 26.
2. Figure 1-5, Environment, Page 27.
3. Figure 1-6, Health, Page 28.
4. Figure 1-7, Nursing, Page 29.
5. Figure 1-8, Format for primary prevention as intervention mode, Page 34.
6. Figure 1-9, Format for secondary prevention as intervention mode, Page 35.
7. Figure 1-10, Format for tertiary prevention as intervention mode, Page 36.

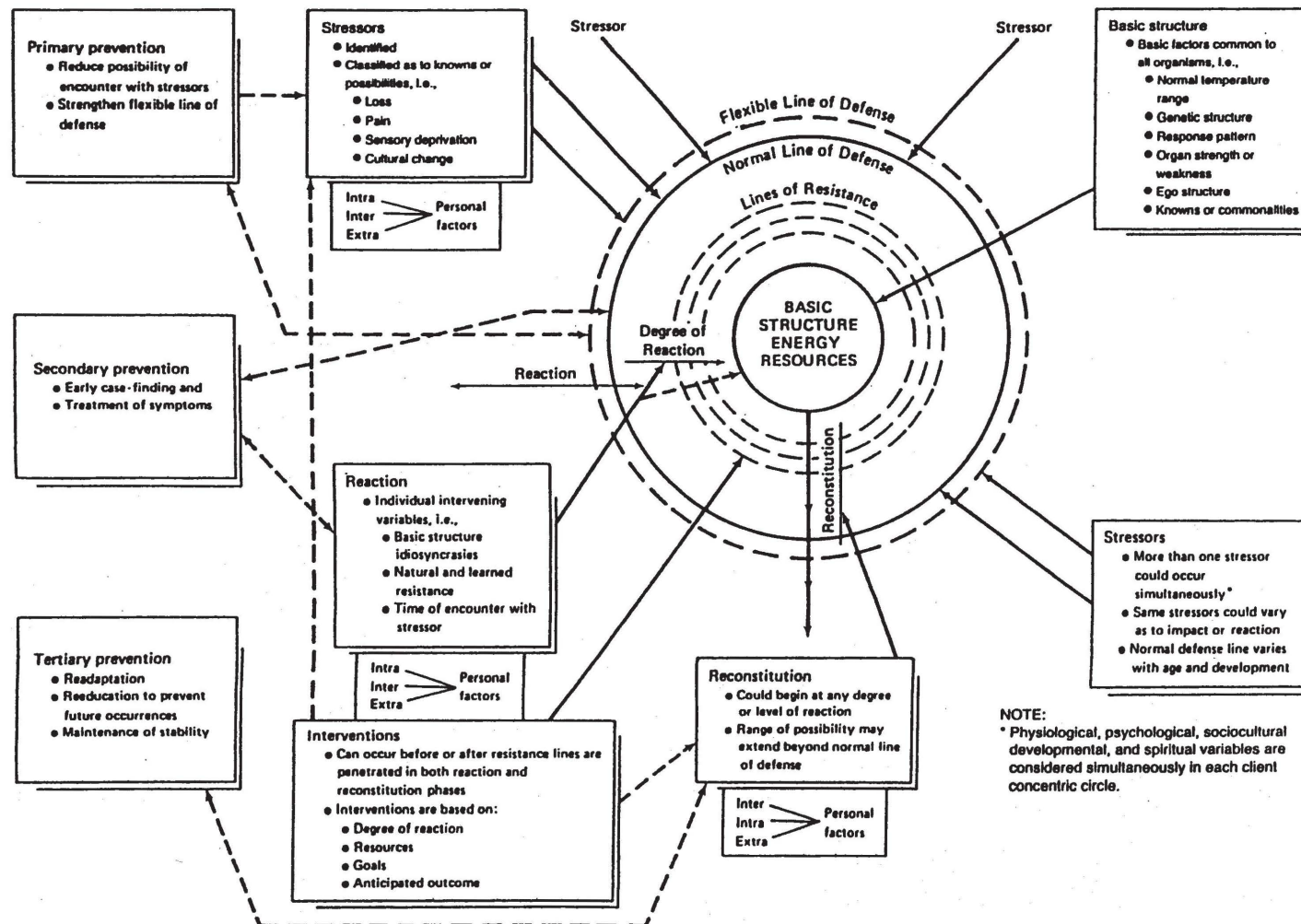
Thank you for considering my request.

Sincerely,



Joan Mahon, RN, MS
2601 Bellefontaine, C-307
Houston, Texas 77025
(713) 667-4032 (Home)
(713) 667-3392 (Fax)

Signature  Date 2/28/01



The Neuman Systems Model. Original diagram copyright © 1970 by Betty Neuman.

APPENDIX B
AGENCY APPROVALS

TEXAS WOMAN'S UNIVERSITY
DENTON DALLAS HOUSTON
INSTITUTIONAL REVIEW BOARD - HOUSTON CENTER

EXEMPT REVIEW
Application to the Institutional Review Board

This form must be completed if the research committee (for student research) or the department coordinator (for faculty research) decides that the proposed research is exempt from Full Review or Expedited Review by the IRB. A proposal may be eligible for Exempt Review if any of the following conditions is met:

- 1) only minimal risk to subjects, as described in the Human Subjects in Research: Institutional Review Board Policies and Procedures, pp. 11-12;
and/or
- 2) the project will be completed at another institution or in collaboration with investigators at another institution, and that institution's IRB has provided written approval for the proposal as described. To be eligible for this exemption a signed copy of the institution's current IRB approval form must be attached to this application. If applicable, attach a memo indicating the student's role in the approved study;
and/or
- 3) the project involves an analysis of a data set generated from a currently approved project.

For Exempt Review by the TWU Institutional Review Board, submit three copies of this form, any relevant Informed Consent Forms, surveys, questionnaires, and (if applicable) the collaborating institution's signed IRB approval form. Approval is required prior to the initiation of the research project. The investigator will be notified if the Institutional Review Board requires additional information.

To complete this form electronically, type information into the blanks provided. If your typing fills the blank, text will wrap automatically. Print out, secure appropriate signatures, and submit three copies (along with accompanying documents) to the Office of Research, MJG 913. Paper-clip each of the copies—no staples, please.

Principal Investigator(s) Joan A. Mahon, RN, MS SS# _____
 _____ SS# _____
 Faculty Advisor (if applicable) Jeanette Kernicki, RN, PHD Dept. Nursing
 Title of Study The Effect of a Dental Health Education Program on the Dental Health Knowledge
of Inner-city and Non Inner-city Elementary Age Children
 Justification for Exempt Review status Educational intervention is a part of school district curriculum
 Estimated beginning date of the study January, 2001
 Estimated duration of the study 4 months
 Research being conducted for (place an X in the appropriate blank):
 _____ Professional Paper _____ X _____ Dissertation _____ Pilot Study
 _____ Thesis _____ _____ Class Project _____ Faculty
 IRB-H 2000-10

Is this research being conducted for a non-university sponsor?

Yes: Name of Sponsor _____

X No

**If you are using an electronic form, fill in the blanks provided below. Text will wrap automatically.
If you are completing a hardcopy form, attach additional typed page(s) as needed.**

1. Give a brief description of the study.
First, describe the subjects, i.e., # of subjects, age, gender, race/ethnicity, institutional affiliation; how will they be recruited?
Any exclusion criteria?
Secondly, describe the procedures that relate to their participation, i.e., What will the subjects do? What will be done to them? Where will the study be conducted? What is the time involvement?
(See attachment)
2. What are the potential risks to the human subjects involved in this research or investigation?
(See attachment)

SIGNATURE REQUIREMENTS.

1. For students

The research protocol and the IRB application have been read and approved by the members of the student's research committee:

Names of Committee Members

Signatures

Jeanette Kernicki

Elizabeth Gonzalez

Anne Young

Signatures

Janette Kernicke
Elizabeth Gonzales
Anne Johnson

Elizabeth Gonzales
Dance Academy

Done Jan 2

2. For faculty

The research protocol and the IRB application have been read and approved by the academic administrator.

Name of Academic Administrator

Signature

Approved by IRB Chair Dulinda Schaulski Date 12-15-00



TEXAS WOMAN'S
UNIVERSITY

1901 - 2001 CENTENNIAL

The Graduate School
P.O. Box 425649, Denton, TX 76204-5649
T 940-898-3400 F 940-898-3412

038-24-6368

March 12, 2001

Title Correction

Ms. Joan F. Mahon
2601 Bellefontaine #A208
Houston, TX 77025

Dear Ms. Mahon:

I have received and approved the prospectus entitled "**The Effect of a Dental Health Education Program on the Dental Health Knowledge of Inner-city and Non Inner-city Elementary Age Children**" for your *dissertation* research project.

Best wishes to you in the research and writing of your project.

Sincerely yours,

Michael H. Droge
Dean of Graduate Studies and Research

MHD/sjr

cc Dr. Jeanette Kernicki, Nursing-Houston
Dr. Carolyn Gunning, Nursing

Simply the **BEST**



HOUSTON INDEPENDENT SCHOOL DISTRICT

HATTIE MAE WHITE ADMINISTRATION BUILDING
3830 RICHMOND AVENUE • HOUSTON, TEXAS 77027-5838

ROD PAIGE
Superintendent of Schools

Kathryn S. Sanchez
Assistant Superintendent, Department of Research and Accountability
TEL (713) 892-6350 • FAX (713) 963-9156

November 10, 2000

Joan Mahon, RN, MS
2601 Bellefontaine C-307
Houston, TX 77025

Dear Ms. Mahon:

The Houston Independent School District (HISD) is pleased to approve the study entitled, "The Effect of a Dental Health Education Program on the Dental Health Knowledge of Inner-city and Non Inner-city Elementary Age Children." This research seeks to measure student knowledge of dental health and identify disparities between inner-city and non inner-city elementary age children. Study findings will be used to improve the dental education programs and health status of children.

Approval to conduct the study in HISD is contingent on your meeting the following conditions:

- The study population is fourth and fifth grade students at Clemente Martinez Elementary (inner-city) and Roberts Elementary (non-inner-city) schools.
- The students will be administered the demographic data sheet, "Questions About You" and the "Dental Health Knowledge Questionnaire."
- The investigator will collect all of the data for the study.
- The school principal approves participation of students for data collection and the use of the school premises to conduct the study.
- Active signed consent is obtained on all study participants.
- The principal will receive a copy of the entire proposal.
- HISD approval is contingent upon the approval of the Texas Women's University College of Nursing, Committee for the Protection of Human Subjects, and a copy of the approval letter must be submitted to the Research and Accountability Department prior to conducting the study.
- The investigator will follow the guidelines of the Committee for the Protection of Human Subjects at Texas Women's University College of Nursing regarding confidentiality.
- The study does not interfere with the districtwide instructional/testing program.
- District personnel or students are not identified in process or final reports.
- The study involves no expense to the district.
- The district receives copies of the completed final report within 30 days of its completion.

Any further changes or modifications to the current proposal must be submitted to the Department of Research and Accountability for approval. Should you need additional information or have any questions concerning the process, please call (713) 892-6350.

Sincerely,

Kathryn Sanchez
Kathryn Sánchez, Ed.D.

KS: vh

cc: Dr. Susan Sciafani Mr. Ray Reiner
Ms. Faye Bryant Ms. Patricia Sosa-Gonzalez
Mr. James LaVois Mr. Gifford Lockley



Texas Department of Health

William R. Archer III, M.D.
Commissioner of Health

Charles E. Bell, M.D.
Executive Deputy Commissioner

Public Health Region 6/5 South
5425 Polk Avenue, Suite J
Houston, Texas 77023-1497
(713) 767-3470
FAX (713) 767-3435

H. Mark Guidry, M.D., M.P.H.
Regional Director

December 11, 2000

Joan Mahon, R.N., M.S.
School Nurse
Clemente Martinez Elementary School
901 Hays Street
Houston, Texas 77009

Dear Mrs. Mahon:

As you know, Tattletooth II: "A New Generation" was developed in 1990 to provide effective oral health lessons for children from pre-kindergarten through sixth grade. Each grade curriculum consisted of five lessons and two additional enrichment lessons and was written in accordance with the then "Essential Elements" and the Texas Assessment of Academic Skills. The resulting curriculum was the work of many public health educators, school administrators, teachers, and dental public health professionals.

After conferring with the State Dental Director, Jerry W. Felkner, D.D.S., M.P.H., the Texas Department of Health sees no problem in allowing you to use the fourth grade component of this curriculum, "Special Care for Special Smiles", in your doctoral pursuits. This includes any minor changes that you feel might be necessary in the pre/post test component of the module. Please call if you have additional questions concerning the original curriculum. Thank you for your continued interest in the oral health of Texas residents. Dr. Felkner and I wish you well in your research.

Sincerely,

William G. Gray, D.D.S., M.P.H.
Regional Dental Director, P.H.R. 6/5s

APPENDIX C

STUDY INSTRUMENTS

QUESTIONS ABOUT YOU

DATE:

STUDENT CODE # :

L: 1. Y 2. N

PLEASE ANSWER THE FOLLOWING QUESTIONS ABOUT YOU.

1. What is your age? _____ years
2. Circle your sex: a. female b. male
3. Circle your race: a. Asian b. Black c. Hispanic d. White e. Other
4. What is your grade in school? _____ grade
5. Circle if you have a regular dentist: a. Yes b. No
6. Circle if you have been to a dentist:
a. during the past 6 months b. during the past year c. never

DENTAL HEALTH KNOWLEDGE QUESTIONNAIRE

Date: _____ Student Code #: _____

READ EACH QUESTION. CHOOSE ONE ANSWER. CIRCLE YOUR ANSWER.

1. How often should you go to the dentist?
 - a. about twice a year
 - b. never
 - c. only when you have a toothache
 - d. each time you lose a tooth
2. Dental cleaning is the:
 - a. filling of cavities
 - b. cleaning of the teeth and gums by the dentist and/or dental hygienist
 - c. cleaning of the teeth and gums with brush and floss
 - d. a special cup that holds the dentifrice
3. Plaque that is not removed forms:
 - a. tartar
 - b. dentin
 - c. fluoride
 - d. sugar
4. X-rays are taken to:
 - a. cure gingivitis
 - b. cure dental cavities
 - c. see hidden signs of dental problems
 - d. see if the teeth have plaque on them
5. Fluoride helps to prevent cavities by:
 - a. keeping the teeth cleaner
 - b. making the teeth stronger
 - c. killing the bacteria in your mouth
 - d. all of the above
6. Fluoride applied to the teeth by a dentist or dental hygienist strengthens the:
 - a. gingiva
 - b. dentin
 - c. teeth
 - d. pulp
7. Which source of fluoride is applied over teeth?
 - a. fluoride in foods such as beef and liver
 - b. fluoride tablets
 - c. fluoride toothpaste
 - d. fluoridated drinking water

8. Dental cavities are caused by:
 - a. plaque and sugar
 - b. plaque and germs
 - c. sugar and enamel
 - d. sugar and gingiva
9. Foods or sugars that cause cavities are called:
 - a. caries
 - b. cavity-making agents
 - c. non cavity-making agents
 - d. artificial sweeteners

Use the chart below on how much sugar is in certain foods to answer question 10 and 11.

FOOD	SERVING SIZE	TEASPOONS OF SUGAR
Chocolate cake and icing	1/12 cake	15
Orange juice	8 ounces	4
Cheese	2 ounces	0
Sherbet	4 ounces	9
Cola drink	12 ounces	9
Peanuts	2 ounces	0
Sugar Cookie	1 cookie	1 ½

10. Which food has the most amount of sugar?
 - a. 1 sugar cookie
 - b. 8 ounces of orange juice
 - c. 12-ounce cola drink
 - d. 1 piece of chocolate cake with icing
11. Which of the following snack foods would be the wisest choice for dental health?
 - a. 1 sugar cookie
 - b. 12-ounce cola drink
 - c. 2 ounces of cheese
 - d. 4 ounces of sherbet
12. Which statement is false?
 - a. All sugars are bad for your teeth.
 - b. Sucrose is the most damaging form of sugar to your teeth.
 - c. Some sugars are sweeter than others.
 - d. Honey and molasses are sugars.
13. Which statement is true? It is better to eat sugary foods:
 - a. for snacks rather than at meals
 - b. a little at a time
 - c. that are very chewy
 - d. at meals rather than for snacks

14. Flossing your teeth:
 - a. helps remove the plaque between your teeth
 - b. takes the place of brushing
 - c. is not necessary if you brush
 - d. removes tooth enamel
15. The best way to brush teeth is:
 - a. back and forth, pressing hard
 - b. up and down only
 - c. with a gentle circular motion
 - d. any direction with a firm, hard brushing motion
16. You should brush your teeth two times a day and should floss at least:
 - a. once a week
 - b. once a day
 - c. every time sugar is eaten
 - d. once a month
17. Which statement is true?
 - a. Plaque can be removed only by a dentist
 - b. Plaque begins to form on the teeth when you become a teenager
 - c. Plaque cannot be removed once it hardens into tartar
 - d. Plaque can be removed by you before it hardens into tartar
18. A toothpaste that does not display the ADA Seal of Acceptance or statement:
 - a. has not been tested or approved by the ADA
 - b. is harmful to your teeth.
 - c. has submitted good evidence that the product is safe and useful.
 - d. is the one recommended by the American Dental Association

APPENDIX D
PARENTAL CONSENT FORMS

CLEMENTE MARTINEZ ELEMENTARY
901 HAYS STREET
HOUSTON, TEXAS 77009

Estimados Padres,

Queremos informarles que su hijo participará en un estudio para aprender acerca de la salud e higiene dental. Se le pedirá que conteste un cuestionario sobre aspectos de la higiene dental tales como: técnicas para cepillarse los dientes, usar hilo dental, uso de pasta con fluoruro e igualmente como escoger golosinas saludables. De la misma forma, en este cuestionario su hijo podrá contestar algunas preguntas de tipo personal como: su edad, grado, origen étnico, frecuencia con que ha visitado a un dentista, y si tiene un dentista familiar.

Como parte del currículo del Distrito Escolar Independiente de Houston y después de que su hijo haya contestado el cuestionario, un programa de salud dental será presentado a la clase. Al final de la lección, el cuestionario les será devuelto a los niños para que identifiquen lo que aprendieron sobre la salud dental.

El nombre de su hijo no aparecerá en los cuestionarios, su privacidad será respetada. No habrá ningún riesgo físico por que el niño solo contestará las preguntas por escrito. Estos cuestionarios no son un examen y se les explicará a los niños ante mano para evitar confusiones. La información provista será de gran beneficio para usted y su hijo y los resultados del estudio servirán para mejorar el programa dental de la escuela.

Usted y su niño pueden decidir no participar por razones personales. Yo les podré contestar cualquier pregunta acerca del estudio. Se pueden comunicar conmigo a la escuela Clemente Martinez de 7:30 a.m. a 4:00 p.m. al 713-224-1424. Después de las seis de la tarde se puede comunicar conmigo al 713-667-4032. Su ayuda para llevar a cabo este estudio es realmente apreciada, les damos las más cordiales gracias.

<input type="checkbox"/>	Si, yo estoy de acuerdo de que mi hijo _____ participe en el estudio dental.
<input type="checkbox"/>	No, en este momento no deseo que mi hijo _____ participe en el estudio dental.
Firma: _____ Parentesco: _____ Fecha: _____	

Joan Mahon
Joan Mahon, RN, MS.
Clemente Martinez Elementary School Nurse
Nursing Doctoral Candidate, Texas Woman's University
School: 713-224-1424
Home: 713-667-4032

or

Sandra Felder
Sandra Felder, RN, BSN
Roberts Elementary School Nurse
School: 713-295-5272

CLEMENTE MARTINEZ ELEMENTARY
901 HAYS ST.
HOUSTON, TEXAS 77009

Dear Parent:

Your child is being asked to participate in a study to learn about children's knowledge of dental health. Your child will be asked to fill out a questionnaire about what he or she knows of dental health including how to brush and floss teeth, using fluoride toothpaste, and choosing healthy snacks. In addition, your child will be asked to fill out a "Questions About You" form asking for information such as age, grade, race, been to a dentist, and have a regular dentist.

After your child completes the questionnaires, a dental health education program (part of HISD'S curriculum) will be presented to your child's class. Following the lesson, the questionnaire will be given again to identify what your child has learned about dental health.

The name of your child will not appear on the questionnaires; privacy will be respected. No physical risks are involved since your child will only be responding by written response to the questionnaires. These questionnaires are not a test and this will be explained to your child to prevent any potential anxiety. The possible benefit to you and your child is the information about the results of this study and how the dental program at the school may be improved.

You or your child may decide not to participate at any time for any reason without penalty. I will answer any questions that you may have about the study. I can be reached at Clemente Martinez Elementary during the day from 7:30am-4:00pm at 713-224-1424. After six o'clock, I can be reached at 713-667-4032. I appreciate your help in doing this study on children's dental health knowledge.

<input type="checkbox"/>	I do agree to allow my child _____ to participate
	Name of child
	in the dental health knowledge study.
<input type="checkbox"/>	I do not agree to allow my child _____ to participate
	Name of child
	in the dental health knowledge study.
Signature _____	Relationship _____ Date _____

Joan Mahon
Joan Mahon, RN, MS.
Clemente Martinez Elementary School Nurse
Nursing Doctoral Candidate, Texas Woman's University
School: 713-224-1424
Home: 713-667-4032

or

Sandra Felder
Sandra Felder, RN, BSN
Roberts Elementary School Nurse
School: 713-295-5272

APPENDIX E
DENTAL HEALTH EDUCATION PROGRAM OUTLINE

Dental Health Education Program Outline

A. Regular Program

1. Videotape, "The Haunted Mouth" (American Dental Association)
 - a. Brush and floss to remove plaque
 - b. Use an accepted fluoride toothpaste
 - c. Cut down on sweet foods-sticky at meals
 - d. Have regular dental check-ups-two times per year
2. Review
 - a. Bacteria Plaque + Sugar = Acid
 - b. Acid + Tooth = Caries

B. Comprehensive Program = Regular Program plus the following:

Teaching/Strategy/Resources

- | | |
|--------------------|--|
| 1. Brushing Review | Interactive demonstration using tooth model and tooth brush |
| 2. Flossing Review | Interactive demonstration using floss |
| 3. Fluoride | Lecture and demonstration
Topical: toothpaste, mouth rinse, treatment at dentist's office |
| 4. Healthy Snacks | Lecture and demonstration |
| 5. Summary | Questions/answers |

APPENDIX F

PANEL OF EXPERTS' CONTENT VALIDATION FORM

PANEL OF EXPERTS

1. Dental Hygienist for Houston Independent School District (HISD).
Provides dental health education to elementary age students (pre-k-6).
2. Elementary school nurse, masters prepared-HISD 26 years.
Provides dental health education to student population.
3. Elementary school nurse, bachelor's prepared, student in masters program
for health education-HISD 11 years.
4. Health & physical education curriculum specialist, former school nurse,
masters prepared (in education). Teaches health education at University
of Houston.
5. Elementary teacher-4th grade, bachelor's prepared.
6. Elementary teacher-5th grade, bachelor's prepared.
7. Reading specialist, elementary-taught 4th & 5th grades.

September 7, 2000

Dear _____:

Thanks for taking your time to review the Dental Health Knowledge Questionnaire. The questionnaire was developed by the Texas Department of Health for 4th and 5th graders. The purpose of the questionnaire is to identify dental health knowledge in the areas of: brushing, flossing, fluoridation, identifying hidden sugars in foods, and selecting low sugar snacks.

Would you please evaluate each item listed on the following pages and consider:

- the importance of the content of the item for 4th and 5th graders.
- the quality of the item (i.e., question written clearly for student level?, correct answer appropriate?, item free of irrelevant material?).
- the expected level of difficulty for 4th and 5th graders.
- the items that you would suggest to use in the final version of the questionnaire. Circle the keep items!

<u>Test Item</u>	<u>Importance of the Item</u>			<u>Quality of Item</u>					<u>Item Difficulty</u>					<u>Comments</u>
	1.	2.	3.	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	
1	1.	2.	3.	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	
2	1.	2.	3.	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	
3	1.	2.	3.	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	
4	1.	2.	3.	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	
5	1.	2.	3.	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	
6	1.	2.	3.	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	
7	1.	2.	3.	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	
8	1.	2.	3.	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	
9	1.	2.	3.	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	
10	1.	2.	3.	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	
11	1.	2.	3.	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	
12	1.	2.	3.	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	
13	1.	2.	3.	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	
14	1.	2.	3.	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	
15	1.	2.	3.	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	
16	1.	2.	3.	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	
17	1.	2.	3.	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	
18	1.	2.	3.	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	
19	1.	2.	3.	1.	2.	3.	4.	5.	1.	2.	3.	4.	5.	

Thank you again for your help!

Joan Mahon