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Toothbrushing, Flossing, and Preventive Dental Visits by Richmond-Area Residents in Relation to Demographic and Socioeconomic Factors

Kim T. Isringhausen
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TOOTHBRUSHING, FLOSSING, AND PREVENTIVE DENTAL VISITS BY RICHMOND-AREA RESIDENTS IN RELATION TO DEMOGRAPHIC AND SOCIOECONOMIC FACTORS

Kim T. Isringhausen
PMCH 691 – MPH Research Project
Virginia Commonwealth University / School of Medicine
Medical College of Virginia Campus

Department of Preventive Medicine and Community Health

Master of Public Health Program

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_____

Signature

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Date

MPH Research Project Agreement Form
Department of Preventive Medicine and Community Health

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Number of semester hours (3-6): 3 **Semester:** spring **Year:** 2004

A. PROJECT TITLE:

Toothbrushing, Flossing, and Preventive Dental Visits by Richmond-area Residents in Relation to Demographic and Socioeconomic Factors

B. PURPOSE (state hypothesis/research question):

The purpose of this investigation is to determine how preventive dental behaviors are related to socioeconomic and demographic variables in an attempt to improve our understanding of why individuals do and do not follow recommendations. In addition, this study aims to identify target groups who can benefit most from interventions directed toward adherence to recommended preventive dental behaviors.

C. SPECIFIC OBJECTIVES (list the major aims of study):

The objectives of the study are to determine: (1) whether preventive dental behaviors are more commonly practiced by women than men; (2) if all three preventive behaviors are positively associated with socioeconomic status, and, if so, (3) are preventive dental visits, because of their cost, more strongly associated with economic variables (income and insurance) than are the other two preventive behaviors, (4) whether non-whites are less likely to brush, floss, and obtain dental checkups at the recommended frequencies and, if so, are such differences reduced or eliminated when socioeconomic status is controlled, and (5) target groups for interventions.

D. DESCRIPTION OF METHODS:

D.1 Identify source(s) of data (e.g., existing data set, data collection plans, etc):
The data for this study will be obtained from information collected from the Behavioral Risk Factor Surveillance Survey (BRFSS) by means of a report developed for the Dental Division of the Virginia Department of Health as a survey of the oral health of Virginians. BRFSS is a telephone survey designed to collect information regarding the prevalence of self-reported health problems and health risk behaviors. The Survey and Evaluation Research Laboratory (SERL) of Virginia Commonwealth University conducted the survey under contract with the Virginia Department of Health, Office of Family Health Services. Completed interviews were compiled by the Centers for Disease Control and Prevention in Atlanta, Georgia, and the resulting sample

was weighted to increase its representativeness and ensure a more accurate picture of health risk behaviors in Virginia.

D.2 Type of study design (e.g., cross-sectional, cohort, case-control, intervention, etc):
The design of this study is a cross-sectional survey.

D.3 Describe study population and sample size:
For this proposed study, the independently pooled cross section consists of 400 adults, 18 years of age or older living in the Chesterfield, Hanover, Henrico and Richmond Health Districts. Only one adult per household was selected regardless of the total number of adults living there.

D.4 List variables to be included (If a qualitative study, describe types of information to be collected):
The predictors in the study, demographics (age, race, sex) and socioeconomics (education, income and insurance), are the independent variables. The behaviors, brushing, flossing, preventive dental visits, are the dependent (outcome) variables.

D.5 Describe methods to be used for data analysis (If a qualitative study, describe general approach to compiling the information collected):
In the proposed study, independent and dependent variables will be presented using descriptive statistics in combination with tables. Initial hypothesis testing will be performed using univariate logistic regression models. Multivariate logistic regression models will be used to test the significance of independent variables while controlling for other possible predictors of behavior. The model building process will take into account the content expertise of the primary investigator. Efforts will be made to reduce all forms of potential bias in order to produce valid estimates.

E. ANTICIPATED RESULTS:

We anticipate that the findings from this study will support our hypotheses: (1) preventive dental behaviors are more commonly practiced by women than men; (2) all three preventive behaviors are positively associated with socioeconomic status, (3) preventive dental visits, because of their cost, are more strongly associated with economic variables (income and insurance) than are the other two preventive behaviors, (4) non-whites are less likely to brush, floss, and obtain dental checkups at the recommended frequencies but that such differences are reduced or eliminated when socioeconomic status is controlled, and (5) target groups for intervention will be identified.

F. SIGNIFICANCE OF PROJET TO PUBLIC HEALTH:

Data from this cross-sectional survey will be of great value to public health administrators in assessing the oral health care needs of Richmond-area residents. Specifically, this investigation will enable us to differentiate performance among the preventive behaviors hence identifying groups for intervention. Differences in performance of the three behaviors are imperative for planning new interventions, as it may prove more important to target interventions to specific behaviors than to target interventions to groups of people. We must also recognize current dental

health education interventions in the Richmond area, as new interventions are likely to be most successful if they take past programs into account. Community-based oral health promotion complements personal and provider approaches to oral health. The interaction of these components is critical to oral health.

G. IRB Status:

1) Do you plan to collect data through direct intervention or interaction with human subjects?

_____yes __X__no

2) Will you have access to any existing identifiable private information? ___yes _X_no

If you answered "no" to both of the questions above, IRB review is not required.
If you answered "yes" to either one of these questions, your proposed study must be reviewed by the VCU Institutional Review Board (IRB). Please contact Dr. Turf or Dr. Buzzard for assistance with this procedure.

Please indicate you IRB status:

_____to be submitted (targeted date_____)

_____submitted (date of submission_____; VCU IRB#_____)

_____IRB exempt review approved (date_____)

_____IRB expedited review approved (date_____)

__X__IRB approval not required

H. PROPOSED SCHEDULE: Start Date: January 2004 End Date: April 2004

INDICATE WHICH OF THE FOLLOWING AREAS OF PUBLIC HEALTH KNOWLEDGE WILL BE DEMONSTRATED:

1. Biostatistics – collection, storage, retrieval, analysis and interpretation of health data; design and analysis of health-related surveys and experiments; and concepts and practice of statistical data analysis. __X__yes _____no (if yes, briefly describe):

    - Results of BRFFS data will be analyzed using STATA and interpreted by the investigator.

2. Epidemiology – distributions and determinants of disease, disabilities and death in human populations; the characteristics and dynamics of human populations; and the natural history of disease and the biologic basis of health. __X__yes _____no (if yes, briefly describe):

    - The results of the data analysis will provide us with a better understanding of the relationship between preventive dental behaviors and the characteristics (demographics and socioeconomic status) of Richmond area residents. In addition, the results can be used to assess the oral health care needs of the population and identify target groups for intervention. This offers the possibility of altering the practice of preventive behaviors (reducing risk) through intervention.

3. Environmental Health Sciences – environmental factors including biological, physical and chemical factors which affect the health of a community. _____yes __X__no (if yes, briefly describe)

4. Health Services Administration – planning, organization, administration, management, evaluation and policy analysis of health programs. _____yes __X__no (if yes, briefly describe):

5. Social/Behavioral Sciences – concepts and methods of social and behavioral sciences relevant to the identification and the solution of public health problems. __X__yes _____no (if yes, briefly describe):

    - One of the major objectives of this study is to improve our understanding of why people do and do not follow recommended preventive dental behaviors.

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Virginia Commonwealth University / Medical College of Virginia
Master of Public Health Program

TOOTHBRUSHING, FLOSSING, AND PREVENTIVE DENTAL VISITS BY RICHMOND-AREA RESIDENTS IN RELATION TO DEMOGRAPHIC AND SOCIOECONOMIC FACTORS

Submitted to the Graduate Faculty of the
Virginia Commonwealth University / Medical College of Virginia
School of Medicine in partial fulfillment
of the requirements for the degree
of Masters of Public Health

Approved: Date:

MPH Student – Kim T. Isringhausen

MPH Research Project Preceptor – Dr. Russell Bogacki

MPH Research Project Faculty Advisor – Dr. Ronald Hunt

Program Coordinator – Karen Bryant
Master of Public Health Program

Graduate Programs Director
Master of Public Health Program

To Barry, without your love and support, this would not be possible

CONTENTS

TABLES

ACKNOWLEDGMENTS

Dr. Russell Bogacki
For your valuable time and expertise in data analysis, as well as your understanding and patience

Dr. Ronald J. Hunt
For being a stable force in guiding me through the MPH program

Kim T. Isringhausen
Spring / 2004

TITLE:
Toothbrushing, Flossing, and Preventive Dental Visits by Richmond-area Residents in Relation to Demographic and Socioeconomic Factors

ABSTRACT

Purpose – This study was conducted to identify factors that influence preventive dental behaviors and, from the results, target groups for intervention.

Methods – Data were collected using the 1997 Behavioral Risk Factor Surveillance System (BRFSS) resulting in a probability sample of 399 dentate adults living in Richmond City, Henrico, Chesterfield and Hanover Counties in Virginia. All analyses were performed using the statistical software program STATA. Initial hypothesis testing was performed using univariate logistic regression models. Multivariate logistic regression models were used to test the significance of independent variables while controlling for other possible predictors of behavior.

Results – Females were more likely than males to brush and floss their teeth at the recommended frequencies (OR 2.7, 95% CI 1.4-5.1; OR 2.8, 95% CI 1.5-5.1 respectively). Individuals with higher levels of education were more likely than those with lower levels of education to brush twice daily and have preventive dental visits (OR 4.2, 95% CI 1.3-13.2; OR 5.3, 95% CI 2.0-14.4 respectively). There was no racial difference in the three preventive dental behaviors.

Conclusions – Findings suggest that sex and education are important considerations when planning dental health interventions. In the Richmond area, less educated males are in the greatest need of education and other interventions aimed at twice-daily toothbrushing and daily flossing. Further, men and women with lower levels of education are in need of interventions for increasing the utilization of preventive dental services.

Introduction

The percentage of older adults in the United States who have retained their natural teeth has increased steadily during the past several decades (Marcus *et al*., 1996; Slade *et al*., 1997; Burt and Eklund, 1999; Suominen-Taipale *et al*., 1999). Increased tooth retention is a result of substantial improvements in dental technologies and treatment modalities as well as community water fluoridation and fluoride dentifrices (Eklund, 1999). One recent study found that the increased practice of preventive dental behaviors, such as toothbrushing, flossing, and dental visits, resulted in greater tooth retention (Kressin *et al*., 2003).

If current trends in increased tooth retention continue, individuals will lose fewer teeth as they age but will have more teeth that are at risk for oral disease throughout their life. This increased retention of teeth highlights the need for dental public health professionals to re-emphasize the importance of preventive dental behaviors. To help adults maintain sound teeth, the American Dental Association recommends that individuals brush twice and floss at least once a day, and have regular prophylactic dental visits (American Dental Association, 1998, 2002).

Wide variation in the rates of tooth retention among segments of the population suggests that many adults have yet to benefit fully from improvements in dental technologies or have failed to adopt preventive dental behaviors. For example, tooth retention is lower among men, the poor, and non-Hispanic blacks (CDC, 2003).

The factors that contribute to an individual's tooth retention are the same factors that influence an individual's practice of preventive dental behaviors. Previous studies have identified several demographic and socioeconomic factors that may distinguish between those who adopt preventive dental behaviors and those who do not. In general, preventive oral

hygiene habits are practiced more frequently by women than men (Ronis *et al*., 1993, 1998; Swank *et al*., 1986; Murtomaa and Metsaniitty, 1994; Davidson *et al*., 1997; Christenen *et al*., 2003). All three preventive dental behaviors have been found to be positively associated with higher socioeconomic status (Chen and Stone, 1983; Chen, 1986; Ronis *et al*., 1993, 1998). Several of these studies have found that minority group members visit the dentist less frequently than non-Hispanic whites. Past research has also found inconsistent and usually weak relationships between age and preventive dental behaviors.

Some of the aforementioned studies are significantly dated. In addition, many of the studies examined only dental visits and failed to distinguish preventive from restorative care. Other studies are limited by the use of non-probability samples and failure to conduct multivariate analysis.

Given current trends in tooth retention and limitations of past studies, the decision was made to reassess the factors that influence preventive dental behaviors. The purpose of this study was to identify the factors that influence preventive dental behaviors and target groups that can benefit most from intervention. Specifically, the current study sought to reexamine the relationships between preventive dental behaviors and demographic and socioeconomic variables in a probability sample of residents in Richmond city and three surrounding counties in Virginia.

Objectives

Based on this goal, the following hypotheses were tested: (1) preventive dental behaviors will be more commonly practiced by women than men, even after controlling for socioeconomic status and other demographic variables; (2) all three preventive behaviors – toothbrushing, flossing, and dental visits – will be positively associated with higher socioeconomic status, (3) preventive dental visits will be more strongly associated with economic variables (income and

insurance) than toothbrushing and flossing, and (4) there will be no racial difference in the three preventive dental behaviors when socioeconomic status is controlled.

Methods and Materials

The study was a probability sample survey of 399 adults 18 years of age or older having at least one tooth and living in Richmond City, Chesterfield, Henrico and Hanover Counties in Virginia. Data were used from the 1997 Virginia Behavioral Risk Factor Surveillance System (BRFSS). BRFSS is an annual state-based, random-digit-dialed telephone survey of the non-institutionalized, U.S. civilian population aged 18 years and older. It is administered in all 50 states, the District of Columbia, and three U.S. territories, Guam, Puerto Rico, and the U.S. Virgin Islands. In 2002, the median response rate was 58.6 percent.

Toothbrushing frequency was assessed using the question "How often do you brush your teeth?" and categorized: less than one time a day; once a day; twice a day; three times a day; more than three times a day; don't know/not sure; and refused. For the current analyses, the categories were collapsed and coded 1 if the person brushed twice a day or more once and 0 if the person brushed once a day or less. Flossing frequency was assessed by using the question "How often do you floss?" and categorized: every day; a few days a week; once a week; less than once a week; never; don't know/not sure; and refused. For the current analyses the categories were collapsed and coded 1 if the person flossed every day and 0 if the person flossed less than daily.

Reported age from 18-99 was recoded into four categories: 18-29, 30-39, 40-54, and 55 and older. Sex was indicated by the respondent and coded 1 if the respondent was male and 0 if the respondent was female. Race/ethnicity was determined by the question: "What is your race?" The interviewer read to the participant a list of options to choose from which included

White, Black, Asian/Pacific Islander, Aleutian/Eskimo or American Indian, other (specify), don't know/not sure, and refused. For the current analyses the categories were collapsed and coded 1 if the person was white and 0 if the person was black or other race (nonwhite).

Socioeconomic status was represented by two separate variables, education and income, each assessed by single questions. The education question was "What is the highest grade or year of school you completed?" and the choices were: never attended school or kindergarten only; grades 1 through 8 (Elementary); Grades 9 through 11 (Some high school), Grade 12 or GED (High school graduate); College 1 year to 3 years (Some college or technical school); College 4 years or more (College graduate); and refused. For the current analyses, categories were collapsed as follows: less than high school graduate (<12 years), high school graduate or GED certificate (12 years), college 1-3 years (13-14 years), college 4 years or more (15+ years). Income was determined using the question: "What is your annual household income from all sources?" The original choices were: less than $10,000, $10,000 to less than $15,000; $15,000 to less than $20,000, $20,000 to less than $25,000; $25,000 to less than $35,000; $35,000 to less than $50,000, $50,000 to $75,000; $75,000 or more; and don't know/not sure; and refused. The categories were collapsed and recoded into four categories: less than $20,000, $20,000 to less than $35,000, $35,000 to less than $50,000 and over $50,000.

Preventive dental visits were determined using the question "What dental service did you receive at your last visit?" If the respondent answered exam or checkup, cleaning, x-rays, fluoride, or sealants it was categorized as preventive and coded 1. Responses to fillings, extractions, root canal, gum surgery, orthodontics, or dentures were categorized non-preventive and coded 0.

A final question was used to assess whether subjects had any dental insurance: "Do you have any kind of insurance coverage that pays for some or all of your routine dental care, including dental insurance, prepaid plans such as HMO, or government plans such as Medicare?" The variable was coded 1 if the subject responded yes and 0 if the subject responded no.

All statistical analyses were performed using the statistical software program STATA version 7.0. The first phase of the analysis involved the production of descriptive statistics of the data. Tables were constructed and trends were examined. The next phase involved univariate analysis of the data using logistic regression models. This phase was used to confirm trends found in the tables. The odds ratio of 1 was indicated for the reference category with which the other variables were compared. Reference categories were determined by choosing groups with the least probability of engaging in the preventive dental behavior at the recommended frequency.

The final phase involved multivariate logistic regression. Construction of multivariate models was guided by the hypotheses of this study. Multivariate logistic regression models were used to determine the behavior from all six predictors. This was done to characterize the relationships when all of the other predictors were controlled. In order to control for other potential variable biases, employment and region were added in to the forward step-wise modeling building process. All multivariate models were checked for accuracy using the Hosmer-Lemeshow goodness-of-fit test as well as area under the receiver operator characteristic (ROC) curve.

For all analyses, alpha was set at .05. Results are presented in the attached tables.

Results

Distributions for all variables are shown in Table 1. Consistent with past findings, a significant proportion of individuals reported brushing daily, a fraction reported daily flossing, and a moderate percentage indicated dental visits for preventive services.

Brushing

As can be seen in Table 2, brushing twice daily had statistically significant relationships with sex and education (one of the variables indicating socioeconomic status), but not with age, race, income, or dental insurance coverage. Women were 2.7 times more likely than men to brush their teeth twice daily. The percentage of persons brushing daily increased steadily with increases in education. College graduates were 4.4 times more likely than those with less than a high school education to brush their teeth twice daily.

The multivariate analysis, Table 3, showed the same relationships for sex and similar relationships for education. Women were 2.7 times more likely than men to brush their teeth twice daily. Again, the percentage of persons brushing daily increased steadily with increases in education. However, there was no statistically significant relationship between those with a high school education and twice daily brushing.

In examination of Table 2 and Table 3, the strongest effect was that for education, with an odds ratio of 4.2 for college graduates, statistically significant at the .05 level in both analyses.

Flossing

As shown in Table 4, daily flossing had statistically significant relationships with age and sex, but not with race, education, income or insurance coverage. Women were 3.3 times more likely than men to floss their teeth daily. The percentage of persons flossing daily increased

steadily after age 39. Individuals age 55 and older were almost four times more likely to floss daily than individuals age 18-29.

The multivariate analysis, Table 5, showed similar relationships for age and sex. Women were 2.8 times more likely than men to floss their teeth daily.

In examination of Table 4 and Table 5, the strongest effect was that for age, with an odds ratio of 3.7 for individuals age 55 and older, statistically significant at the .05 level in both analyses.

Preventive Dental Visits

As seen in Table 6, the likelihood of preventive dental visits was significantly associated with education (one of the two variables indicating socioeconomic status), but not with income, age, race, or sex. In addition, having dental insurance significantly increased the chance that an individual would obtain preventive dental visits. As expected, this association contrasted with toothbrushing and flossing, which were not significantly associated with insurance coverage. The percentage of persons taking action in preventive dental visits increased with increases in education. College graduates were four times more likely than those with less than a high school education to partake in preventive dental visits. Individuals with dental insurance were 1.7 times more likely than those without dental insurance to obtain preventive dental services.

The multivariate analysis, Table 7, showed a statistically significant relationship only between education and preventive dental visits. The strength of this relationship actually increased in the multivariate model. College graduates were 5.3 times more likely then those with less than a high school education to have a preventive dental visit.

The relationship between dental insurance and preventive dental visits was statistically significant in the univariate analysis, but not in the multivariate analysis, suggesting that some of

the other predictors could explain the lack of effect of dental insurance on preventive dental visits. In a separate multivariate analysis of dental insurance (Table 9), significant relationships were found with income and employment status. Individuals earning $50,000 or more annually were 4.9 times more likely than those earning less than $20,000 annually to have dental insurance. Individuals who were employed were 2.9 times more likely than those unemployed to have dental insurance. These findings further support the possibility that the lack of effect of dental insurance on preventive dental visits could be explained by considering these other variables.

In examination of Table 6 and Table 7, the strongest effect was that for education, with an odds ratio of 5.3 for college graduates, statistically significant at the .05 level in both analyses.

Discussion

The focus of this research project is to identify the factors that influence preventive dental behaviors. The results of these findings can be used to pinpoint groups for intervention.

The first hypothesis of the study was that preventive dental behaviors would be more commonly practiced by women than men, even after controlling for socioeconomic status and other demographic variables. Incongruous with previous studies (Ronis *et al.,* 1993, 1998; Swank *et al*., 1986) this hypothesis was only partially supported. Women were significantly more likely than men to brush and floss at the recommended frequencies, but not more likely to have preventive dental visits. In a separate univariate analysis (Table 8), women were 1.9 times less likely than men to have dental insurance. This could explain why women may be less likely to have preventive dental visits at the recommended frequencies. Still, in terms of practical applications, men are in greater need of intervention for brushing and flossing.

The other variable that significantly influenced toothbrushing was education. Individuals with less education were less likely than those with higher levels of education to brush at the recommended frequency. People with lower levels of education may have less knowledge or awareness of toothbrushing as one of the effective methods for dental disease prevention, which may result in failure to adopt a proper brushing schedule. In order to reach and educate individuals who are not brushing twice daily, dental health professionals should focus on those groups with lower education levels.

The second hypothesis was that all three behaviors would be positively associated with socioeconomic status. Again, unlike other studies (Ronis *et al*, 1993; Swank *et al.*, 1986), this hypothesis was only partially supported. Two variables, education and income, were used to determine socioeconomic status. The likelihood of twice daily brushing and preventive dental behaviors was higher among individuals with higher levels of education, but there was no effect on flossing. In addition, income was not a significant predictor for any of the preventive dental behaviors. In support of these findings, previous studies have found the relationships between education and the behaviors to be stronger than the relationships between income and the behaviors (Chen, 1983). These findings, coupled with previous discussions (Ronis *et al*, 1993), indicate that educational differences may be more important than financial differences in explaining the impact of income on preventive dental behaviors. Once more, these results suggest that groups with less education are important targets for intervention programs to increase preventive dental behaviors.

The third hypothesis was that, because of cost, preventive dental visits would be more strongly associated with the economic variables, income and insurance, than would be the other two behaviors. Similar to the findings by Ronis *et al*., little support was found for this

hypothesis as it applies to income. In both univariate and multivariate analyses, income was not found to be a significant predictor of any of the behaviors. The relationship between dental insurance and preventive dental visits was significant in the univariate analysis but dropped out in the multivariate analysis. Other factors, such as employment status, may explain the lack of effect of dental insurance. In addition, the majority of dentists in Virginia do not accept Medicaid. There are yet other access to care issues that may be unaccounted for in this study. Nonetheless, interventions to facilitate appropriate utilization of preventive services may have the greatest success if they directly address financial barriers such as unemployment.

While some studies have found strong associations between dental visits and insurance and income (Swank, *et al.*, 1986; Ronis, *et al.*, 1993), other studies have found strong associations between dental visits and education and income (Chen and Stone, 1983; Chen, 1986). Although income was not a significant finding in this study, education was the strongest predictor of preventive dental visits, producing an even stronger effect than that on brushing. Based on this finding, it is advisable that more resources be allocated to those people with less education. Programs should be designed to educate those with lower educational levels about the importance of preventive dental visits.

The fourth hypothesis was that there is no racial difference in the three preventive behaviors when socioeconomic status is controlled. Consistent with this hypothesis, univariate and multivariate analyses showed that nonwhites were not significantly less likely than whites to brush twice daily, floss daily, or have preventive dental visits. The only other study to examine this relationship was a study by Ronis *et al*., who reported that any difference between nonwhites and whites was greatly reduced when socioeconomic status was statistically controlled.

No hypothesis was made about age in relation to the behaviors. Though age was not statistically significant in relation to brushing, individuals age 55 and older were 3.7 times more likely than those age 18-29 to report daily flossing. Although no statistical analyses were performed, it is plausible that, although dentate, the oldest group may have been more likely to have fewer teeth, and for that reason found it easier to floss fewer numbers of teeth. Further, if tooth loss was due to dental disease, these individuals may be more motivated to floss their remaining teeth in an effort to prevent future problems. However, given current trends in increased tooth retention, this explanation may be contradictory. Another conceivable reason for increased flossing in this age group may be due to the probable likelihood of periodontal disease. Food debris that accumulates interproximally may result in pain, thus, requiring routine flossing out of necessity for debris removal.

Limitations

This study was a non-experimental cross-sectional design and, therefore, did not provide evidence about the directions of causal relationships. Data were obtained from the Behavioral Risk Factor Surveillance System, which produced inherent limitations. For example, all variables were assessed by self-report and may be subject to measurement error due to communication difficulties, memory errors, and social desirability. Another weakness in using data from BRFSS is that the same questions are not asked from year to year. This creates restrictions when choosing questions to create variables and may result in poor variables. The sample size of this study presented limitations in investigating the relationships with race. Due to small cell frequencies after collapsing race categories, it was not possible to further distinguish between white and nonwhite or among nonwhite subgroups. Therefore, this study did not represent the entire population in terms of race. Future research should address these limitations.

Conclusions

Among the six predictor variables analyzed in this study, sex and education had the strongest relationship with preventive dental behaviors. In order to achieve the greatest effectiveness of dental health interventions, dental health educators must carefully choose the target populations with poor preventive dental behaviors. In the Richmond area, less-educated males are in the greatest need of intervention. To be most effective, interventions should be targeted not only to specific groups but to specific behaviors as well. Specifically, the findings of this study indicated that less educated males can benefit most from interventions aimed at increasing twice daily toothbrushing and daily flossing. Further, men and women with lower levels of education are in need of interventions for increasing the utilization of preventive dental services.

TABLE 1

Distribution of All Measures

	No. of Cases	%
Brushing	355	
Twice daily or more		78
Once daily or less		20
Flossing	354	
Daily		28
< Daily		69
Dental Visits	378	
Preventive		63
Non-preventive		35
Age	399	
18-29		22
30-39		21
40-54		30
55+		27
Race	393	
White		74
Non-White		25
Sex	399	
Male		41
Female		59
Education	397	
< 12 years		12
12 years		28
13-14 years		27
15+ years		32
Income	336	
< $20,000		19
$20,000-34,999		19
$35,000-49,999		15
$50,000+		31
Dental Insurance	392	
No		35
Yes		63

TABLE 2

Univariate Relationship Between Brushing and Predictor Variables

	% Brushing 2x Daily	Odds Ratio	95% CI
Age (n=355)			
18-29	85	1.0	
30-39	78	0.9	0.4 - 2.0
40-54	73	0.5	0.3 - 1.1
55+	76	0.6	0.3 - 1.3
Race (n=349)			
White	78	1.2	0.7 - 2.1
Nonwhite	75	1.0	
Sex (n=355)			
Male	70	1.0	
Female	84	2.7	1.6 - 5.0
Education (n=354)			
< 12 years	57	1.0	
12 years	75	2.6	1.1 - 5.7
13-14 years	80	3.7	1.6 - 8.5
15+ years	84	4.4	1.9 - 10.0
Income (n=299)			
< $20,000	76	1.0	
$20,000-34,999	78	1.1	0.4 - 2.4
$35,000-49,999	76	0.9	0.4 - 2.2
$50,000+	78	1.1	0.5 - 2.3
Dental Insurance (n=354)			
No	33	1.0	
Yes	67	0.9	0.5 - 1.6

TABLE 3

Multivariate Relationship Between Brushing and Predictor Variables (N=294)

	% Brushing 2x Daily	Odds Ratio	95% CI
Age			
18-29	85	1.0	
30-39	78	1.1	0.4 - 2.8
40-54	73	0.6	0.3 - 1.6
55+	76	0.8	0.3 – 2.3
Race			
White	78	0.9	0.4 - 2.2
Nonwhite	75	1.0	
Sex			
Male	70	1.0	
Female	84	2.7	1.4 - 5.1
Education			
< 12 years	57	1.0	
12 years	75	2.4	0.8 – 7.1
13-14 years	80	4.0	1.3 - 12.0
15+ years	84	4.2	1.3 – 13.2
Income			
< $20,000	76	1.0	
$20,000-34,999	78	0.9	0.3 - 2.5
$35,000-49,999	76	0.9	0.3 - 2.5
$50,000+	78	0.9	0.3 - 2.8
Dental Insurance			
No	33	1.0	
Yes	67	0.8	0.4 - 1.7

Overall Model P-value <0.05
Hosmer-Lemeshow goodness-of-fit test P>Chi2 = 0.23
ROC curve = 0.75

TABLE 4

Univariate Relationship Between Flossing and Predictor Variables

	% Flossing Daily	Odds Ratio	95% CI
Age (n=354)			
18-29	15	1.0	
30-39	27	2.0	0.9 - 4.7
40-54	29	2.3	1.1 - 4.7
55+	42	3.9	2.0 - 8.2
Race (n=348)			
White	29	1.1	0.6 - 1.7
Nonwhite	28	1.0	
Sex (n=354)			
Male	16	1.0	
Female	38	3.3	2.0 - 5.5
Education (n=352)			
< 12 years	22	1.0	
12 years	26	1.2	0.5 - 3.1
13-14 years	28	1.4	0.6 - 3.4
15+ years	32	1.7	0.7 - 4.0
Income (n=297)			
< $20,000	25	1.0	
$20,000-34,999	22	0.8	0.3 - 1.7
$35,000-49,999	26	0.9	0.4 - 2.2
$50,000+	29	1.1	0.5 - 2.2
Dental Insurance (n=353)			
No	35	1.0	
Yes	65	0.8	0.5 - 1.4

TABLE 5

Multivariate Relationship Between Flossing and Predictor Variables (N=291)

	% Flossing Daily	Odds Ratio	95% CI
Age			
18-29	15	1.0	
30-39	27	2.6	1.0 - 6.5
40-54	29	2.4	1.0 - 6.0
55+	42	3.7	1.4 - 10.1
Race			
White	29	1.1	0.6 – 1.7
Nonwhite	28	1.0	
Sex			
Male	16	1.0	
Female	38	2.8	1.5 - 5.1
Education			
< 12 years	22	1.0	
12 years	26	1.1	0.3 - 3.4
13-14 years	28	1.4	0.4 - 4.9
15+ years	32	1.8	0.5 - 6.2
Income			
< $20,000	25	1.0	
$20,000-34,999	22	0.8	0.3 - 2.0
$35,000-49,999	26	1.1	0.4 - 2.9
$50,000+	29	1.1	0.4 - 2.7
Dental Insurance			
No	35	1.0	
Yes	65	0.9	0.5 - 1.7

Overall Model P-value <0.05
Hosmer-Lemeshow goodness-of-fit test P>Chi2 = 0.08
ROC curve = 0.73

TABLE 6

Univariate Relationship Between Preventive Dental Visit and Predictor Variables

	% Preventive Dental Visit	Odds Ratio	95% CI
Age (n=378)			
18-29	68	1.0	
30-39	59	0.7	0.3 - 1.3
40-54	72	1.2	0.6 - 2.1
55+	54	0.6	0.3 - 1.1
Race (n=372)			
White	59	1.3	0.8 - 2.1
Nonwhite	66	1.0	
Sex (n=378)			
Male	61	1.0	
Female	66	1.3	0.8 - 1.9
Education (n=376)			
< 12 years	35	1.0	
12 years	66	3.6	1.7 - 7.5
13-14 years	67	3.4	1.6 - 7.2
15+ years	70	4.0	1.9 - 8.2
Income (n=321)			
< $20,000	54	1.0	
$20,000-34,999	61	1.3	0.7 - 2.5
$35,000-49,999	74	2.2	1.0 - 4.7
$50,000+	65	1.5	0.8 - 2.7
Dental Insurance (n=377)			
No	30	1.0	
Yes	69	1.7	1.1 - 2.7

TABLE 7

Multivariate Relationship Between Preventive Dental Visit and Predictor Variables (N=315)

	% Preventive Dental Visit	Odds Ratio	95% CI
Age			
18-29	68	1.0	
30-39	59	0.6	0.3 - 1.4
40-54	72	1.2	0.6 - 2.5
55+	54	0.7	0.3 - 1.7
Race			
White	59	1.2	0.6 - 2.4
Nonwhite	66	1.0	
Sex			
Male	61	1.0	
Female	66	1.1	0.7 - 1.8
Education			
< 12 years	35	1.0	
12 years	66	5.0	2.0 - 13.3
13-14 years	67	4.4	1.7 - 11.6
15+ years	70	5.3	2.0 - 14.4
Income			
< $20,000	54	1.0	
$20,000-34,999	61	0.9	0.4 - 1.9
$35,000-49,999	74	1.5	0.6 - 3.8
$50,000+	65	0.9	0.4 - 2.0
Dental Insurance			
No	30	1.0	
Yes	69	1.2	0.7-2.2

Overall Model P-value = 0.05
Hosmer-Lemeshow goodness-of-fit test P>Chi2 = 0.21
ROC curve = 0.65

TABLE 8

Univariate Relationship Between Dental Insurance and Predictor Variables

	% with Dental Insurance	Odds Ratio	95% CI
Age (n=392)			
18-29	63	1.0	
30-39	70	1.5	0.8 – 2.9
40-54	72	1.6	0.9 – 2.9
55+	48	0.5	0.3 – 0.9
Race			
White	63	0.9	0.6 – 1.5
Nonwhite	63	1.0	
Sex			
Male	72	1.0	
Female	57	0.5	0.3 – .08
Education (n=390)			
< 12 years	55	1.0	
12 years	55	1.1	0.5 – 2.1
13-14 years	67	1.8	0.9 – 3.7
15+ years	71	2.0	1.0 – 4.0
Income (n=331)			
< $20,000	43	1.0	
$20,000-34,999	58	1.8	0.9 – 3.4
$35,000-49,999	72	3.4	1.6 – 7.1
$50,000+	78	4.9	2.6 – 9.3
Employment (n=392)			
No	39	1.0	
Yes	73	4.3	2.7 – 6.9

TABLE 9

Multivariate Relationship Between Dental Insurance and Predictor Variables (N=325)

	% with Dental Insurance	Odds Ratio	95% CI
Age			
18-29	63	1.0	
30-39	70	1.1	0.5 – 2.4
40-54	72	0.8	0.4 – 1.8
55+	48	0.8	0.4 – 2.0
Race			
White	63	0.4	0.2 – 0.9
Nonwhite	63	1.0	
Sex			
Male	72	1.0	
Female	57	0.6	0.3 – 1.0
Education			
< 12 years	55	1.0	
12 years	55	0.4	0.2 – 1.2
13-14 years	67	0.8	0.3 – 2.1
15+ years	71	0.5	0.2 – 1.5
Income			
< $20,000	43	1.0	
$20,000-34,999	58	2.1	1.0 – 4.5
$35,000-49,999	72	3.0	1.2 – 7.0
$50,000+	78	4.9	2.1 – 11.4
Employment			
No	39	1.0	
Yes	73	2.9	1.5 – 5.8

Overall Model P-value < 0.001
Hosmer-Lemeshow goodness-of-fit test P>Chi2 = 0.35
ROC curve = 0.75

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