

Racial Differences in Predictors of Dental Care Use

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Objective. To test five hypotheses that non-Hispanic African Americans (AAs) and non-Hispanic whites (NHWs) differ in responsiveness to new dental symptoms by seeking dental care, and differ in certain predictors of dental care utilization.

Data Sources/Study Setting. *Florida Dental Care Study*, comprising AAs and NHWs 45 years old or older, who had at least one tooth, and who lived in north Florida.

Study Design. We used a prospective cohort design. The key outcome of interest was whether dental care was received in a given six-month period, after adjusting for the presence of certain time-varying and fixed characteristics.

Data Collection/Extraction Methods. In-person interviews were conducted at baseline and 24 months after baseline, with six-monthly telephone interviews in between.

Principal Findings. African Americans were less likely to seek dental care during follow-up, with or without adjusting for key predisposing, enabling, and oral health need characteristics. African Americans were more likely to be problem-oriented dental attenders, to be unable to pay an unexpected \$500 dental bill, and to report postbaseline dental problems. However, the effect of certain postbaseline dental signs and symptoms on postbaseline dental care use differed between AAs and NHWs. Although financial circumstance was predictive for both groups, it was more salient for NHWs in separate NHW and AA regressions. Frustration with past dental care, propensity to use a homemade remedy, and dental insurance were significant predictors among AAs, but not among NHWs. The NHWs were much more likely to have sought care for preventive reasons.

Conclusions. Racial differences in responsiveness to new dental symptoms by seeking dental care were evident, as were differences in other predictors of dental care utilization. These differences may contribute to racial disparities in oral health.

Key Words. Dental care, health disparities, race, socioeconomic status, longitudinal

The growing literature on racial disparities in health and health care use has documented significantly poorer health and lower health care utilization among non-Hispanic African Americans (AAs), when compared with non-Hispanic whites (NHWs). Possible reasons for these disparities are numerous, and include racial differences in clinical condition, quality of health care and insurance coverage, knowledge of disease or treatment options, overuse of

health care by NHWs and/or underuse by AAs, subconscious treatment bias, among other reasons (e.g., King 1996; Fiscella et al. 2000; Mayberry, Mili, and Ofili 2000). Although conclusions do differ with the type of health service or disease entity, what has emerged is a relatively consistent pattern of disadvantage for AAs.

With the release of the first Surgeon General's report on oral health, racial disparities in oral health are now widely recognized (U.S. Department of Health and Human Services 2000). Improving our understanding of the potentially complex relationship between dental care and oral health is salient, because dental care constitutes more than \$50 billion in the United States annually (Braden et al. 1998), and because oral health is an important component of health in its own right through its impact on quality of life and its contribution to certain medical conditions. Furthermore, the association between oral health and race is particularly strong, and may help elucidate the links between race and health in general.

Racial differences in dental utilization may help explain oral health disparities. We know that AAs are less likely to receive dental care within a given time interval, and this association remains even after adjusting for differences in socioeconomic status (Grembowski, Andersen, and Chen 1989). To our knowledge, no longitudinal studies have focused on these racial differences. This is noteworthy because being able to account for new dental problems may help explain any racial differences in dental utilization that are observed. Conducting a longitudinal analysis stratified by race may yield additional insight into the role that certain factors play in dental utilization by AAs, an analysis that is not diluted by the role of these same factors among NHWs. We describe herein the results from such a study. We were able to identify only two studies in which race-stratified multiple regression analyses of dental utilization were reported, both of which were cross-sectional studies.

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A study of AA and NHW residents of a rural North Carolina county who were 21 years old or older observed that need variables were strongly associated with dental visits among AAs, but that predisposing characteristics were more salient for NHWs (Wolinsky 1982). Level of formal education was significant for NHWs, but not for AAs. A study of Baltimore NHWs and AAs found that education was significantly associated with use for NHWs, but not among AAs (Davidson and Andersen 1997).

We previously investigated the role of a comprehensive range of oral health factors in understanding dental utilization (Gilbert, Duncan, and Vogel 1998) using data from the Florida Dental Care Study, a prospective cohort study. The conclusions were that certain measures of need (or oral health) were important predictors of dental care utilization. However, persons with need as determined by direct clinical examination, and persons with need as determined by self-reported decrements in certain measures of oral health, were actually less likely to have sought dental care. We also observed that AAs had less dental care use than NHWs, even after adjusting for other need, predisposing, and enabling factors. Following other findings from the Florida Dental Care Study, we became intrigued by consistent racial differences in oral health and related behaviors. This led us to investigate the value of conducting race-stratified analyses. This is the purpose of this report.

OBJECTIVES AND HYPOTHESES TESTED

The objective for this report was to test five hypotheses. That

- compared with NHWs, AAs have a higher propensity for problem-oriented dental attendance, for using a homemade remedy before seeking dental care, a higher prevalence of frustration with past dental care, a higher probability of reporting negative dental attitudes, less ability to pay for dental care, and a lower prevalence of dental insurance coverage;
- compared with NHWs, AAs have a higher incidence of dental problems (need characteristics);
- AAs and NHWs are differentially responsive (seek dental care) to these new dental problems;
- the common reasons for dental attendance by AAs are problem-oriented, whereas the most common reasons among NHWs are preventively oriented or routine;

- each of these predisposing, enabling, and need characteristics are predictive of dental care utilization, but that there are differences in the statistical significance and effect magnitudes of these predictors between AAs and NHWs.

METHODS

Sampling and Study Design

Sampling methodology details have been provided previously (Gilbert, Duncan, Kulley, Coward, and Heft 1997). Briefly, however, the 873 subjects who participated at baseline (weighted n of 244 AAs, 629 NHWs) resulted in a sample that was representative of the population of interest, defined as persons 45 years old or older, who had a household telephone, did not reside in an institutional setting, resided in one of four counties in Florida, could engage in a coherent telephone conversation, and had at least one tooth (one study objective was to investigate tooth loss). Race and ethnicity were queried separately; only AAs and NHWs were included. The sample's typical interval since last dental visit at baseline was very similar to national data; conclusions from the Florida Dental Care Study and national data regarding socio-demographic determinants of dental utilization were also the same (Bloom, Gift, and Jack 1992; Gilbert, Duncan, Kulley, Coward, and Heft 1997). Also, the percentage of persons with at least one visit in the first two years of the Florida Dental Care Study, 77 percent, was very similar to the figure, 75 percent, among the comparable national group.

Subjects participated for a baseline in-person interview, which was followed immediately by a clinical dental examination. Actual questionnaire wording can be found at <http://nersp.nerdc.ufl.edu/~gilbert/question.htm>. The baseline was followed by a telephone interview 6, 12, and 18 months later. These interviews queried dental utilization since last interview and a broad range of self-reported oral health decrements (discussed later). At 24 months, the interview was done in-person again, and was again followed by a clinical examination. The mean (SD) number of months that this interview took place was 24.6 (1.3). Mean observation periods did not differ between socio-demographic or baseline disease groups (Gilbert, Duncan, and Vogel 1998), so statistics reported are not adjusted for length of observation period. By the end of the 24-month stage, 87.5 percent of the sample remained in the study. Bias in the sample due to attrition was small (Gilbert, Duncan, and Vogel 1998).

A Model of Longitudinal Dental Utilization

To conceptualize the study of dental utilization, we used a behavioral model proposed by Andersen (Andersen and Newman 1973; Andersen 1995). In this model, health care utilization is seen as the result of characteristics of the population at risk and the health care delivery system. Relevant population characteristics can be summarized by three groups: predisposing, enabling, and need. *Predisposing* characteristics are those that exist prior to disease, and can be either mutable or immutable. *Enabling* characteristics are resources that affect one's ability to access the health care system, such as household income or health insurance coverage. *Need* variables reflect illness levels, such as dental disease, pain, or a person's perceived need for care. A table of all the predisposing, enabling, and need variables used in this study is available at <http://nersp.nerdc.ufl.edu/~gilbert/supplemental.html>, as is documentation of reliability estimates for interview questions and clinical examination variables. Briefly, however, percent concordance for interview items ranged from 76 percent to 100 percent, and from 82 percent to 100 percent for clinical examination items.

Predisposing Variables. At baseline, participants were asked to describe their "typical approach to dental care" as: (1) "I never go to a dentist"; (2) "I go to a dentist when I have a problem or when I know that I need to get something fixed"; (3) "I go to a dentist occasionally, whether or not I have a problem"; or (4) "I go to a dentist regularly." Persons who responded #1 or #2 were classified as "problem-oriented attenders," and those who responded #3 or #4 were classified as "regular attenders." After participants answered the "approach" question, they were asked "Over the past five years, did you ever go to a dentist just to get a check-up?" and for those who answered affirmatively, "Have you gone on a regular basis, say once a year or more often?" Regular attenders who answered affirmatively to both questions were categorized as "Consistent"; those who answered negatively to either of these two questions were categorized as "Inconsistent." Problem-oriented attenders who answered affirmatively to the first of these two questions were categorized as "Inconsistent," while those who answered negatively were categorized as "Consistent."

Six dental attitude constructs were queried at baseline (Gilbert, Duncan, Heft, and Coward 1997). As the study progressed, we came to realize the salience of dental self-care in understanding dental utilization (Gilbert, Duncan, and Earls 1998; Gilbert et al. 2000), and at a 30-month interview, dental self-care questions were included. One item was "What would you do

or what would you recommend that someone do if they experienced toothache pain?" One of the responses was "Apply a homemade remedy." Our inclusion of this item makes the assumption that propensity to use a homemade remedy was the same as that during the 24-month observation period.

Enabling Variables. "Ability to pay an unexpected \$500 dental bill" (not able to pay; able to pay, but with difficulty; or able to pay), "present financial situation," household income, and poverty status were also queried. Subjects were also asked if they had any dental insurance coverage, the source of that coverage, and which dental services were covered.

A Model of the Multiple Dimensions of Oral Health

Because the multiple dimensions of oral health are relevant to understanding dental utilization, we used a multidimensional model of oral health, the construct validity and predictive validity of which we have detailed (Gilbert, Duncan, Heft, Dolan, and Vogel 1997; Gilbert, Duncan, and Vogel 1998; Gilbert, Duncan, Heft, Dolan, and Vogel 1998). The model posits a sequential causal process that involves specific antecedents and consequents, and parallels strongly the biomedical conception of the natural history of disease. Data on *oral disease/tissue damage* were gathered by direct clinical examination and by selected self-reported items. The clinical examination recorded the presence of remaining teeth, dental decay ("cavities") and restorations (fillings), fractured fillings and fractured teeth, severe root surface defects (deep "notches" on the lateral aspects of the root), severely loose teeth, and periodontal loss (vertical loss of gums to the tooth). *Oral pain and discomfort* were measured by asking subjects to report toothache pain and dental sensitivity to hot/cold changes. *Oral functional limitation* was measured by asking subjects whether they had any difficulty speaking or pronouncing words because of dental problems within the previous six months, and what was their current chewing ability. *Oral disadvantage* was measured with eight questions (Gilbert, Duncan, Heft, Dolan, and Vogel 1997) about whether mouth problems caused subjects to avoid certain activities within the previous six months. *Self-rated oral health* was measured by asking participants to rate their oral health (excellent, very good, good, fair, poor). Satisfaction with chewing ability and dental appearance were also queried (very satisfied, satisfied, dissatisfied, very dissatisfied). "Perceived need for dental care" was measured by asking "Do you think you need to see a dentist now or in the next couple of weeks?" Participants who answered affirmatively were asked

“Is that: a) for a routine check-up; or b) for a dental problem?” while those who answered negatively were asked “Is that: a) because although you have a dental problem, it can wait; or b) because your mouth is in good shape now.” Participants who specified that their answer was related to a dental problem were asked to specify the problem.

Statistical Methods

Results were weighted using the sampling proportions in order to reflect the population in the counties studied (Gilbert, Duncan, Kulley, Coward, and Heft 1997). Fixed characteristics (predisposing and enabling variables) in Tables 1 and 2 were tested using a χ^2 or Mantel-Haenszel χ^2 trend test. Time-varying characteristics (need variables) in Tables 1 and 2 were tested using a generalized estimating equation to account for repeated measurements made on the same individuals (GENMOD procedure; SAS Institute 2000).

The unit of analysis in Table 3 was the person-interval. One person-interval comprised one subject participating in a single six-monthly interview. The outcome of interest was coded 1 if the subject had used any dental care within the previous six-month period, and 0 if not. In Table 3, results are presented in four columns. The second column shows a multivariable logistic regression of dental care utilization that is limited to AAs (821 person-intervals). The third column is limited to NHWs (2,318 person-intervals). The fourth column pools AAs and NHWs into a single regression, formally testing whether an interaction term between race and the characteristic under consideration is statistically significant, suggesting that the effect magnitude is significantly different between races, as distinct from statistically significant within a single race. The value of stratifying analysis by race lies in the ability to conduct a within-race analysis that is not influenced by effects from the other race. This allowed us to calculate best race-specific effect magnitudes (odds ratios), and to determine which variables were statistically significant within each race, without having to simultaneously account for possible effects from the other race. From stratified models we learned that certain variables not significant in the aggregated model were indeed important for one of the racial groups (“insurance,” “use of homemade remedy” variables). Each regression was adjusted for time interval (6, 12, 18, or 24 months) to account for any time-interval effect.

Table 1: Descriptive Statistics of Study Variables by Race

<i>Characteristic (Number of Person-intervals)</i>	<i>Percent of AA or NHW Person-intervals in Which the Characteristic Was Reported</i>	
	<i>AA</i>	<i>NHW</i>
<i>Predisposing Variables</i>		
Approach to dental care		
Consistent regular attender (1,405)	19	54*
Inconsistent regular attender (335)	9	11
Inconsistent problem-oriented attender (313)	11	10
Consistent problem-oriented attender (1,068)	61	25
Frustration with past dental care		
Yes (485)	12	17 ^{ns}
No (2,645)	88	83
Would use homemade remedy		
Yes (360)	14	11 ^{ns}
No (2,714)	86	89
Gender		
Female (1,761)	59	55 ^{ns}
Male (1,378)	41	45
<i>Enabling Variables</i>		
Ability to pay an unexpected \$500 dental bill		
Able to pay comfortably (1,481)	23	56*
Able to pay, but with difficulty (1,246)	51	36
Not able to pay the bill (402)	26	9
Had dental insurance		
Yes (1,068)	29	36 ^{ns}
No (2,067)	71	64
<i>Need Variables</i>		
Had toothache or abscess		
Yes (530)	20	16*
No (2,591)	80	84
Had dental cavities		
Yes (466)	20	13*
No (2,601)	80	87
Had loose tooth		
Yes (344)	21	8*
No (2,778)	79	92

continued

Table 1: Continued

Characteristic (Number of Person-intervals)	Percent of AA or NHW Person-intervals in Which the Characteristic Was Reported	
	AA	NHW
Had broken tooth		
Yes (452)	18	13*
No (2,659)	82	87
Had broken filling		
Yes (252)	7	9 ^{ns}
No (2,861)	93	91
Had oral disadvantage due to disease or tissue damage		
Yes (368)	20	9*
No (2,763)	80	91
Satisfaction with dental appearance		
Very satisfied (744)	18	26 ^{ns}
Satisfied (1,714)	51	56
Dissatisfied (541)	26	14
Very dissatisfied (122)	6	3
Perceived need for dental care due to a specific problem		
Yes (858)	40	23*
No (2,254)	60	77

Note: Interview data were taken from each six-monthly interview. Each time one participant completed a six-monthly interview, one person-interval was completed. For fixed characteristics (predisposing and enabling variables), the sample sizes used for statistical testing were those from baseline.

*The association between race and the characteristic being tested was statistically significant, $p < 0.05$.

^{ns}The association was not statistically significant.

RESULTS

Of the 24-month participants, 77 percent reported having been to a dentist at least once during follow-up. This was strongly associated with race: 84 percent of NHWs, compared to 59 percent of AAs ($\chi^2 = 54.7$; $p < 0.001$; 1 *df*). As shown in Table 2, AAs reported dental utilization in 30 percent of the six-monthly person-intervals, compared to 57 percent for NHWs ($p < 0.001$).

Table 2: Percent Who Reported Using Dental Care within a Given Six-Month Interval, by Study Variables after Stratifying by Race

<i>Characteristic (Number of Person-intervals)</i>	<i>Percent of Person-intervals in Which a Dental Visit Was Reported</i>	
	<i>AA</i>	<i>NHW</i>
Overall (3,139)	30	57
<i>Predisposing Variables</i>		
Approach to dental care		
Consistent regular attender (1,405)	61*	73*
Inconsistent regular attender (335)	43	54
Inconsistent problem-oriented attender (313)	36	48
Consistent problem-oriented attender (1,068)	18	27
Frustration with past dental care		
Yes (485)	23 ^{ns}	52 ^{ns}
No (2,645)	31	59
Would use homemade remedy		
Yes (360)	27 ^{ns}	50 ^{ns}
No (2,714)	31	58
Gender		
Female (1,761)	34*	59 ^{ns}
Male (1,378)	25	55
<i>Enabling Variables</i>		
Ability to pay an unexpected \$500 dental bill		
Able to pay comfortably (1,481)	42*	67*
Able to pay, but with difficulty (1,246)	31	50
Not able to pay the bill (402)	19	21
Had dental insurance		
Yes (1,068)	43*	61 ^{ns}
No (2,067)	25	55
<i>Need Variables</i>		
Had toothache or abscess		
Yes (530)	43*	65*
No (2,591)	27	56
Had dental cavities		
Yes (466)	35*	63*
No (2,601)	29	56
Had loose tooth		
Yes (344)	33*	55 ^{ns}
No (2,778)	30	57

continued

Table 2: Continued

Characteristic (Number of Person-intervals)	Percent of Person-intervals in Which a Dental Visit Was Reported	
	AA	NHW
Had broken tooth		
Yes (452)	27 ^{ns}	64*
No (2,659)	31	56
Had broken filling		
Yes (252)	45*	76*
No (2,861)	29	55
Had oral disadvantage due to oral disease or tissue damage		
Yes (368)	30 ^{ns}	48 ^{ns}
No (2,763)	31	58
Satisfaction with dental appearance		
Very satisfied (744)	38 ^{ns}	69*
Satisfied (1,714)	29	57
Dissatisfied (541)	28	42
Very dissatisfied (122)	33	33
Perceived need for dental care due to a specific problem		
Yes (858)	32 ^{ns}	54 ^{ns}
No (2,254)	30	58

Note: Interview data were taken from each six-monthly interview. Each time one participant completed a six-monthly interview, one person-interval was completed.

*The association between use of dental care and the characteristic being tested was statistically significant, $p < 0.05$ (within race grouping); tested using a generalized estimating equation to account for repeated measurements made on the same individuals (GENMOD procedure).

^{ns}The association was not statistically significant.

HYPOTHESIS 1. There were racial differences in key predictors of dental attendance (Table 1). The AAs were much more likely to have been problem-oriented attenders and not able to pay an unexpected dental bill. There were no statistically significant racial differences in presence of dental insurance, frustration with past dental care, or in propensity to use a homemade remedy.

HYPOTHESIS 2. The AAs were more likely to have had these dental problems: toothache or abscess, dental cavities, loose tooth, broken tooth, oral disadvantage due to oral disease/tissue damage, and perceived need for care due to a specific problem (Table 1). No racial differences in incidence of broken filling or satisfaction with dental appearance were observed.

Table 3: Generalized Estimating Equation for Dental Care Use in Six-Month Intervals during a Twenty-Four-Month Period, Stratified by Race

<i>Characteristic</i>	<i>Odds Ratios and 95% Confidence Intervals</i>		<i>Statistical Significance of Race Interaction Term</i>
	<i>AAs</i>	<i>NHWs</i>	
Intercept	18.8 (4.1, 86)	77.9 (12, 491)	**
Predisposing characteristics			
Consistent regular attender	7.3 (4.2, 12.8)	8.3 (5.2, 13.4)	ns
Inconsistent regular attender	4.7 (2.6, 8.5)	3.8 (2.0, 7.3)	
Inconsistent problem-oriented attender	2.6 (1.5, 4.5)	2.4 (1.2, 4.5)	
Consistent problem-oriented attender	—	—	
Frustrated with past dental care	0.4 (0.2, 0.8)	0.9 (0.6, 1.4)	ns
Would use homemade remedy	0.5 (0.3, 0.9)	1.1 (0.7, 1.8)	ns
Female	2.3 (1.5, 3.6)	1.5 (1.1, 2.1)	ns
Enabling characteristics			
Able to pay comfortably	2.2 (1.2, 3.9)	7.8 (3.6, 16.9)	**
Able to pay, but with difficulty	1.7 (1.1, 2.6)	3.8 (1.8, 7.9)	
Not able to pay	—	—	
Had dental insurance	2.3 (1.5, 3.5)	0.8 (0.5, 1.2)	**
Need characteristics			
Had toothache or abscess	3.2 (2.1, 4.8)	1.8 (1.2, 2.7)	ns
Had cavities	1.8 (1.1, 2.8)	3.0 (2.0, 4.6)	ns
Had loose tooth	1.5 (1.1, 2.2)	1.6 (0.9, 3.0)	ns
Had broken tooth	0.8 (0.5, 1.2)	2.3 (1.6, 3.4)	**
Had broken filling	1.6 (0.8, 3.1)	3.6 (2.0, 6.4)	ns
Had oral disadvantage due to oral disease or tissue damage	0.9 (0.6, 1.4)	2.0 (1.1, 3.7)	ns
Very satisfied with dental appearance	0.7 (0.3, 1.7)	3.8 (1.3, 11.1)	**
Satisfied with dental appearance	0.9 (0.4, 1.9)	2.8 (1.1, 7.9)	
Dissatisfied with dental appearance	0.8 (0.4, 1.7)	2.0 (0.7, 5.6)	
Very dissatisfied	—	—	
Perceived need due to specific problem	1.2 (0.8, 1.8)	1.5 (1.1, 2.1)	ns

continued

Table 3: Continued

Characteristic	Odds Ratios and 95% Confidence Intervals		Statistical Significance of Race Interaction Term
	AAs	NHWs	
Model fit statistics			
Sample size (number of persons)	200	561	
Number of person-intervals	774	2,193	
Deviance	758.5	2390.0	
Df	1,168	1,619	
Value/df	0.65	1.48	

AAs = African-Americans; NHWs = non-Hispanic whites; ns = not statistically significant
 ** statistically significant, $p < 0.05$

HYPOTHESIS 3. Some racial differences in responsiveness to dental signs and symptoms were observed (Table 2). Both AAs and NHWs with a dental problem were more likely to have sought dental care than those without that problem, when the problem was a toothache/abscess, dental cavities, or broken filling. The AAs were more likely to have responded to a loose tooth, but less likely than NHWs to have responded to a broken tooth. The NHWs who were satisfied with their dental appearance were *more* likely to have sought dental care.

HYPOTHESIS 4. The NHWs were more likely to have reported “regular checkup” as a reason (42 percent of visits; compared to 15 percent for AAs; $p < 0.001$), as well as “needed teeth cleaned” (29 percent of visits; compared to 12 percent for AAs; $p < 0.001$), “broken tooth or cap” (6 percent of visits; compared to 3 percent for AAs; $p < 0.001$), “broken filling” (5 percent of visits; compared to 2 percent for AAs; $p < 0.005$), “infected tooth” (3 percent of visits; compared to 1 percent for AAs; $p < 0.001$), and “cap or bridge was loose” (3 percent of visits; compared to 1 percent for AAs; $p < 0.005$). One reason was more common among AAs: “tooth was loose” (3 percent of visits; compared to 1 percent for NHWs; $p < 0.005$). There were no significant racial differences in reporting “cavities” as a reason, nor for “toothache or painful tooth,” “tooth sensitive to hot/cold,” “gums infected or bleeding,” “denture broken,” or “sore denture.”

HYPOTHESIS 5. Several characteristics were significantly associated with utilization for both races at the bivariate level (Table 2): approach to dental care, ability to pay an unexpected dental bill, toothache or abscess, dental cavities, and broken filling. Three characteristics were significantly associated with utilization among AAs only: gender, dental insurance, and loose tooth. Two characteristics were significantly associated with utilization among NHWs only: broken tooth and satisfaction with dental appearance.

Racial differences were also observed during multiple regression modeling (Table 3). With other covariates taken into account, NHWs were much more

likely than AAs to have used dental care within any single six-month interval (significant interaction term for intercept). We also observed that several predisposing, enabling, and need characteristics were explanatory of utilization.

Predisposing Characteristics. Approach to care was strongly predictive, with consistent regular attenders having the highest utilization, followed by inconsistent regular attenders and inconsistent problem-oriented attenders, with other covariates taken into account. Approach was significant for both races, although odds ratios were not statistically different between racial groups. Gender was salient in understanding utilization among both AAs and NHWs, although the effect magnitudes were not statistically different. Frustration with past dental care and propensity to use a homemade remedy both were statistically significant in the AA regression, although the effect magnitudes were not different between races.

Enabling Characteristics. Ability to pay was predictive for both AAs and NHWs. However, the odds ratios were significantly larger among NHWs, suggesting that ability to pay is more salient in distinguishing users from nonusers among NHWs. Dental insurance was salient among AAs, but not NHWs, and the effect magnitude was statistically different between racial groups.

Need Characteristics. A number of need variables were also explanatory. Toothache or abscess, as well as dental cavities, were significant in both AA and NHW regressions, although effect magnitudes were not statistically different between races. Loose tooth was salient among AAs, although the effect magnitude was not statistically different between races. Two need characteristics (broken tooth and satisfaction with dental appearance) were salient among NHWs; also, effect magnitudes were significantly larger among NHWs. Three variables (broken filling, oral disadvantage, perceived need) were salient in distinguishing NHW users from NHW nonusers, but effect magnitudes were not statistically different between races. Model fit in the AA regression was better than in the NHW regression.

DISCUSSION

Our finding that AAs were less likely to receive dental care has been a consistent finding in the literature on dental utilization (e.g., Manski and Magder 1998). Our current findings improved our understanding of why this could be the case, because we were able to go past the factors commonly

adjusted for in the literature to date (e.g., income, education, age). Although we have demonstrated that this sample had much in common with what would have been derived from a comparable national sample (Bloom, Gift, and Jack 1992; Gilbert, Duncan, Kulley, Coward, and Heft 1997), we remind the reader that generalization is with regard to the defined population of interest, and studies from other AA-NHW populations are advisable. We have discussed limitations of self-reported oral health measures elsewhere (Gilbert, Duncan, and Vogel 1998), and we glean no racial differences in these limitations.

The strategy to stratify analyses by race was indeed more elucidative, at both the bivariate and multivariate levels. Stratified analyses led to a better understanding of the prevalence and incidence of the predictors of dental utilization, to a better understanding of the distinction between prevalence of a factor and the race-specific magnitude of its effect, and to racial differences in the statistical significance and effect magnitude of predictors. We now discuss each of these in turn.

Hypothesis 1. Racial differences in approach to dental care (Table 1) were especially revealing. Note that 61 percent of AAs classified themselves at baseline as consistent problem-oriented attenders, compared to only 25 percent of NHWs. What has consistently emerged from Florida Dental Care Study findings to date has been the value of understanding participants' typical approach to dental care, which not only predicts subsequent dental utilization, but also is associated with dental disease, self-reported oral health problems, dental attitudes, dental self-care, dental self-extractions, and use of tobacco products (Gilbert et al. 1996; Gilbert, Duncan, Heft, and Coward 1997; Gilbert, Duncan, and Vogel 1998; Gilbert et al. 2000).

Racial differences in ability to pay an unexpected dental bill (Table 1) were also revealing. More than half of NHWs stated that they would be able to pay comfortably, compared to less than one-fourth of AAs. Income has consistently been identified as a predictor of dental utilization. Our race-specific analyses highlight the racial differences in this key predictor.

There were no statistically significant racial differences in prevalence of frustration with past dental care, propensity to use a homemade remedy, or presence of dental insurance (Table 1). However, these similar prevalences between races contrast with the substantively different effects on dental utilization that were evident between AAs and NHWs (Table 3).

Hypotheses 2 and 3. African Americans have a higher prevalence of oral diseases and certain self-reported measures of oral health, and a higher incidence of clinically determined disease (e.g., Hunt, Slade, and Strauss 1995; Davidson et al. 1996). In our report, although AAs and NHWs had a similar

incidence of broken fillings and satisfaction with dental appearance (Table 1), for the six other need variables, AAs had a significantly higher incidence. To our knowledge, this is the first report in the literature to have analyzed racial differences in incidence of these conditions. Although AAs had higher levels of need for dental care (Table 1), they were less likely to have sought care for that need (Table 2). Also note that when comparing results from Tables 2 and 3, even though several new dental problems were independently predictive of dental utilization among AAs (Table 3), less than half of AAs with these problems sought care in the same interval. Tables 2 and 3 also reveal a paradoxical circumstance for NHWs; although satisfaction with dental appearance was predictive of dental care utilization, persons least satisfied with appearance were actually less likely to seek care.

Hypothesis 4. Congruent with racial differences in typical approach to dental care, NHWs were much more likely to have sought care for preventive reasons, and this is consistent with existing reports (Dolan, Corey, and Freeman 1988; Aday and Forthofer 1992; Newman and Gift 1992; Ronis et al. 1998). Consistent with the results in Table 2 that linked new symptoms with dental utilization for any reason, AAs were more likely to have reported "loose tooth" as a reason for a visit, while NHWs were more likely to have reported "broken filling" or "broken tooth" as a reason. We are not aware of previous reports of racial differences in responsiveness to these symptoms with which to compare our findings. Development of loose teeth is generally a long-term, chronic, nonpainful process, while broken fillings and broken teeth typically occur as instantaneous, acute events that often are not painful. We speculate that we observed these racial differences in symptom responsiveness because AAs were more likely to require that a nonpainful process be chronic before acting on it, consistent with the fact that AAs were more likely as a group to be problem-oriented dental attenders.

Hypothesis 5. Several cross-sectional studies have examined dental utilization in racially diverse samples (e.g., Aday and Forthofer 1992; Newman and Gift 1992; Davidson and Andersen 1997; Manski and Magder 1998). A theoretical public health model of dental care (Grembowski, Andersen, and Chen 1989) posited that a complex array of structural, historical, and cognitive factors explain whether dental care is sought, but points out that there is little evidence on the relative importance of these factors in understanding the lower utilization among AAs. Our report is an effort to improve this understanding. Our expectation was that, although AAs use less dental care, the factors predictive of that use would be the same as those predictive for NHWs. The multivariable regression results largely

supported this expectation, and this is important in itself. Health promotion efforts designed to optimize dental utilization for AAs would have much in common with efforts designed exclusively for NHWs. However, the racial differences were also informative.

Supportive of our findings from baseline data (Gilbert, Duncan, Heft, and Coward 1997), attitudes toward dental care were predictive of longitudinal dental utilization. However, attitudes were not statistically significant in multiple regression modeling because they may exert an indirect effect on use through a direct effect on typical approach to care. These findings suggest that modifying dental attitudes may be a method to optimize use among AAs, provided that the importance of regular care is emphasized, instead of only responding to dental problems. An alternative explanation could be that prior attendance in fact shaped dental attitudes. Among NHWs, the finding that oral disadvantage due to oral disease/tissue damage (avoidance of laughing or smiling, avoidance of talking, or embarrassment due to dental appearance) is predictive of utilization, opens an intriguing possibility for oral health promotion. For NHW high-risk groups, such as NHW problem-oriented attenders, promoting dental esthetic improvements may provide a segue for promotion of oral "health."

The AA-only regression (Table 3) suggests that frustration with past care is a salient predictor of use among AAs. Note that it is necessary to distinguish whether a variable is a statistically significant predictor within each race (in this case, frustration is statistically significant among AAs), from whether or not the odds ratios are statistically different between AAs and NHWs (the race interaction term for "frustration" is not statistically significant, meaning that we cannot state that the odds of 0.4 for AAs is really different from the 0.9 among NHWs). Finding that frustration is salient among AAs is consistent with our baseline finding that AAs rated the quality of their dental care lower than did NHWs (Gilbert, Duncan, Heft, and Coward 1997). To our knowledge, the role of frustration with past care among AAs is new to the dental utilization literature. This parallels studies in other health care contexts in which it has been hypothesized that racial differences in quality of care or racial bias in health care at least partly account for racial disparities in health (King 1996; Fiscella et al. 2000; Mofidi, Rozier, and King 2002). For other AAs, underutilization may result from a reasonable decision-making process in response to perceived lack of long-term benefit, based upon family or group norms, or upon previous experience with dental care. An understanding of what benefits, or lack thereof, AAs perceive as being derived from dental care may provide a key link in understanding why some

AAs underutilize care or receive services that presumably do not provide the most long-term benefit.

The AA-only regression (Table 3) also suggests that a propensity to use a homemade remedy to treat toothache pain is a significant consideration among AAs, even once differences in typical approach to care have been taken into account. To our knowledge, this is also new to the literature on dental utilization. This finding underscores the potential for effecting improvements in utilization through an emphasis on preventive orientation, even once differences in approach to care, insurance, and ability to pay have been taken into account.

Our expectation was that if racial differences in the effect of ability to pay on dental utilization were evident, then this factor would be more significant among AAs. In fact, the opposite was observed. Although ability to pay was important for both races, it better distinguished NHW users from NHW nonusers than it did AAs (Table 3). The AA-only regression (Table 3) also suggests that dental insurance is a more salient consideration among AAs than among NHWs, even after adjusting for differences in approach to care and ability to pay. Ability to pay was significantly associated with dental insurance coverage (e.g., 48 percent of persons "able to pay" reported dental insurance, compared to only 15 percent for those who said "not able to pay"), but this association was not different between the races. A total of 61 percent of those with dental insurance had insurance because of an employer-based private plan, and this did not differ by race. Like most states, in Florida Medicaid only pays for adult dental care in unusual circumstances. In a subsequent analysis, we repeated the regressions in Table 3, except that we coded insurance by coverage type. Among AAs, dental insurance was a significant predictor if that insurance was a private insurance plan. If the insurance was Medicaid, Veterans Affairs, or some "other" type, insurance status was not a significant predictor. Bivariate results from the 1989 National Health Interview Study showed that lack of dental insurance coverage had the largest effect on AAs who made three or more visits in the previous year, with the insured group having almost twice the proportion with three or more visits as the uninsured group (Isman and Isman 1997). The Rand Health Insurance Experiment did include a dental insurance component, finding that increasing levels of dental insurance led to increasing dental utilization, but race-specific analyses were not reported (Manning et al. 1985).

Taken as a whole, this study suggests that: (1) The AAs are more likely to be problem-oriented attenders, to be unable to pay an unexpected \$500 dental bill, and to have dental problems; (2) although AAs reported higher levels of

need for dental care, they were less likely to have sought dental care; (3) The NHWs were much more likely to have sought care for preventive reasons; (4) frustration with past dental care, propensity to use a homemade remedy, and dental insurance were salient predictors of use among AAs, but not among NHWs, with other covariates taken into account; (5) although NHWs reported a greater ability to pay for dental care, ability to pay actually had a stronger effect on dental utilization among NHWs than it did among AAs; (6) The NHWs were more responsive to a broken tooth and satisfaction with dental appearance than AAs, and broken fillings and oral disadvantage were salient predictors among NHWs, but not among AAs; and (7) although fewer predictors were statistically significant in the AA model, ability to explain utilization was better for AAs, judging from a better regression model fit.

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REFERENCES

- Aday, L. A., and R. N. Forthofer. 1992. "A Profile of Black and Hispanic Subgroups' Access to Dental Care: Findings from the National Health Interview Survey." *Journal of Public Health Dentistry* 52 (4): 210-15.
- Andersen, R., and J. F. Newman. 1973. "Societal and Individual Determinants of Medical Care Utilization in the United States." *Milbank Quarterly* 51 (1): 95-124.
- Andersen, R. M. 1995. "Revisiting the Behavioral Model and Access to Medical Care: Does It Matter?" *Journal of Health and Social Behavior* 36 (1): 1-10.
- Bloom, B., H. C. Gift, and S. S. Jack. 1992. "Dental Services and Oral Health: United States, 1989." National Center for Health Statistics *Vital and Health Statistics Series* 10 (183), Table 5, p. 31.
- Braden, B. R., C. A. Cowan, H. C. Lazenby, A. B. Martin, P. A. McDonnell, A. L. Sensenig, J. M. Stiller, L. S. Whittle, C. S. Donham, A. M. Long, and M. W. Stewart. 1998. "National Health Expenditures, 1997." *Health Care Financing Review* 20 (1): 83-126.
- Davidson, P. L., and R. M. Andersen. 1997. "Determinants of Dental Care Utilization for Diverse Ethnic and Age Groups." *Advances in Dental Research* 11 (2): 254-62.
- Davidson, P. L., R. M. Andersen, M. Marcus, K. A. Atchison, N. Reifel, T. Nakazono, and H. Rana. 1996. "Indicators of Oral Health in Diverse Ethnic and Age

- Groups: Findings from the International Collaborative Study of Oral Health Outcomes (ICS-II) USA Research Locations." *Journal of Medical Systems* 20 (5): 295-316.
- Dolan, T. A., C. R. Corey, and H. E. Freeman. 1988. "Older Americans' Access to Oral Health Care." *Journal of Dental Education* 2 (11): 637-42.
- Fiscella, K., P. Franks, M. R. Gold, and C. M. Clancy. 2000. "Inequality in Quality: Addressing Socioeconomic, Racial, and Ethnic Disparities in Health Care." *Journal of the American Medical Association* 283 (19): 2579-84.
- Gilbert, G. H., D. E. Antonson, I. A. Mjör, M. L. Ringelberg, T. A. Dolan, U. Foerster, M. W. Heft, and R. P. Duncan. 1996. "Coronal Caries, Root Fragments, and Restoration and Cusp Fractures in U.S. Adults." *Caries Research* 30 (2): 101-11.
- Gilbert, G. H., R. P. Duncan, and J. L. Earls. 1998. "Taking Dental Self-care to the Extreme: Dental Self-extractions in the Florida Dental Care Study." *Journal of Public Health Dentistry* 58 (2): 131-4.
- Gilbert, G. H., R. P. Duncan, M. W. Heft, and R. T. Coward. 1997. "Dental Health Attitudes among Dentate Black and White Adults." *Medical Care* 35 (3): 255-71.
- Gilbert, G. H., R. P. Duncan, M. W. Heft, T. A. Dolan, and W. B. Vogel. 1997. "Oral Disadvantage among Dentate Adults." *Community Dentistry and Oral Epidemiology* 25 (4): 301-13.
- . 1998. "Multi-dimensionality of Oral Health in Dentate Adults." *Medical Care* 36 (7): 988-1001.
- Gilbert, G. H., R. P. Duncan, A. M. Kulley, R. T. Coward, and M. W. Heft. 1997. "Evaluation of Bias and Logistics in a Survey of Adults at Increased Risk for Oral Health Decrements." *Journal of Public Health Dentistry* 57 (1): 48-58.
- Gilbert, G. H., R. P. Duncan, and W. B. Vogel. 1998. "Determinants of Dental Care Use in Dentate Adults: Six-Monthly Use during a 24-Month Period in the Florida Dental Care Study." *Social Science and Medicine* 47 (6): 727-37.
- Gilbert, G. H., M. K. Miller, R. P. Duncan, M. L. Ringelberg, T. A. Dolan, and U. Foerster. 1999. "Tooth-Specific and Person-Level Predictors of 24-Month Tooth Loss among Older Adults." *Community Dentistry and Oral Epidemiology* 27 (5): 372-85.
- Gilbert, G. H., E. P. Stoller, R. P. Duncan, J. L. Earls, and A. M. Campbell. 2000. "Dental Self-care among Dentate Adults: Contrasting Problem-Oriented Dental Attenders with Regular Dental Attenders." *Special Care in Dentistry* 20 (4): 155-63.
- Grembowski, D., R. M. Andersen, and M. -S. Chen. 1989. "A Public Health Model of the Dental Care Process." *Medical Care Review* 46 (4): 439-96.
- Hunt, R. J., G. D. Slade, and R. P. Strauss. 1995. "Differences between Racial Groups in the Impact of Oral Disorders among Older Adults in North Carolina." *Journal of Public Health Dentistry* 55 (4): 205-9.
- Isman, R., and B. Isman. 1997. *Oral Health America White Paper: Access to Oral Health Services in the United States, 1997 and Beyond*. Chicago: Oral Health America, America's Fund for Dental Health.
- King, G. 1996. "Institutional Racism and the Medical/Health Complex: A Conceptual Analysis." *Ethnicity and Disease* 6 (1-2): 30-46.

- Manning, W. G., H. L. Bailit, B. Benjamin, and J. P. Newhouse. 1985. "The Demand for Dental Care: Evidence from a Randomized Trial in Health Insurance." *Journal of the American Dental Association* 110 (6): 895–902.
- Manski, R. J., and L. S. Magder. 1998. "Demographic and Socioeconomic Predictors of Dental Care Utilization." *Journal of the American Dental Association* 129 (2): 195–200.
- Mayberry, R. M., F. Mili, and E. Ofili. 2000. "Racial and Ethnic Differences in Access to Medical Care." *Medical Care Research and Review* 57 (1, supplement): 108–45.
- Mofidi, M., R. G. Rozier, and R. S. King. 2002. "Problems with Access to Dental Care for Medicaid-Insured Children: What Caregivers Think." *American Journal of Public Health* 92 (1): 53–8.
- Newman, J. F., and H. C. Gift. 1992. "Regular Pattern of Preventive Dental Services—A Measure of Access." *Social Science and Medicine* 35 (8): 997–1001.
- Ronis, D. L., W. P. Lang, C. L. Antonakos, and W. S. Borgnakke. 1998. "Preventive Oral Health Behaviors among African-Americans and Whites in Detroit." *Journal of Public Health Dentistry* 58 (3): 234–40.
- SAS Institute, Inc. 2000. *SAS/STAT user's guide*. Version 8.0. Cary, NC: SAS Institute, Inc.
- U.S. Department of Health and Human Services. 2000. *Oral Health in America: A Report of the Surgeon General*. Rockville, MD: National Institutes of Health. (Available at <http://www.nidcr.nih.gov/sgr/execsumm.htm>).
- U.S. Bureau of the Census. 1992. *Census of Population and Housing, 1990*. Public Use Microdata Samples, U.S. Technical Documentation. Washington, DC: U.S. Bureau of the Census.
- Wolinsky, F. D. 1982. "Racial Differences in Illness Behavior." *Journal of Community Health* 8 (2): 87–101.