



Project
MUSE[®]
Scholarly journals online

Differences in Quality between Dental Practices Associated with Race and Income Mix of Patients

Gregg H. Gilbert, DDS, MBA

Mark S. Litaker, PhD

Sonia K. Makhija, DDS, MPH

Abstract: We recently demonstrated with the Florida Dental Care Study (FDCCS) that the racial mix of the dental practice attended was significantly associated with patient-specific service receipt and health outcome. Therefore, our objective here was to determine if African Americans and lower-income people attended dental practices with characteristics systematically different from the practices attended by their counterparts. The FDCCS was a prospective cohort study of 873 people at baseline who were followed for 48 months. Participants' dentists were asked to complete questionnaires about their practices. Significant racial and income differences were evident in dentists' reports of payment mix, characteristics of typical patients, types of procedures typically done, typical fees, practice busyness, waiting room times, and delays to get an appointment. Systematic differences in the dental practices attended were evident, as a function of the person's race and income, differences that are associated with social disparities in oral health.

Key words: Practice characteristics, health disparities, dental care, race, socioeconomic status.

Racial and socioeconomic status (SES) disparities in health have now been widely documented, with significantly poorer health being evident among non-Hispanic African Americans than among non-Hispanic Whites.^{1,2} The numerous possible reasons for these social disparities include differences in quality of health care and the types of health care practices attended.³⁻⁷

The role of dental practice characteristics in social disparities in oral health and dental care use has received little investigation. A major advantage of the study in this report, the Florida Dental Care Study (FDCCS), is that it provides multi-level data (specifically, at the level of individual teeth, patients, and dental practices). We have demonstrated using FDCCS data that African Americans and lower-income people, compared with their non-Hispanic White and higher-income counterparts, had lower rates of dental care incidence during follow-up, were less likely to have received complex diagnostic

GREGG GILBERT is Professor and Chair in the Department of Diagnostic Sciences, School of Dentistry, University of Alabama at Birmingham, where **MARK LITAKER** is an Associate Professor and Director of Biostatistics and **SONIA MAKHIJA** is an Assistant Professor. Address all correspondence to Dr. Gregg H. Gilbert, Professor and Chair, Department of Diagnostic Sciences, UAB School of Dentistry, SDB Room 109, 1530 3rd Avenue South, Birmingham, AL 35294-0007; (205) 934-5423; ghg@uab.edu.

and treatment services if they did enter the dental care system, and had worse oral health-related quality of life.⁹⁻¹⁴ Recent FDCC work provided the literature's first report that certain dental practice characteristics make independent contributions to racial differences in both service receipt¹⁵ and dental health outcome.¹⁶ One of these practice characteristics was the racial mix of the practice's patient population. This effect was independent of the individual patient's race, clinical circumstance, and SES, although these individual characteristics also contributed independent effects to service receipt and health outcome.

Because African Americans and lower-SES people in the FDCC also reported at baseline that they had low-quality dental care¹⁷ and reported during follow-up a low likelihood of having had dentists discuss treatment alternatives with them,¹⁰ we hypothesized that there were systematic differences in the characteristics of the dental practices attended by these groups. Therefore, our objective for this report was to test the hypothesis that African Americans and lower-SES people attend dental practices that have significantly different characteristics than those attended by their non-Hispanic White and higher-SES counterparts, characteristics that are associated with a lower quality of care.

Methods

Sampling methods. Florida Dental Care Study sampling methodology details are provided elsewhere.¹⁸ Briefly, the 873 baseline subjects constituted a representative sample of people 45 years old or older who had a telephone, did not reside in an institutional setting, resided in one of four counties in north Florida, could engage in a coherent telephone conversation, and had at least one tooth (one objective was to investigate tooth loss). Race and ethnicity were established separately; only non-Hispanic African Americans and non-Hispanic Whites were included. Four counties in north Florida were selected because they provided an urban/rural contrast, have large percentages of African Americans, older adults, and poor individuals, because they were geographically proximate, and near the administrative base for the project. Less than 2% of people in the counties sampled considered themselves to be of Hispanic heritage.

At baseline, the sample's *interval since last dental visit* was very similar to that found in National Health Interview Survey (NHIS) data; conclusions about determinants of that interval were the same. Also, the percentage that had at least one dental visit in the first two years (77%) was very similar to the figure (75%) among comparable NHIS respondents.^{18,19}

The study began with 873 participants and by 48 months 85% (weighted $n=743$; un-weighted $n=714$) remained. The issues of sampling weights and bias due to attrition have been addressed in detail in previous reports.^{18,20-21} Briefly, however, as an example of its typical magnitude, 47% of baseline participants had been to a dentist in the previous 6 months. If the baseline had only included people who ultimately participated for the 48-month interview, that figure would have been 49%.

Interviews and examinations of participants. An in-person interview and clinical dental examination of participants were conducted at baseline. This was followed by telephone interviews at 6, 12, 18, 30, 36, and 42 months. At 24 and 48 months,

the interview was conducted in person and was followed immediately by the clinical examination. Questionnaire content and test-retest reliability of questions have been described previously,^{17,20,22} although for the sake of clarity the wording of some items is reported here. Briefly, in addition to the race and ethnicity questions alluded to in the *Sampling methods* section, a key question of interest for this report was household income. Household income was queried by asking at baseline, "Would you say that your household's total annual income before taxes is under or over \$20,000?" (People at the \$20,000 level were grouped with people in the over-\$20,000 category.)

Of the 718 (weighted *n*) participants who reported having had at least one dental visit during the first 48 months of the study (and for whom a dental record search was therefore applicable), we located complete chart data on 623 (weighted *n*); 513 (weighted *n*) of these had dentists who completed a practice characteristics questionnaire. These included 414 non-Hispanic Whites and 99 African Americans, 182 people in the low-income category (less than \$20,000 yearly income) and 315 people in the high-income category (17 people did not answer the household income question).

Practice characteristics questionnaires completed by dentists who treated these participants. Participants were asked for permission to review their dental records, and their dentists were asked for permission to abstract treatment record information.²³ Of the 297 dentists in 286 practices named by subjects through the first 48 months, all but 10 practices participated for chart abstraction. There were 32 group practices: 25 with 2 dentists each, 6 with 3 dentists, and 1 with 5 dentists. Thirty-one dentists reported working at multiple practices; 28 worked at 2 practices and 3 worked at 3 practices. Because the current report is limited to questionnaire items asked of FDACS participants and their dentists, we provide no further detail here regarding abstraction of treatment records.

All dentists who treated at least one FDACS participant were asked to complete an 11-page questionnaire about the characteristics of their practice(s). A total of 204 dentists from the 286 dental practices did so. The questionnaire probed items listed in Box 1. Practice characteristics were structured into 4 domains (practice setting, patient population, dental procedure characteristics, dentist individual characteristics). Practice characteristics questionnaire test-retest reliability estimates were done with 10 dental faculty in Faculty Practice at the University of Florida and 10 dentists in private practice outside of the 4-county FDACS area. Depending upon the measurement scale, kappa values exceeded .70 and intra-class correlation coefficients exceeded .83 for all items. Complete wording of all questionnaire items can be viewed at the Internet site listed in the Acknowledgments section.

This information on practice characteristics was taken from the questionnaires completed by the dentists who coincidentally were the dental care providers of at least one FDACS participant. This information on practice characteristics was then linked to information on the FDACS participants whom they coincidentally treated, resulting in a merged data set of information about each FDACS participant and the characteristics of the dental practice(s) that they attended during 48 months of follow-up. If a FDACS participant attended more than one practice, a mean value for all practices attended was used to represent the value of the characteristic to which the FDACS participant was exposed.

Box 1.

DENTAL PRACTICE CHARACTERISTICS TESTED FOR THEIR ASSOCIATION WITH RACE AND INCOME OF THE FDCS PARTICIPANT

Practice setting	Patient population	Dental procedure characteristics	Dentist individual characteristics
Number of different general practices attended during follow-up ^a	Dental insurance coverage	Percent of extracted teeth that are replaced by specified treatment options (5 total) ^d	Year of graduation from dental school
Number of different specialty practices attended during follow-up ^a	Practice charges by payment source	Number patients each month receiving or referred for dental extractions	Agreement with beliefs about treatment options (5 total) ^f
Practice busyness ^b	Percent of patients on extended payment schedules	Percent time each day doing specified procedure categories (7 total) ^e	
Waiting time for new patient exam	Percent of patients who have certain characteristics (12 total) ^c		
Waiting time for restorative dentistry appointment	Age distribution		
Waiting time after arriving in waiting room	Racial/ethnic distribution		

(Continued on p. 851)

Box 1 (continued).

Practice setting	Patient population	Dental procedure characteristics	Dentist individual characteristics
Percent of visits due to unscheduled care Number of patient visits each week Hours in patient care each week Number of dental chairs regularly used Number of full-time staff Number of part-time staff			

^aAlthough this variable can also be conceptualized as a patient-specific characteristic, we have operationalized it herein as a measure of practice setting because it also reflects exposure to different sets of practice characteristics.

^b1 = Too busy to treat all people requesting appointments; 2 = Provided care to all who requested appointments, but the practice was overburdened; 3 = Provided care to all who requested appointments, and the practice was not overburdened; 4 = Not busy enough – the practice could have treated more patients.

^cPercent of patients you see who: Seek care soon enough; Fear dentists; Complain about waiting; Pay their bills; Follow advice about oral hygiene; Show for appointments as scheduled; Take responsibility for their oral health; Treat me with the respect that I deserve; Want to know details about the condition of their mouth; Want to know details about their treatment options; Use credit cards to pay for their dental treatment in my practice.

^dFor extractions that you do or recommend, other than wisdom teeth, deciduous teeth, or for orthodontic reasons, what percent are replaced eventually by a: Fixed bridge; Removable partial or full denture; Dental implant; Not replaced; Other.

^ePercent of patient contact time that you spend in a typical month performing the following procedures: Non-implant restorative dentistry (fillings, etc.); Implants (either implant surgery or time spent with implant placement); Removable prosthetics (dentures); Dental extractions; Periodontal therapy (either time spent doing surgery or with non-surgical procedures); Endodontic therapy (root canals, etc.); Other (preventive and diagnostic).

^fPatients should seek second opinions; Patients are better off not knowing all the facts about their oral problems; Dentists should present all treatment options to patients; If a patient opposes the dentist's recommended treatment, the dentist should try to convince the patient to accept it; If a patient does not accept the dentist's recommended treatment, the patient should be dismissed from the practice. (1 = very strongly disagree; 2 = strongly disagree; 3 = somewhat disagree; 4 = somewhat agree; 5 = strongly agree; 6 = very strongly agree).

Statistical methods. Results were weighted using sampling proportions to reflect the population of interest, using a method that minimized the variance inflation resulting from sample design effects.¹⁸ The only instance where un-weighted numbers are used in this paper is for calculating attrition rates. All analyses were done using SAS[®].²⁴ Means and standard errors and statistical tests of differences in means in Table 1 were calculated using the SAS[®] General Linear Model procedure. Least-squares means and standard errors are reported in order to account for differences in sample size between sub-groups and to adjust for covariates. Multi-collinearity was assessed using the method of Belsley and colleagues;²⁵ no multi-collinearity was observed.

Results

Table 1 shows the least-squares means and standard errors of characteristics of the dental practices attended by FDCS participants, by the participant's race and income.

Practice setting. Race was associated with 5 of the 10 measures of practice setting (Table 1). Practices attended by African American FDCS participants reported being busier, had longer delays in getting a restorative dentistry appointment, had longer waiting times in the waiting room, and had more patient visits each week than did practices attended by non-Hispanic White FDCS participants. This was despite the fact that practices attended by African American FDCS participants had significantly fewer patient contact hours.

Low-income FDCS participants attended practices that had longer waiting times in the waiting room and a larger percentage of patients visits that were due to unscheduled care than did the practices attended by higher-income FDCS participants (Table 1). Additionally, an analysis was conducted of the number of general practices attended and the number of specialty practices attended. There were no statistically significant differences in number of practices attended by race and/or income.

Patient population. Race was associated with 13 of the 30 measures of patient population (Table 1). Practices attended by African American FDCS participants reported having fewer patients covered by a private insurance program and more covered by a public program, fewer practice charges that were derived from dental insurance and more from *other* sources.* Practices attended more commonly by African American FDCS participants, in comparison with other practices, reported having lower percentages of patients who seek care soon enough, pay their bills, follow advice about dental hygiene, show for appointments as scheduled, take responsibility for their oral health, and treat dentists with the respect they deserve, and fewer patients who are non-Hispanic White. Practices attended by African American FDCS participants reported having higher percentages of patients who fear dentists and more patients who are African American than did practices attended by non-Hispanic Whites.

*Of course, practices could be attended by both African Americans and non-Hispanic Whites. What is being compared is the characteristics of the practices attended more commonly by African Americans to the characteristics of the practices attended more commonly by non-Hispanic Whites, understanding that there is some overlap of practices.

Income was associated with 6 of the 30 measures of patient population (Table 1). Practices attended by lower-SES FDCS participants reported having fewer patients covered by a private insurance program and more covered by a public program, more patients who are not covered by any third party, and more patients who are African American and of *other ethnicity* than did practices attended by higher-SES FDCS participants. Race by income interactions were significant for 6 of the measures of patient population. Race by income interactions were significant for 6 patient population characteristics.

Dental procedure characteristics. Race was associated with 22 of the 42 measures of dental procedure characteristics (Table 1). Practices attended by African American FDCS participants reported having fewer patients whose dental extractions were eventually replaced by a fixed bridge or dental implant, and more patients who never got a replacement of any type or for which the tooth was replaced by a removable denture. Practices more commonly attended by African American FDCS participants (1) did more dental extractions each month, and (2) had dentists who spent more patient contact time doing dental extractions and removable prosthetics, and less time doing non-implant restorative dentistry, than practices attended more commonly by non-Hispanic Whites. Race was significantly related to each measure of typical fee. African American FDCS participants were more likely than non-Hispanic White FDCS participants to have attended practices that referred prosthetic crown procedures to other dentists, but were also more likely to have attended practices that were significantly less likely to refer anterior root canals, non-surgical extractions, and surgical extractions. African American FDCS participants were less likely than non-Hispanic White FDCS participants to attend practices that had high percentages of patients who received oral hygiene instruction, fluoride gel/rinse prescribed or recommended, patient education from written pamphlets, and who had intraoral video images taken.

Income was associated with 6 of the 30 measures of dental procedure characteristics (Table 1). In comparison with practices attended by higher-SES FDCS participants, practices attended by lower-SES FDCS participants reported having fewer patients whose dental extractions were eventually replaced by a fixed bridge, and more patients who never got a replacement of any type or for which the tooth was placed by a removable denture. Lower-SES people also attended practices that did more dental extractions each month, but less oral hygiene instruction. Race by income interactions were significant for 3 measures of dental procedure characteristics.

Dentist individual characteristics. Race was associated with only one dentist individual characteristic; specifically, African American FDCS participants were more likely to attend practices where the dentist believes that patients are better off not knowing all the facts about their oral problems (Table 1). Socioeconomic status of the FDCS participant was not associated with any of the measures of dentist individual characteristics (Table 1).

Table 1.

LEAST-SQUARES MEANS AND 95% CONFIDENCE INTERVALS OF CHARACTERISTICS OF DENTAL PRACTICE(S) ATTENDED BY FDCS PARTICIPANTS DURING FOLLOW-UP, BY RACE AND HOUSEHOLD INCOME OF THE FDCS PARTICIPANT

Dental practice characteristic	AA low income	NHW low income	AA high income	NHW high income	Statistically significant comparisons
Practice setting					
Practice busyness rating	1.99 (1.74, 2.24)	2.19 (2.01, 2.37)	2.06 (1.75, 2.37)	2.43 (2.31, 2.55)	race (p=.013)
<i>Typical time a patient has to wait . . .</i>					
for a new patient exam appointment (in days)	26.22 (19.32, 33.12)	20.78 (16.15, 25.41)	24.43 (15.83, 33.03)	17.55 (14.43, 20.67)	—
for a restorative dentistry appt (in days)	21.74 (16.17, 27.31)	17.29 (13.55, 21.03)	26.24 (19.30, 33.18)	14.93 (12.40, 17.46)	race (p=.002)
in waiting room (in minutes)	17.35 (14.96, 19.74)	13.43 (11.82, 15.04)	15.01 (12.03, 17.99)	10.80 (9.72, 11.88)	race (p=.001), income (p=.024)
Percent of visits in practice due to unscheduled care	10.41 (7.82, 13.00)	10.79 (9.05, 12.53)	8.15 (4.92, 11.38)	8.32 (7.14, 9.50)	income (p=.046)
Number of patient visits each week done by dentist	63.40 (55.87, 70.93)	56.69 (51.63, 61.75)	63.01 (53.64, 72.38)	54.25 (50.86, 57.64)	race (p=.025)
Number of hours each week in direct patient care	30.29 (28.39, 32.19)	32.19 (30.92, 33.46)	29.41 (26.98, 31.84)	32.71 (31.85, 33.57)	race (p=.003)
Number of dental chairs regularly used	5.39 (4.63, 6.15)	4.78 (4.27, 5.29)	4.95 (4.01, 5.89)	4.30 (3.97, 4.63)	—
Number of full-time staff	3.51 (2.98, 4.04)	3.82 (3.47, 4.17)	3.70 (3.03, 4.37)	3.88 (3.64, 4.12)	—

(Continued on p. 855)

Table 1 (continued).

Dental practice characteristic	AA low income	NHW low income	AA high income	NHW high income	Statistically significant comparisons
Number of part-time staff	2.25 (1.88, 2.62)	2.01 (1.76, 2.26)	2.17 (1.72, 2.62)	1.80 (1.64, 1.96)	—
Patient population					
<i>Percent of patients who are . . .</i>					
covered by a private insurance program	40.62 (34.86, 46.38)	48.32 (44.46, 52.18)	43.80 (36.63, 50.97)	56.29 (53.68, 58.90)	race (p=.001), income (p=.035)
covered by a public program	17.87 (14.52, 21.22)	11.08 (8.20, 13.96)	13.13 (8.96, 17.30)	8.23 (6.72, 9.74)	race (p=.001), income (p=.014)
not covered by any third party, pay own bills	39.26 (33.62, 44.90)	37.28 (33.50, 41.06)	32.64 (25.62, 39.66)	33.59 (31.04, 36.14)	income (p=.046)
not covered, receive free or reduced-free care	1.94 (.45, 3.43)	2.71 (1.71, 3.71)	5.28 (3.44, 7.12)	1.86 (1.19, 2.53)	race*income (p=.002)
<i>Percent of practice charges derived from . . .</i>					
dental insurance	49.11 (43.78, 54.44)	50.69 (47.12, 54.26)	44.32 (37.70, 50.94)	52.77 (50.38, 55.16)	race (p=.040)
self-pay	42.34 (36.99, 47.69)	41.90 (38.31, 45.49)	39.88 (33.22, 46.54)	41.15 (38.74, 43.56)	—
unpaid bills	4.80 (3.27, 6.33)	4.60 (3.58, 5.62)	6.21 (4.31, 8.11)	4.46 (3.77, 5.15)	—
other	3.12 (1.47, 4.77)	2.21 (1.11, 3.31)	3.56 (1.50, 5.62)	.98 (.24, 1.72)	race (p=.021)

(Continued on p. 856)

Table 1 (continued).

Dental practice characteristic	AA low income	NHW low income	AA high income	NHW high income	Statistically significant comparisons
Percent of patients on extended payment schedules	13.40 (7.48, 19.32)	12.96 (8.98, 16.94)	9.78 (2.41, 17.15)	16.15 (13.46, 18.84)	—
<i>Percent of patients who . . .</i>					
seek care soon enough	47.69 (42.28, 53.10)	56.05 (52.42, 59.68)	45.49 (38.55, 52.43)	65.37 (62.92, 67.82)	race (p=.001), race*income (p=.022)
fear dentists	39.16 (31.73, 46.59)	38.34 (33.38, 43.30)	53.92 (44.71, 63.13)	33.55 (30.22, 36.88)	race (p=.001), race*income (p=.004)
visit dentists more often than necessary	3.49 (2.24, 4.74)	3.42 (2.58, 4.26)	2.09 (.54, 3.64)	4.01 (3.44, 4.58)	—
complain about waiting	7.66 (4.52, 10.80)	6.42 (4.30, 8.54)	8.04 (4.12, 11.96)	4.61 (3.18, 6.04)	—
pay their bills	83.29 (76.53, 90.05)	84.21 (79.68, 88.74)	74.78 (66.35, 83.21)	87.31 (84.27, 90.35)	race (p=.030)
follow advice about dental hygiene	46.84 (40.74, 52.92)	52.42 (48.30, 56.54)	47.30 (39.71, 54.89)	57.35 (54.59, 60.11)	race (p=.005)
show for appointments as scheduled	84.87 (82.40, 87.34)	85.12 (83.47, 86.77)	78.84 (75.78, 81.90)	86.67 (85.55, 87.79)	race (p=.001), race*income (p=.001)
take responsibility for their oral health	59.11 (53.41, 64.81)	64.29 (60.45, 68.13)	56.35 (49.24, 63.46)	71.54 (68.93, 74.15)	race (p=.001)

(Continued on p. 857)

Table 1 (continued).

Dental practice characteristic	AA low income	NHW low income	AA high income	NHW high income	Statistically significant comparisons
treat me with the respect that I deserve	81.80 (75.08, 88.52)	84.33 (79.82, 88.84)	73.41 (65.04, 81.78)	89.08 (86.06, 92.10)	race (p=.003), race*income (p=.033)
want to know details about condition of their mouths	65.04 (57.63, 72.45)	68.03 (63.05, 73.01)	61.19 (51.96, 70.42)	71.10 (67.77, 74.43)	—
want to know details about treatment options	71.72 (65.21, 78.23)	72.96 (68.59, 77.33)	69.66 (61.02, 78.30)	74.43 (71.49, 77.37)	—
use credit cards to pay for their treatment	15.27 (11.59, 18.95)	16.79 (14.32, 19.26)	16.70 (12.11, 21.29)	21.61 (19.92, 23.30)	—
<i>Percent of patients who are . . .</i>					
1–18 years old	15.67 (13.73, 17.61)	15.65 (14.36, 16.94)	15.47 (12.98, 17.96)	13.95 (13.07, 14.83)	—
19–44 years old	29.39 (26.82, 31.96)	29.36 (27.64, 31.08)	27.69 (24.40, 30.98)	30.50 (29.34, 31.66)	—
45–64 years old	35.90 (33.16, 38.64)	34.55 (32.71, 36.39)	35.68 (32.17, 39.19)	35.96 (34.73, 37.19)	—
65 years old or older	19.04 (16.49, 21.59)	19.83 (18.12, 21.54)	16.66 (13.39, 19.93)	19.48 (18.32, 20.64)	—
<i>Percent of patients who are . . .</i>					
non-Hispanic White	51.52 (47.07, 55.97)	61.92 (58.94, 64.90)	49.79 (44.05, 55.53)	70.02 (68.00, 72.04)	race (p=.001), race*income (p=.018)
non-Hispanic Black	43.49 (39.28, 47.70)	31.79 (28.97, 34.61)	40.14 (34.69, 45.59)	23.67 (21.75, 25.59)	race (p=.001), income (p=.004)

(Continued on p. 858)

Table 1 (continued).

Dental practice characteristic	AA low income	NHW low income	AA high income	NHW high income	Statistically significant comparisons
Hispanic	3.25 (2.11, 4.39)	3.39 (2.63, 4.15)	3.31 (1.84, 4.78)	3.78 (3.27, 4.29)	—
of Asian descent	1.67 (.91, 2.43)	2.13 (1.62, 2.64)	1.60 (.62, 2.58)	2.25 (1.90, 2.60)	—
of other ethnicity	.07 (-.26, .40)	.16 (-.06, .38)	.56 (.13, .99)	.35 (.19, .51)	income (p=.030)
Dental procedure characteristics					
For dental extractions . . . what percent are replaced eventually by . . .					
fixed bridge	15.74 (9.84, 21.64)	24.72 (20.76, 28.68)	18.23 (10.90, 25.56)	38.41 (35.74, 41.08)	race (p=.001), income (p=.003)
removable partial or full denture	38.39 (33.88, 42.90)	32.44 (29.40, 35.48)	34.11 (28.48, 39.74)	27.78 (25.74, 29.82)	race (p=.003), income (p=.031)
dental implant	1.07 (-1.05, 3.19)	3.64 (2.21, 5.07)	.92 (-1.73, 3.57)	4.84 (3.88, 5.80)	race (p=.001)
not replaced	43.83 (38.24, 49.42)	38.40 (34.66, 42.14)	42.29 (35.35, 49.23)	28.67 (26.14, 31.20)	race (p=.003), income (p=.028)
other	.07 (-.05, .19)	.08 (.00, .16)	.18 (.02, .34)	.02 (-.04, .08)	—
Number dental extraction patients each month	32.75 (27.07, 38.43)	28.17 (24.43, 31.91)	26.96 (19.98, 33.94)	21.20 (18.73, 23.67)	race (p=.045), income (p=.013)

(Continued on p. 859)

Table 1 (continued).

Dental practice characteristic	AA low income	NHW low income	AA high income	NHW high income	Statistically significant comparisons
<i>Percent patient contact time dentist spends doing . . .</i>					
non-implant restorative dentistry	45.96 (40.18, 51.74)	52.96 (49.08, 56.84)	46.40 (39.21, 53.59)	61.20 (58.59, 63.81)	race (p=.001)
dental implants (surgery or prosthetic time)	.71 (-.45, 1.87)	1.06 (.28, 1.84)	.43 (-1.02, 1.88)	2.07 (1.54, 2.60)	—
removable prosthetics	18.48 (14.32, 22.64)	13.97 (11.19, 16.75)	16.44 (11.27, 21.61)	9.28 (7.42, 11.14)	race (p=.002)
dental extractions	12.68 (10.72, 14.64)	10.43 (9.12, 11.74)	11.93 (9.48, 14.38)	8.07 (7.19, 8.95)	race (p=.001)
periodontal therapy (surgical and non-surgical)	4.04 (2.67, 5.41)	3.63 (2.71, 4.55)	4.39 (2.68, 6.10)	3.44 (2.83, 4.05)	—
endodontic (surgical and non-surgical)	7.64 (5.66, 9.62)	7.61 (6.30, 8.92)	7.92 (5.47, 10.37)	7.18 (6.30, 8.06)	—
other (preventive and diagnostic)	9.66 (7.41, 11.91)	9.65 (8.14, 11.16)	8.28 (5.48, 11.08)	8.74 (7.72, 9.76)	—
<i>Typical fee for a . . .</i>					
2-surface amalgam	56.15 (49.62, 62.68)	65.19 (60.90, 69.48)	59.05 (51.03, 67.07)	68.85 (65.91, 71.79)	race (p=.002)
3-canal molar root canal	315.04 (262.51, 367.57)	381.49 (344.27, 418.71)	352.76 (283.40, 422.12)	438.83 (412.88, 464.78)	race (p=.003)
Single uncomplicated extraction	58.16 (52.61, 63.71)	63.07 (59.33, 66.81)	57.95 (51.11, 64.79)	66.35 (63.84, 68.86)	race (p=.009)
Cast partial denture	547.67 (473.43, 621.91)	667.29 (617.68, 716.90)	568.04 (475.98, 660.10)	742.95 (709.59, 776.31)	race (p=.001)

(Continued on p. 860)

Table 1 (continued).

Dental practice characteristic	AA low income	NHW low income	AA high income	NHW high income	Statistically significant comparisons
Full denture	610.14 (521.70, 698.58)	668.78 (609.98, 727.58)	564.06 (451.50, 676.62)	755.41 (716.56, 794.26)	race (p = .002)
Porcelain-to-metal crown	446.37 (405.60, 487.14)	503.41 (476.70, 530.12)	455.11 (404.91, 505.31)	540.58 (522.67, 558.49)	race (p = .001)
<i>Percent of procedures you refer to other dentists</i>					
periodontal surgery	69.42 (58.91, 79.93)	74.21 (67.15, 81.27)	71.14 (58.05, 84.23)	78.51 (73.79, 83.23)	—
prosthetic crowns and bridges (other than implants)	5.82 (2.74, 8.90)	2.77 (.71, 4.83)	3.50 (-.34, 7.34)	.90 (-.49, 2.29)	race (p = .045)
implant surgery	93.56 (84.88, 102.24)	88.10 (82.28, 93.92)	93.20 (82.38, 104.02)	85.22 (81.30, 89.14)	—
implant restorations	40.12 (28.44, 51.80)	35.82 (27.98, 43.66)	38.21 (23.67, 52.75)	28.28 (22.99, 33.57)	—
full dentures	13.70 (5.31, 22.09)	13.87 (8.24, 19.50)	16.13 (5.68, 26.58)	13.90 (10.12, 17.68)	—
removable partial dentures	2.03 (.17, 3.89)	2.00 (.77, 3.23)	.75 (-1.56, 3.06)	1.41 (.57, 2.25)	—
anterior tooth root canals	13.6 (3.66, 23.54)	21.21 (14.55, 27.87)	11.31 (-1.06, 23.68)	32.04 (27.57, 36.51)	race (p = .002)
molar tooth root canals	57.95 (47.13, 68.77)	60.67 (53.42, 67.92)	52.22 (38.74, 65.70)	64.88 (60.00, 69.76)	—

(Continued on p. 861)

Table 1 (continued).

Dental practice characteristic	AA low income	NHW low income	AA high income	NHW high income	Statistically significant comparisons
endodontic surgery	79.51 (71.55, 87.47)	86.12 (80.77, 91.47)	82.17 (72.25, 92.09)	87.54 (83.95, 91.13)	—
non-surgical extractions	10.62 (1.60, 19.64)	16.92 (10.86, 22.98)	4.43 (-6.82, 15.68)	29.12 (25.06, 33.18)	race (p=.001), race*income (p=.026)
surgical extractions	54.09 (43.84, 64.34)	59.22 (52.34, 66.10)	48.16 (35.38, 60.94)	65.65 (61.02, 70.28)	race (p=.016)
orthodontics	91.59 (86.16, 97.02)	96.09 (92.44, 99.74)	90.99 (84.23, 97.75)	94.94 (92.49, 97.39)	—
<i>Percent of patients who receive the following services at some time while in your practice</i>					
dental x-rays	96.28 (94.48, 98.08)	97.36 (96.14, 98.58)	97.20 (94.95, 99.45)	98.45 (97.63, 99.27)	—
diet counseling	17.22 (10.44, 24.00)	19.11 (14.56, 23.66)	20.83 (12.38, 29.28)	19.75 (16.69, 22.81)	—
blood pressure screening	28.72 (19.41, 38.03)	29.39 (23.22, 35.56)	32.62 (21.17, 44.07)	29.73 (25.59, 33.87)	—
oral cancer screening examination	93.61 (89.87, 97.35)	94.15 (91.64, 96.66)	92.10 (87.45, 96.75)	94.42 (92.73, 96.11)	—
oral hygiene instruction	77.67 (72.93, 82.41)	86.37 (83.19, 89.55)	83.09 (77.19, 88.99)	91.61 (89.47, 93.75)	race (p=.001), income (p=.014)
in-office fluoride application	43.64 (35.76, 51.52)	45.88 (40.61, 51.15)	40.43 (30.63, 50.23)	47.30 (43.75, 50.85)	—

(Continued on p. 862)

Table 1 (continued).

Dental practice characteristic	AA low income	NHW low income	AA high income	NHW high income	Statistically significant comparisons
fluoride gel/rinse prescribed/recommended for home	19.99 (13.64, 26.34)	24.39 (20.18, 28.60)	17.89 (10.07, 25.71)	29.33 (26.51, 32.15)	race (p=.006)
patient education from written pamphlets	28.36 (20.48, 36.24)	38.40 (33.15, 43.65)	26.12 (16.44, 35.80)	33.86 (30.33, 37.39)	race (p=.013)
patient education from videos or slides	5.86 (-1.37, 13.09)	12.38 (7.58, 17.18)	17.05 (8.15, 25.95)	10.62 (7.41, 13.83)	race *income (p=.049)
intraoral photographs taken	3.33 (-20, 6.86)	4.38 (2.01, 6.75)	2.69 (-1.70, 7.08)	7.93 (6.34, 9.52)	—
intraoral video images taken	2.36 (-3.74, 8.46)	10.86 (6.78, 14.94)	8.24 (.65, 15.83)	11.77 (9.03, 14.51)	race (p=.031)
Dentist individual characteristics					
Dentist's current age	51.29 (48.86, 53.72)	51.10 (49.47, 52.73)	50.45 (47.43, 53.47)	51.24 (50.14, 52.34)	—
Last two figures of dentist's graduation year	73.26 (70.73, 75.79)	73.57 (71.86, 75.28)	74.14 (70.98, 77.30)	73.36 (72.22, 74.50)	—
<i>Amount of agreement with these statements . . .</i>					
Patients should seek second opinions	4.28 (4.06, 4.50)	4.16 (4.02, 4.30)	4.17 (3.90, 4.44)	4.06 (3.96, 4.16)	—
Patients better off not knowing all the facts . . .	1.83 (1.52, 2.14)	1.70 (1.50, 1.90)	2.22 (1.85, 2.59)	1.73 (1.59, 1.87)	race (p=.026)

(Continued on p. 863)

Table 1 (continued).

Dental practice characteristic	AA low income	NHW low income	AA high income	NHW high income	Statistically significant comparisons
Dentists should present all treatment options	5.41 (5.12, 5.70)	5.29 (5.09, 5.49)	5.09 (4.74, 5.44)	5.25 (5.11, 5.39)	—
... dentist should try to convince patient to accept it	3.47 (3.14, 3.80)	3.46 (3.22, 3.70)	3.09 (2.66, 3.52)	3.47 (3.31, 3.63)	—
... the patient should be dismissed from the practice	2.46 (2.18, 2.72)	2.35 (2.17, 2.53)	2.43 (2.10, 2.76)	2.28 (2.16, 2.40)	—

The 57 low income AAs in the sample attended 32 dental practices. The 126 low income NHWs attended 79 practices. The 36 high income AAs attended 34 practices. The 278 high income NHWs attended 146 practices.

Least-squares means were calculated using the SAS' GLM procedure. Statistical tests of differences in means by race and household income were done using an analysis of variance with race and income as main effects and a race*income interaction term (SAS' GLM procedure). Least-squares means are adjusted for unequal sample sizes between subgroups.

Values in parentheses are normal-based 95% confidence intervals for least-squares means.

Effects listed in the "Statistically significant comparisons" column were significant at $p < .05$.

Race: indicates that the race main effect was statistically significant

Income: indicates that the income main effect was statistically significant

Race*income: indicates that the two-factor interaction term for race and income was statistically significant

AA = African American
 NHW = non-Hispanic White

Discussion

To our knowledge, this is the literature's first report on the differences in practice characteristics attended, by race and income of the patient. Our results suggest that systematic differences do exist for these stratifications.

Baseline findings from the FDCS observed that African American and lower-SES FDCS participants rated the quality of their dental care as worse than did their counterparts.¹⁷ Note from Table 1 that African American FDCS participants more often attended practices that had significantly lower fees than those attended by non-Hispanic White FDCS participants. As a possible corollary, depending upon the practice characteristic under consideration, at least one of the groups suffering disparities (African American or low-income patients) was more likely than its counterpart to attend practices that had lower rates for certain preventive practices (oral hygiene instruction, fluoride recommended for home, and certain forms of patient education), that spent more time performing dental procedures that could possibly be associated with lower-quality care (e.g., dental extractions, removable prosthetics), and that had longer waiting times and delays in getting appointments.

The literature does provide some evidence that dental price is associated with quality of dental care. A study of 15 dental practices in Connecticut demonstrated a significant positive relationship between prices charged for dental services and 2 components of quality of care (an index of technical quality of dental restorations and the level of dentist training).²⁶ A cross-sectional mailed survey of 3,048 U.S. dentists observed that higher quality of care was associated with higher prices of services.²⁷ Specifically, higher prices were associated with higher ratings for 5 measures of office preparation for emergencies (e.g., routine medical history updates), 6 measures of staff policies and benefits (e.g., continuing dental education), shorter in-office waiting times (but not the length of time to get an appointment), 8 process measures of diagnostic procedures during new-patient examinations (e.g., head and neck and temporomandibular joint examinations), and measures of the comprehensiveness of care based on 11 intra-operative procedures (e.g., blood pressure taken). The authors concluded that there appears to be a *price premium* in the dental market for superior quality, and found support for the hypothesis that higher price acts as a type of quality guarantee. This is essentially the notion that "you get what you pay for," suggesting that because African Americans attend practices that have lower fees, they may therefore be attending practices that provide a lower quality of care.

Our findings provide indirect evidence for the conclusion that social differences in quality of care contribute to frequently noted social disparities in health. Higher dental extraction rates are consistent with the lower ratings for quality of care reported by subjects at baseline and the lower likelihood of having non-extraction treatment alternatives discussed. However, we caution against such an inference because these high extraction rates may be heavily influenced by treatment requests made by the practice's patients, and not indicate an inherently low-quality practice as such. Quality health care has been defined as "doing the right thing, at the right time, in the right way, for the right person—and having the best possible results [*A Quick Look at Qual-*

ity <http://www.ahcpr.gov/consumer/qnt/qntqlook.htm>].”²⁸ Note from Table 1 that the dentists at practices attended more commonly by African Americans are significantly more likely to report that patients in their practices do not seek care soon enough, fear dentists, do not follow advice about oral hygiene, do not show for appointments as scheduled, do not take responsibility for their oral health, and are less likely to replace extracted teeth with a prosthesis.

Parenthetically, we also conducted analyses that used highest level of formal education attained as the measure of SES, instead of household income. The substantive conclusions were largely the same (for details, see <http://nersp.nerdc.ufl.edu/~gilbert/supplemental.html>). Similar analyses were also done for stratifications by *typical approach to care*, in which people were categorized at baseline as *problem-oriented attenders* or *regular attenders* (for details, see <http://nersp.nerdc.ufl.edu/~gilbert/supplemental.html>).

Although we have demonstrated that this sample had much in common with what would have been derived from a comparable national sample,^{18,19} we remind the reader that generalizations are with regard to the defined population of interest, and studies of other populations are advisable. It is also possible that patients self-select into practices based on patients’ individual preferences, which then are reflected as differences at the practice level.

Our findings of social disparities in dental practice characteristics parallel similar findings from physician practices and from hospital care. For example, Bach and colleagues⁴ observed that physicians whom African American patients visited were less likely to be board-certified than were physicians visited by non-Hispanic White patients, and were also more likely to report that they were unable to provide high-quality care to all their patients. The physicians treating African American patients also reported facing greater difficulties in obtaining for their patients access to high-quality sub-specialists, high-quality diagnostic imaging, and non-emergency admission to the hospital. A recent study of hospital treatment among Medicare beneficiaries observed that hospitals with higher-than-average proportions of African American patients were less likely to perform beneficial technologically-advanced procedures on patients regardless of race, and that racial disparities were also larger within these hospitals.^{7,29} Risk-adjusted mortality after acute myocardial infarction is significantly higher in hospitals that serve higher percentages of African American patients.⁵

Previous work from the FDACS identified social disparities at several different points along the population-to-practice continuum, in what has developed into a series of papers about the different mechanisms by which these social disparities become evident after disaggregating the health care and disease processes into defined steps.⁸ Without regard to whether the dental care system was entered, social differences were evident in these papers in 1) incidence of need, 2) responsiveness to this need, and 3) propensity to seek preventive services. Once the dental care system had been accessed, social differences were still evident with regard to 1) clinical condition, 2) awareness of treatment options, and 3) treatment discussions and recommendations. Once differences in clinical condition were taken into account, and once analysis was limited to people who had entered the dental care system, social differences in receipt of care were still evident. The larger contribution of the results of the current analysis lies in

the demonstration that practice characteristics are associated with race and SES, opening up the possibility that which dental practice was attended itself influenced these social disparities.^{15,16}

Acknowledgments

Opinions and assertions contained herein are those of the authors and are not to be construed as necessarily representing the views of the University of Alabama at Birmingham or the National Institutes of Health. This investigation was supported by NIH grants DE-11020, DE-14164, DE-12457, and DE-16747. An Internet home page devoted to details about the FDCCS is located at <http://nersp.nerdc.ufl.edu/~gilbert/>.

Notes

1. Smedley BD, Stith AY, Nelson AR, et al., eds. Institute of Medicine, Committee on Understanding and Eliminating Racial and Ethnic Disparities in Health Care. *Unequal treatment: confronting racial and ethnic disparities in healthcare*. Washington, DC: The National Academies Press, 2003.
2. U.S. Dept. Health and Human Services (HHS), National Institutes of Health (NIH). *Oral health in America: a report of the Surgeon General*. Rockville, MD: HHS, National Institute of Dental and Craniofacial Research, NIH, 2000. Available at <http://www.nidcr.nih.gov/AboutNIDCR/SurgeonGeneral/ExecutiveSummary.htm>.
3. Kelley E, Moy E, Stryer D, et al. The national healthcare quality and disparities reports: an overview. *Med Care*. 2005 Mar;43(3 Suppl):I3-8.
4. Bach PB, Pham HH, Schrag D, et al. Primary care physicians who treat blacks and whites. *New Engl J Med*. 2004 Aug 5;351(6):575-84.
5. Skinner J, Chandra A, Staiger D, et al. Mortality after acute myocardial infarction in hospitals that disproportionately treat black patients. *Circulation*. 2005 Oct 25; 112(17):2634-41.
6. Farmer MM, Ferraro KF. Are racial disparities in health conditional on socioeconomic status? *Soc Sci Med*. 2005 Jan;60(1):191-204.
7. Zaslavsky AM, Ayanian JZ. Integrating research on racial and ethnic disparities in health care over place and time. *Med Care*. 2005 Apr;43(4):303-7.
8. Gilbert GH. Racial and socioeconomic disparities in health from population-based research to practice-based research: the example of oral health. *J Dent Educ*. 2005 Sep;69(9):1003-14.
9. Gilbert GH, Coke JM, Weems RA, et al. Patient characteristics associated with receipt of dental radiographic procedures during a 48-month population-based study of dentate adults. *Oral Surg Oral Path Oral Med Oral Radiol Endod*. 2004 May;97(5):642-51.
10. Gilbert GH, Duncan RP, Shelton BJ. Social determinants of tooth loss. *Health Serv Res*. 2003 Dec;38(6 Pt 2):1843-62.
11. Gilbert GH, Shah GR, Shelton BJ, et al. Racial differences in predictors of dental care use. *Health Serv Res*. 2002 Dec;37(6):1487-507.
12. Gilbert GH, Shelton BJ, Duncan RP. Use of specific dental treatment procedures by dentate adults during a 24-month period. *Community Dent Oral Epidemiol*. 2002 Aug;30(4):260-76.
13. Fisher MA, Gilbert GH, Shelton BJ. A cohort study found racial differences in dental

- insurance, utilization, and the effect of care on quality of life. *J Clin Epidemiol.* 2004 Aug;57(8):853–7.
14. Gilbert GH, Shelton BJ, Chavers LS, et al. The paradox of dental need in a population-based study of dentate adults. *Med Care.* 2003 Jan;41(1):119–34.
 15. Gilbert GH, Weems RA, Litaker MS, et al. Practice characteristics associated with patient-specific receipt of dental diagnostic radiographs. *Health Serv Res.* 2006 Oct;41(5):1915–37.
 16. Gilbert GH, Shewchuk RM, Litaker MS. Effect of dental practice characteristics on racial disparities in patient-specific tooth loss. *Med Care.* 2006 May;44(5):414–20.
 17. Gilbert GH, Duncan RP, Heft MW, et al. Dental health attitudes among dentate black and white adults. *Med Care.* 1997 Mar;35(3):255–71.
 18. Gilbert GH, Duncan RP, Kulley AM, et al. Evaluation of bias and logistics in a survey of adults at increased risk for oral health decrements. *J Public Health Dent.* 1997 Winter;57(1):48–58.
 19. Bloom B, Gift HC, Jack SS. Dental services and oral health: United States, 1989. Table 5. Number of persons 2 years of age and over, by interval since last dental visit and selected health characteristics: United States, 1989. *Vital Health Stat 10.* 1992 Dec; (183):30–1.
 20. Gilbert GH, Duncan RP, Heft MW, et al. Multidimensionality of oral health in dentate adults. *Med Care.* 1998 Jul;36(7):988–1001.
 21. Peek CW, Gilbert GH, Duncan RP, et al. Patterns of change in self-reported oral health among dentate adults. *Med Care.* 1999 Dec;37(12):1237–48.
 22. Gilbert GH, Duncan RP, Vogel WB. Determinants of dental care use in dentate adults: six-monthly use during a 24-month period in the Florida Dental Care Study. *Soc Sci Med.* 1998 Sep;47(6):727–37.
 23. Gilbert GH, Rose JS, Cantey ED, et al. On adding a dental practice component to an ongoing longitudinal population-based study of oral health. *J Public Health Dent.* 2002 Winter;62(1):32–7.
 24. SAS Institute, Inc. SAS/STAT 9.1 user's guide. Cary, NC: SAS Institute, Inc., 2004.
 25. Belsley DA, Kuh E, Welsch RE. *Regression diagnostics: identifying influential data and sources of collinearity.* New York: Wiley, 1980.
 26. Crall JJ, Beazoglou TJ. Relationships between price and two components of quality of dental services. *J Public Health Dent.* 1989 Summer;49(3):153–7.
 27. Whitney CW, Milgrom P, Conrad D, et al. The relationship between price of services, quality of care, and patient time costs for general dental practice. *Health Serv Res.* 1997 Feb;31(6):773–90.
 28. Agency for Healthcare Research and Quality (AHRQ). *Your guide to choosing quality healthcare: summary.* Rockville, MD: AHRQ, Consumer Information, 2002 Sep. Available at <http://www.ahrq.gov/consumer/qntool.htm>.
 29. Groeneveld PW, Laufer SB, Garber AM. Technology diffusion, hospital variation, and racial disparities among elderly Medicare beneficiaries: 1989–2000. *Med Care.* 2005 Apr;43(4):320–9.