Access and Use of Specific Dental Services in HIV Disease

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Abstract

Objectives: *This study examined factors associated with the use of specific dental services by persons with HIV disease.* ***Methods:*** *The data were derived from 1,588 adults who participated in a series of up to six interviews as part of the AIDS Cost and Service Utilization Surveys. Use of dental services such as examinations, x-rays, cleaning, fillings, extractions, root canals, crown and bridge or dentures, and periodontal procedures were evaluated using logistic regression and generalized estimating equations were applied.* ***Results:*** *Multivariate analyses showed that medical insurance, an education beyond high school, income higher than $1,300 per month, high ambulatory visits, and receipt of psychological counseling were generally associated with higher service use. Blacks, those with an inpatient admission, and CD4+ cell counts less than 500 cells/μL were significantly less likely to use most types of dental services.* ***Conclusions:*** *The study concludes that disparities exist in the use of several dental services similar to those seen in the general population. [J Public Health Dent 2000;60(3):172-81]*

Key Words: HIV, access, utilization, dental services, ACSUS.

As the HIV epidemic affects more Americans and expands into almost every area of the United States, the social and economic impact of the disease has particular importance to the health care system. Because of advances in the diagnosis, treatment, and management of HIV, people with the disease are living longer (1). Thus, the growing prevalence of AIDS and the expanded chronicity of HIV infection are increasing the need for more comprehensive and accessible health services. As HIV disease becomes more effectively managed through drug therapy and monitoring, more individuals with HIV will present to providers in other sectors of the health care system such as dentists, psychologists, and psychiatrists for conditions that are secondary to or independent of their HIV infection. Consequently, analyses of the pattern of health services use by individuals with HIV have become increasingly important for policy and planning.

Most studies that examined access and use of services by people with HIV disease have focused on medical services or medication use (2-5). Only recently have access, utilization, and need for other health services such as formal and informal home care, psychological counseling, and dental care been studied (6-11). The dental studies focused on perceived need for dental care (6), unmet need (10,11), prevalence of oral infections or problems (6,8), and use and frequency of use of dental services (7,8,11). However, none of the published dental studies have assessed the types of services used or factors associated with the use of specific services.

In the early part of the HIV epidemic, use of dental services was mainly limited to HIV-associated oral lesions, oral opportunistic infections, and emergency procedures, not the maintenance of a healthy functional dentition (12,13). In addition to having systemic implications, compromised oral health affects an individual's quality of life. Decayed or missing teeth, ill-fitting dentures, and periodontal diseases can affect general health, especially in the medically compromised individual (14). Maintenance of oral health and a functional dentition is therefore important in the HIV-infected individual. Thus, we can anticipate that the use of dental services will increase and that the scope of services will differ from the earlier presentations of this disease.

Physicians are the medical care providers most often seen by an HIV-infected individual. Because of their training, physicians often fail to recognize the oral health needs of their patients (15,16). There is no reason to believe that this practice changes in HIV-infected patients. Additionally, patients with HIV may not seek or have access to dental care; dental utilization is therefore highly variable. The purpose of this paper is to characterize the specific dental services used by HIV-infected adults and to identify factors associated with their use. This information can assist the dental profession, policy makers, and public health officials to better meet the needs of people who are living with HIV disease.

Methods

Data for this study were derived from the AIDS Cost and Services Utilization Survey (ACSUS), a national multisite study conducted over an 18-month period, from spring 1991 to fall 1992. ACSUS examined a comprehensive array of health care and support services used by HIV-infected persons. The ACSUS sample was drawn using a multistage design. Details of the study design and preliminary results have been reported previously (9,17), and a description of the dental data collected has been described by Fleishman et al. (7). Six waves of interviews were held over the 18-month period. At each of the six interview waves, respondents were asked how many times they had seen a "dentist, oral surgeon, or other professional

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dental care provider" since the last interview. In addition, respondents were asked which dental services they had received from a list that included examinations, cleaning teeth, x-rays, fillings, extractions, root canals, crown and bridge or denture work, gum care, and others. For each of these questions, participants were allowed a response of "don't know." Unlike the medical data collected in the ACSUS study, the researchers did not collect any data directly from dental providers. The researchers specifically excluded dental providers because of concern that awareness of a patient's HIV status might "jeopardize" receipt of services by the patient (17).

The use of specific procedures by patients with HIV disease is discussed within the context of Andersen's framework for health services utilization, particularly individual determinants of utilization (18). The variables assessed in the ACSUS data that represent individual determinants of utilization are sex, age, race, marital status, education, income, medical insurance status, employment status, general health status, stage of disease, HIV exposure route, CD4+ cell count, and usual source of medical care. Additionally, use of other services such as inpatient hospital admissions, ambulatory visits, emergency room visits, participation in HIV clinical trials, use of over-the-counter drugs (OTC), receiving psychological counseling, and help with transportation were evaluated in the current study. For purposes of the analyses, health utilization variables such as inpatient admissions and psychological counseling were defined according to whether or not a respondent reported the specific service during the reference period for the interview. Likewise, the number of ambulatory visits refers only to visits that occurred during the interview reference period.

To initially describe the pattern of dental utilization, the percentages of participants who reported using each service during one or more of the waves were calculated for the sample and for subgroups of the sample. To quantify service utilization, the mean number of services used per person was also determined. Service utilization refers to the number of times a visit included a particular dental service. Because the number of observation days varied somewhat for different respondents, the mean number of services was annualized. The annualized mean was derived by summing the number of dental services reported for each respondent across all waves, multiplying the sum by 365 (days), dividing the product by the total number of observation days per respondent, and then averaging across all respondents.

Bivariate analyses were conducted to investigate the relationships among the study variables and to inform the multivariate stage of the analysis. Unadjusted odds ratios, 95 percent confidence intervals, and significance tests for the association between each study variable and each dental service were calculated.

To examine the determinants of specific dental services utilization over time, regression analyses using logistic models were analyzed. The primary response variable was self-reported use of a specific dental service during each interview reference period. Separate regression analyses were performed using the specific dental service as the response variable. Utilization was coded as a binary variable depending upon whether a respondent reported specific dental procedures during a reference period.

Because there were six consecutive interviews, and therefore six possible responses for each individual, responses from the same individual were correlated. Analyses using conventional regression methods could provide erroneous variance estimates because of the conventional assumption that each response is statistically independent (19). Therefore, parameters of the regression models for both the bivariate and multivariate analyses were estimated using the generalized estimating equation (GEE) methods of Zeger and Liang (20). The predisposing variables of sex, age, race, HIV exposure group, and education were assessed as time-independent covariates while the other variables, including need-for-care variables, were assessed as time-dependent covariates. A logit link function, binary mean-variance relationship, and an exchangeable correlation structure were specified in modeling the relationship between dental services use and predisposing, enabling, and need-for-care variables.

The process for deriving the disease stage at each interview wave, an analysis of missing data, and the most common reason for excluding interviews are described elsewhere (21). Briefly, AIDS was defined using a slightly modified version of the 1987 CDC surveillance case definition. Participants were classified with AIDS beginning with the date either an indicator disease or AIDS was diagnosed and appeared in their medical record. Participants who did not meet the 1987 AIDS case definition, but had conditions commonly attributed to HIV infection, were categorized as HIV-symptomatic. All other participants whose medical records were reviewed but did not meet the selection criteria for the other two disease stages were classified as asymptomatic. Interviews by black respondents were more likely to be excluded than those of whites, as were interviews by respondents who had AIDS at the time of the ACSUS screener. The most common reason for excluding an interview was due to missing information about CD4+ cell count (15% of interviews excluded).

Results

Characteristics of the analytic sample are shown in Table 1. The adult sample was predominately male (82%), but demographically diverse in race/ethnicity (42% white, 29% black, and 27% Hispanic). Medical records indicated that sexual transmission was a suspected mode of HIV exposure in approximately two-thirds of the respondents. At the first interview, most of the sample reported public (52%), private (27%), or public and private (6%) medical insurance coverage. However, a number of participants were uninsured (14%). Most respondents also reported having a usual source of medical care at the first interview. In addition, an approximately equal distribution of individuals was categorized at each disease stage (30 percent asymptomatic, 35 percent HIV-symptomatic, and 35 percent with AIDS). Notably, the sample characteristics were very similar to other analyses of the ACSUS cohort (2,7), which suggests that these results are comparable to previous analyses.

The descriptive data for each dental service—percent reporting the service during the overall time period, annualized mean, and standard deviation—are reported in Table 1. Table 2 reports the results of bivariate analyses, and indicates the reference groups

for each variable. Tables 3 and 4 report the multivariate analyses for use of each type of dental service.

Examination. Dental examinations were the most frequently performed service. Over the 18-month study period 36 percent of the study sample reported having a dental examination, with an annualized mean of 0.54 (SD=1.12) services per person. Bivariate analyses indicated several sociodemographic variables were significantly associated with having an examination. Multivariate analyses (Table 3), when controlling for all other variables in the model, showed that those statistically significantly more likely to get a dental examination had more than a high school education; had insurance—public, private, or both public and private insurance; and had one or more ambulatory visits as compared with their respective reference group. Those significantly less likely to get a dental examination were black or Hispanic.

X-ray Examination. Twenty-eight percent of the study sample reported having an X-ray examination over the 18-month study period, with an annualized mean of 0.33 (SD=0.70). Most of the associations seen in the bivariate analyses (Table 2) were also statistically significant in the multivariate analyses (Table 3). Those significantly more likely to get an X-ray examination had more than a high school education; had insurance—public, private, or both public and private insurance; and had three or more ambulatory visits. Blacks, those who reported an inpatient admission, and those who participated in a clinical trial were significantly less likely to get an X-ray examination.

Cleaning. Over the 18-month study period 33 percent of the study sample reported having a cleaning, with an annualized mean of 0.49 (SD=0.90). Cleaning was the second most frequently performed dental service. The bivariate analyses (Table 2) show that more variables predicted the likelihood of receiving a cleaning since the last interview than any other service. When controlled for all other variables in the model, multivariate analyses showed the following to be statistically significant. Those more likely to receive a cleaning were 35–44 years old; had more than a high school education; had an income greater than $1,300 per month; had private, or both public and private insurance; reported three or more ambulatory visits; used counseling services; and perceived their health as good or excellent. Those significantly less likely to receive a cleaning were black and had an inpatient admission.

Fillings. Twenty-one percent of the study sample reported having a filling over the 18-month study period, with an annualized mean of 0.32 (SD=0.87). Few variables that showed statistically significant associations in the bivariate analyses were also significant in the multivariate analyses. Those significantly more likely to get a filling had more than a high school education; had insurance—public, private, or both public and private insurance; reported three or more ambulatory visits; and reported perceived health as fair, good, or excellent (Table 3). Those significantly less likely to get a filling were again black, reported an inpatient admission, and had CD4+ cell counts of 200 cells/μL or less.

Extraction. Over the 18-month study period 15 percent of the study sample reported having an extraction, with an annualized mean of 0.18 (SD=0.56) extractions. Most of the associations seen in the bivariate analyses (Table 2) were also statistically significant in the multivariate analyses (Table 4). Those more likely to have an extraction had public insurance, whereas those less likely to have an extraction had more than a high school education, had an income greater than $1,301 per month, and had CD4+ cell counts over 200 cells/μL or below 50 cells/μL. Sex, race, and employment status, which were significant in the bivariate analyses, dropped out of the multivariate model.

Root Canal. Over the study period 5 percent of the study sample reported having a root canal procedure, with an annualized mean of 0.08 (SD=0.40). Root canals along with gum procedures were the least performed dental procedure, and very few variables significantly predicted the use of the service. Bivariate and multivariate analyses showed that those statistically significantly more likely to have a root canal procedure were those who were of a higher SES or took better care of themselves, such as those with more than a high school education, or who used counseling services, and who reported three or more ambulatory care visits. As expected, those who had an inpatient admission and CD4+ cell counts of fewer than 500 cellsμL were significantly less likely to have a root canal.

Crown, Bridge, or Dentures. Over the 18-month study period 13 percent of the study sample reported having a crown or bridge procedure or a denture procedure, with an annualized mean of 0.26 (SD=0.95). Although several variables were associated with the use of this service in the bivariate analyses (Table 2), in multivariate analyses (Table 4) those statistically significantly more likely to have this service were over the age of 35, had private or public insurance, reported three or more ambulatory care visits, used counseling services, and had help with transportation.

Gum Procedures. Six percent of the study sample reported having a gum procedure, with an annualized mean of 0.08 (SD=0.46). Thus, these procedures were also least reported. Bivariate analyses showed that those significantly more likely to have a gum procedure had more than a high school education; had private, or public and private insurance; worked part time; used counseling services; and were HIV-symptomatic. Blacks were significantly less likely to have a gum procedure, based on findings from the bivariate analyses. Only three variables remained statistically significant in the multivariate analyses. Those more likely to have a gum procedure had both public and private insurance and were classified as HIV-symptomatic, whereas those less likely to have a gum procedure were black.

Discussion

Fleishman et al. (7) have discussed the use of dental care and unmet need among ACSUS respondents. Although dental care use among ACSUS respondents was lower than that of the US population for the comparable age groups, 51 percent of the respondents reported one or more visits to a dentist, oral surgeon, or other professional dental care provider. Fleishman et al. only evaluated sociodemographic variables with respect to overall use and frequency of use of dental services (7). The present paper goes beyond the previous analysis by evaluating use of specific dental services. For example, Fleishman et al. (7) found that those without a college education were less

TABLE 1
Percent of Sample Reporting Use of Specific Dental Services During 18 Months and Annualized Mean Use per Person by Selected Characteristic *[continued next page]*

		Exams		X-rays		Cleaning		Fillings	
Characteristic	*n* (%)	% User	Mean† (SD)	% User	Mean† (SD)	% User	Mean† (SD)	% User	Mean† (SD)
Total sample	1,588 (100)	36.0	0.54 (1.12)	27.7	0.33 (0.70)	32.6	0.49 (0.90)	20.5	0.32 (0.87)
Sex									
Male	1,297 (81.7)	36.9	0.57 (1.15)	27.6	0.34 (0.71)	34.2	0.54 (0.95)	21.4	0.34 (0.90)
Female	291 (18.3)	32.0	0.45 (0.99)	28.2	0.33 (0.69)	25.1	0.28 (0.64)	16.5	0.26 (0.76)
Race									
White, non-Hisp.	673 (42.4)	46.4	0.75 (1.37)	33.9	0.39 (0.69)	41.2	0.65 (0.99)	24.7	0.42 (1.04)
Black, non-Hisp.	458 (28.8)	23.6	0.31 (0.74)	19.9	0.25 (0.66)	19.4	0.27 (0.72)	13.5	0.18 (0.59)
Hispanic	435 (27.4)	32.9	0.48 (0.96)	25.8	0.33 (0.77)	33.1	0.49 (0.91)	21.4	0.34 (0.84)
Other	22 (1.4)	36.4	0.52 (0.96)	40.9	0.37 (0.50)	31.8	0.37 (0.62)	22.7	0.19 (0.37)
HIV exposure									
Gay/bisexual	826 (52.0)	41.0	0.65 (1.28)	30.2	0.35 (0.70)	40.1	0.65 (1.03)	22.5	0.37 (0.97)
IV drugs	339 (21.3)	28.0	0.41 (0.88)	26.0	0.34 (0.77)	19.5	0.26 (0.68)	16.5	0.24 (0.72)
Heterosexual	196 (12.3)	27.6	0.34 (0.83)	24.5	0.29 (0.64)	30.6	0.38 (0.76)	17.4	0.25 (0.68)
Blood transfusion	14 (0.9)	35.7	0.37 (0.54)	35.7	0.36 (0.59)	35.7	0.58 (0.94)	21.4	0.34 (0.69)
Other	38 (2.4)	34.2	0.29 (0.43)	18.4	0.18 (0.49)	23.7	0.27 (0.58)	21.0	0.24 (0.52)
Multiple	175 (11.0)	37.1	0.57 (1.06)	24.6	0.31 (0.68)	26.3	0.34 (0.68)	22.3	0.37 (0.92)
Age (years)									
15–24	88 (5.5)	30.7	0.42 (0.77)	26.1	0.33 (0.69)	26.1	0.34 (0.72)	10.2	0.16 (0.54)
25–34	661 (41.6)	33.7	0.49 (0.97)	26.9	0.29 (0.60)	30.1	0.43 (0.81)	20.4	0.29 (0.74)
35–44	620 (39.0)	37.9	0.59 (1.31)	27.9	0.35 (0.74)	34.8	0.52 (0.90)	21.6	0.38 (1.01)
45–54	167 (10.5)	40.1	0.65 (1.06)	31.1	0.40 (0.84)	36.5	0.64 (1.08)	24.0	0.35 (0.95)
55 and older	52 (3.3)	36.5	0.56 (1.06)	26.9	0.45 (0.96)	34.6	0.77 (1.49)	15.4	0.29 (0.90)
Education									
≤High school	851 (53.6)	29.1	0.44 (0.95)	22.9	0.29 (0.70)	23.2	0.33 (0.75)	16.2	0.25 (0.75)
>High school	737 (46.4)	43.8	0.66 (1.28)	33.2	0.38 (0.71)	43.4	0.68 (1.02)	25.5	0.40 (0.99)
Insurance									
Uninsured	222 (14.3)	28.8	0.35 (0.66)	19.8	0.21 (0.48)	26.6	0.36 (0.74)	16.7	0.29 (0.76)
Public only	814 (52.3)	32.8	0.53 (1.18)	26.4	0.35 (0.80)	24.6	0.35 (0.79)	18.6	0.30 (0.88)
Private only	424 (27.2)	46.0	0.64 (0.93)	34.2	0.36 (0.60)	50.9	0.81 (1.02)	25.7	0.32 (0.71)
Both types	97 (6.2)	41.2	0.75 (1.92)	34.0	0.44 (0.74)	37.1	0.68 (1.23)	23.7	0.49 (1.18)
Usual source of medical care									
None	93 (5.9)	32.3	0.55 (1.77)	26.9	0.22 (0.41)	25.8	0.40 (0.81)	19.4	0.21 (0.51)
Yes	1,486 (94.1)	36.3	0.54 (1.07)	27.8	0.34 (0.72)	33.1	0.50 (0.91)	20.6	0.33 (0.89)
Stage of disease									
Asymptomatic	463 (30.1)	36.9	0.44 (0.77)	29.8	0.30 (0.54)	34.6	0.48 (0.86)	24.2	0.36 (0.87)
HIV-symptomatic	533 (34.6)	40.2	0.64 (1.26)	29.6	0.34 (0.67)	36.4	0.56 (0.97)	19.5	0.29 (0.85)
AIDS	544 (35.3)	30.7	0.52 (1.22)	23.5	0.35 (0.82)	27.4	0.44 (0.88)	18.0	0.31 (0.87)
CD4+ cell count									
>500 cells/μl	170 (12.7)	43.5	0.52 (0.75)	32.4	0.31 (0.53)	38.2	0.50 (0.85)	26.5	0.32 (0.65)
301–500 cells/μl	292 (21.8)	40.8	0.52 (0.78)	32.5	0.33 (0.56)	35.2	0.52 (0.86)	24.7	0.40 (0.99)
201–300 cells/μl	559 (41.7)	36.0	0.49 (0.95)	28.5	0.31 (0.64)	33.5	0.50 (0.89)	19.5	0.34 (1.10)
101–200 cells/μl	559 (41.7)	38.0	0.57 (1.07)	30.8	0.35 (0.69)	38.4	0.55 (0.95)	19.0	0.25 (0.67)
50–100 cells/μl	559 (41.7)	32.0	0.50 (0.97)	24.6	0.29 (0.60)	26.2	0.41 (0.90)	18.9	0.26 (0.71)
0–49 cells/μl	321 (23.9)	31.1	0.57 (1.44)	21.2	0.28 (0.69)	27.1	0.44 (0.91)	17.5	0.29 (0.85)

*For characteristics that could change over time, the frequency reported is for the characteristic at time 1. Data on some characteristics were missing at time 1 for some participants.

†To derive an annual mean, the number of dental services reported for each respondent during ACSUS interview waves 1 through 6 were summed, multiplied by 365, divided by the total number of observation days per respondent, then averaged across all respondents.

TABLE 1
Percent of Sample Reporting Use of Specific Dental Services During 18 Months and Annualized Mean Use per Person by Selected Characteristic *[continued from previous page]*

Characteristic	*n* (%)	Extractions		Root Canal		Crown/Bridge/ Denture Work		Gum Care	
		% User	Mean† (SD)	% User	Mean† (SD)	% User	Mean† (SD)	% User	Mean† (SD)
Total sample	1,588 (100)	14.7	0.18 (0.56)	5.2	0.08 (0.40)	12.6	0.26 (0.95)	5.9	0.08 (0.46)
Sex									
Male	1,297 (81.7)	13.3	0.17 (0.53)	4.86	0.07 (0.40)	13.4	0.27 (0.99)	6.3	0.08 (0.46)
Female	291 (18.3)	20.6	0.26 (0.66)	6.53	0.08 (0.37)	8.9	0.19 (0.77)	4.5	0.07 (0.46)
Race									
White, non-Hisp.	673 (42.4)	12.5	0.16 (0.52)	5.5	0.09 (0.48)	15.8	0.32 (1.03)	7.9	0.10 (0.57)
Black, non-Hisp.	458 (28.8)	17.0	0.19 (0.50)	3.7	0.06 (0.33)	10.0	0.20 (0.95)	2.8	0.04 (0.36)
Hispanic	435 (27.4)	15.4	0.21 (0.66)	6.0	0.07 (0.33)	10.1	0.23 (0.85)	5.8	0.07 (0.36)
Other	22 (1.4)	18.2	0.16 (0.36)	9.1	0.09 (0.31)	18.2	0.19 (0.47)	13.6	0.12 (0.33)
HIV exposure									
Gay/bisexual	826 (52.0)	11.0	0.13 (0.44)	5.2	0.08 (0.45)	13.6	0.28 (1.06)	7.6	0.10 (0.55)
IV drugs	339 (21.3)	20.4	0.30 (0.77)	5.9	0.07 (0.30)	12.7	0.27 (0.90)	4.1	0.04 (0.21)
Heterosexual	196 (12.3)	14.3	0.16 (0.46)	4.1	0.05 (0.30)	4.6	0.07 (0.43)	1.5	0.01 (0.09)
Blood transfusion	14 (0.9)	7.1	0.05 (0.18)	7.1	0.05 (0.18)	28.6	0.50 (1.10)	0.0	0.00 (0.00)
Other	38 (2.4)	18.4	0.18 (0.42)	2.6	0.02 (0.11)	5.3	0.05 (0.24)	7.9	0.07 (0.26)
Multiple	175 (11.0)	21.1	0.28 (0.65)	5.1	0.09 (0.44)	17.1	0.35 (1.03)	6.3	0.13 (0.64)
Age (years)									
15–24	88 (5.5)	14.8	0.13 (0.34)	5.7	0.05 (0.23)	5.7	0.07 (0.35)	3.4	0.03 (0.17)
25–34	661 (41.6)	14.5	0.16 (0.47)	4.1	0.06 (0.37)	8.9	0.16 (0.81)	5.9	0.08 (0.42)
35–44	620 (39.0)	16.0	0.22 (0.65)	5.8	0.09 (0.46)	15.7	0.34 (1.10)	6.6	0.07 (0.33)
45–54	167 (10.5)	9.6	0.15 (0.59)	6.0	0.06 (0.27)	18.0	0.38 (1.09)	3.6	0.03 (0.16)
55 and older	52 (3.4)	17.3	0.23 (0.56)	7.7	0.12 (0.47)	17.3	0.36 (0.97)	9.6	0.31 (1.68)
Education									
≤High school	851 (53.6)	18.5	0.24 (0.61)	3.8	0.05 (0.29)	10.6	0.20 (0.75)	4.4	0.05 (0.30)
>High school	737 (46.4)	10.3	0.13 (0.48)	6.8	0.11 (0.49)	14.9	0.33 (1.14)	7.7	0.11 (0.60)
Insurance									
Uninsured	222 (14.3)	12.2	0.18 (0.60)	5.9	0.08 (0.39)	6.3	0.11 (0.50)	4.5	0.03 (0.16)
Public only	814 (52.3)	19.4	0.24 (0.63)	4.6	0.06 (0.30)	13.0	0.27 (0.94)	5.2	0.07 (0.41)
Private only	424 (27.2)	5.7	0.06 (0.26)	6.1	0.11 (0.51)	15.1	0.31 (0.97)	8.0	0.08 (0.31)
Both types	97 (6.2)	18.6	0.23 (0.60)	6.2	0.11 (0.58)	13.4	0.37 (1.63)	6.2	0.20 (1.25)
Usual source of medical care									
None	93 (5.9)	12.9	0.15 (0.44)	7.5	0.11 (0.42)	7.5	0.13 (0.62)	7.5	0.08 (0.29)
Yes	1,486 (94.1)	14.7	0.19 (0.56)	5.1	0.07 (0.40)	13.0	0.27 (0.97)	5.8	0.07 (0.46)
Stage of disease									
Asymptomatic	463 (30.1)	13.2	0.13 (0.39)	4.8	0.06 (0.32)	13.4	0.26 (0.88)	5.4	0.06 (0.31)
HIV-symptomatic	533 (34.6)	15.8	0.18 (0.55)	6.9	0.10 (0.43)	13.9	0.27 (0.89)	7.1	0.10 (0.60)
AIDS	544 (35.3)	14.5	0.22 (0.64)	3.9	0.07 (0.44)	11.2	0.25 (1.05)	5.3	0.07 (0.42)
CD4+ cell count									
>500 cells/μl	170 (12.7)	17.1	0.19 (0.53)	10.0	0.12 (0.42)	14.1	0.34 (1.10)	8.2	0.08 (0.31)
301–500 cells/μl	292 (21.8)	15.1	0.18 (0.49)	7.2	0.11 (0.46)	15.8	0.21 (0.67)	5.5	0.05 (0.22)
201–300 cells/μl	559 (41.7)	14.0	0.15 (0.49)	4.0	0.08 (0.44)	14.0	0.25 (1.03)	8.0	0.10 (0.44)
101–200 cells/μl	559 (41.7)	14.4	0.18 (0.54)	5.1	0.06 (0.33)	12.7	0.27 (0.89)	6.8	0.14 (0.86)
50–100 cells/μl	559 (41.7)	14.8	0.19 (0.59)	3.3	0.03 (0.21)	12.3	0.27 (0.91)	4.9	0.05 (0.22)
0–49 cells/μl	321 (23.9)	13.7	0.18 (0.55)	3.7	0.05 (0.31)	8.4	0.19 (0.96)	4.4	0.04 (0.23)

*For characteristics that could change over time, the frequency reported is for the characteristic at time 1. Data on some characteristics were missing at time 1 for some participants.
†To derive an annual mean, the number of dental services reported for each respondent during ACSUS interview waves 1 through 6 were summed, multiplied by 365, divided by the total number of observation days per respondent, then averaged across all respondents.

TABLE 2
Results of Bivariate Analysis* by Service Type

	Exam	X-rays	Cleaning	Fillings	Extract	Root Canal	Crown/ Bridge/ Denture	Gum Care
Sex: Female†	‡		‡		§			
Race/ethnicity: white	REF							
Black	‡	‡	‡	‡	§		‡	‡
Hispanic	‡		‡				‡	
Exposure route								
Gay/bisexual	REF							
IV drugs			‡	§				
Heterosexual	‡		‡				‡	
Blood							§	
Other	‡							
Multiple	‡		‡	§				
Age (years): 25–34	REF							
35–44			§				§	
45–54	§		§				§	
55+							§	
Education:> high school†	§	§	§	§	‡	§	§	§
Insurance: None	REF							
Public	§	§		§	§		§	
Private	§	§	§	§			§	§
Both	§	§	§	§			§	§
Income ($ per month)			§					
≤ $350	REF							
$351–500			§					
$501–1,300			§					
$1,301–4,000	§		§		‡			
>$4,000	§		§		‡		§	
Employment status								
Unemployed	REF							
Part-time	§							§
Full-time	§		§		‡	§		
Ambulatory visits:								
None	REF		§					
1–2	§		§					
3+	§	§		§		§	§	
Inpatient admission†			‡	‡		‡		
Psych. counseling†		§	§	§		§	§	§
Emergency room visit†			‡					
Took OTC†	§	§	§	§			§	
Took part in HIV trials†			§					
Had usual source of care†				§				
Help with transport†					§		§	
Health								
Poor	REF							
Fair			§	§				
Good			§	§				
Very good		§	§	§				
Excellent				§				

*Only statistically significant bivariate associations reported.
†Dichotomous variable.
‡Less likely to have the service.
§More likely to have the service.

TABLE 3
Regression Coefficients from Logistic Regression Analyses of Specific Dental Services in ACSUS

	Exam	X-rays	Cleaning	Fillings
Sex: Female	–0.03	0.18	–0.16	–0.13
Race: white	REF	REF	REF	REF
Black	–0.73*	–0.44†	–0.58*	–0.65*
Hispanic	–0.26‡	–0.15	–0.04	–0.02
Other	–0.54	–0.04	–0.46	–0.67
Age (years): 25–34	REF	REF	REF	REF
15–24	0.01	0.17	0.07	–0.57
35–44	0.11	0.10	0.23‡	0.06
45–54	0.19	0.14	0.23	–0.02
55+	0.17	0.26	0.41	–0.31
Education: >high school	0.26†	0.27‡	0.37†	0.35†
Income: >$1,300/month	0.15	–0.05	0.29†	–0.14
Insurance: none	REF	REF	REF	REF
Public	0.47†	0.48‡	0.20	0.84§
Private	0.59†	0.53‡	0.65§	0.80†
Public and private	0.61†	0.63‡	0.61†	0.69‡
Inpatient hospital admission	–0.21	–0.28‡	–0.39†	–0.37‡
Ambulatory visits: none	REF	REF	REF	REF
1–2	0.40‡	0.33	0.34	0.36
3+	0.73*	0.82*	0.83*	0.85*
Participate in clinical trials	–0.13	–0.27‡	–0.16	–0.17
Psychological counseling	0.18	0.17	0.19‡	0.10
Help with transportation	0.23	0.19	–0.01	0.17
Perceived health: poor	REF	REF	REF	REF
Fair	0.01	0.20	0.23	0.61†
Good/excellent	0.10	0.26	0.54†	0.46‡
Stage of disease: asymptomatic	REF	REF	REF	REF
HIV-symptomatic	0.19	0.03	0.20	–0.07
AIDS	0.05	–0.04	0.12	–0.03
CD4+: <500 cells	REF	REF	REF	REF
201–500 cells	–0.16	–0.28	–0.08	–0.20
50–200 cells	–0.13	–0.23	–0.01	–0.47‡
0–49 cells	–0.18	–0.23	–0.07	–0.44‡

Note: all analyses control for length of observation.
*$P \leq .0001$.
†$P \leq .01$.
‡$P \leq .05$.
§$P \leq .001$.

likely to have any use of dental services, whereas in the present analyses they were less likely to have examinations, x-rays, cleaning, filling, and root canals, but more likely to have extractions. The present study also evaluates the impact of other predictors such as the use of medical care and other services.

For the purpose of this discussion, Andersen's Behavioral Model of Health Services Use, particularly its individual determinants of utilization (18), is used to organize the discussion. Use of health services and, in our case, dental services, are dependent on (1) the predisposition of the individual to use services (predisposing factors), (2) his or her ability to secure services (enabling factors), and (3) his or her illness level.

Predisposing Factors. Education and race were the two predisposing factors that consistently predicted use of specific dental services in the bivariate and multivariate analyses. This result is expected. Studies of access and utilization of dental care and medical care in HIV-infected persons and in the general population have shown similar results (2,8,10,22,23). Individuals with more than a high school education were more likely to use all of the dental services except extractions, and blacks and Hispanics were less likely than whites to use all the specific dental services. Age, sex, marital status, and whether an individual worked part time or full time were associated with use of certain dental services. Although not statistically significant in the multivariate analyses, across all procedures except extractions and root canals, the annualized mean use by females was lower than for males (Table 1). This result is the opposite of what is usually seen, where females are more likely to access the medical or dental systems. The reason for this finding may not be a gender issue, but more a socioeconomic one. For most dental services, the proportion of individuals who received a service and the annualized mean use increased with age.

Enabling Factors. Having medical insurance—regardless of whether it was public, private, or a combination of public and private insurance—was a consistent finding for the provision of all types of dental services. Except for root canals, individuals with insurance were more likely to have specific dental services. Although this variable did not necessarily pertain to having dental insurance, those having medical insurance were more likely to get dental services than those who did not. HIV-infected people are more likely to lack dental insurance than the general US population (10). Dental services were the most commonly reported self-perceived unmet need (9%) in this study population (24). Our results and those of other studies (11) confirm that better efforts should be made to make HIV-infected individuals aware of available programs, and at which facilities these services are available. For instance, many individuals with HIV are eligible for free dental services through programs supported by the Ryan White Care Act (25).

After controlling for insurance status, income was a statistically significant enabling factor in the multivariate analyses only for extractions and cleaning. However, the direction

TABLE 4
Regression Coefficients from Logistic Regression Analyses of Specific Dental Services in ACSUS

	Extraction	Root Canal	Crown/ Bridge/ Denture	Gum Care
Sex: Female	0.16	0.35	–0.06	0.003
Race: white	REF	REF	REF	REF
Black	–0.04	–0.01	–0.33	–0.77‡
Hispanic	–0.12	0.22	–0.32	–0.12
Other	0.14	0.43	–0.49	0.51
Age (years): 25–34	REF	REF	REF	REF
15–24	–0.21	0.03	–0.73	–0.52
35–44	0.25	0.21	0.69*	–0.08
45–54	–0.37	–0.001	0.68†	–0.66
55+	0.61	0.66	0.98†	0.90
Education: >high school	–0.39‡	0.61‡	0.17	0.43
Income: >$1,300/month	–0.72†	0.23	0.01	–0.20
Insurance: none	REF	REF	REF	REF
Public	0.98†	–0.11	1.01†	0.82
Private	0.57	–0.30	0.96†	0.82
Public and private	0.76	–0.15	0.82	1.34‡
Inpatient hospital admission	–0.07	–0.98‡	0.03	1.13
Ambulatory visits: none	REF	REF	REF	REF
1–2	0.01	1.22	0.52	–0.04
3+	0.40	1.73†	0.90†	0.52
Participate in clinical trials	–0.15	0.10	0.06	0.09
Psychological counseling	0.07	0.43‡	0.33‡	0.30
Help with transportation	0.30	–0.003	0.46‡	0.17
Health: poor	REF	REF	REF	REF
Fair	0.42	–0.30	0.03	–0.34
Good/excellent	0.42	0.39	0.07	–0.10
Stage of disease: asymptomatic	REF	REF	REF	REF
HIV	0.09	0.44	–0.16	0.66‡
AIDS	0.05	0.32	–0.26	0.40
CD4+ cells: <500	REF	REF	REF	REF
201–500	–0.52‡	–0.65‡	–0.16	–0.25
50–200	–0.22	–0.87†	–0.19	–0.42
0–49	–0.47‡	–1.02†	–0.41	–0.83

Note: all analyses control for length of observation.
*$P \leq .0001$.
†$P \leq .01$.
‡$P \leq .05$.
§$P \leq .001$.

of the association was the opposite in the case of these two services. Individuals with higher income were less likely to have an extraction, but more likely to have a cleaning. This result is hardly surprising, because people in the general population with higher incomes are more likely to have services that would prevent disease or restore and retain a functional tooth than an extraction.

Having a regular source of medical care did not predict the type of services received in this study population, and help with transportation significantly predicted only receipt of crown and bridge or denture services.

Illness Level. Although Fleishman et al. found that those with AIDS were significantly less likely to have any dental use (7), in the present study factors such as stage of illness and emergency room visits did not predict the use of specific dental services in the multivariate analyses. Previous studies using stage of illness to predict use of dental services by HIV-infected individuals have had mixed results. Capilouto and colleagues (6) found results similar to those of the present study. On the other hand, in the study by Greene and colleagues (8), individuals who were symptomatic, defined as an individual with two or more oral conditions, were 1.6 times more likely to use dental services compared to those with fewer conditions. As expected, those with CD4+ cell counts less than 500 cells/μL were less likely to receive any kinds of dental services, but the association was statistically significant only for fillings, extractions, and root canals. More studies are needed to monitor the use of dental services during the different stages of the disease, as it is anticipated that dental usage will change substantially in the future.

Having an inpatient admission, and in some cases the individual's perceived health, predicted use of dental services. The finding that individuals who had an inpatient admission were less likely to have definitive dental procedures such as cleanings, fillings, and root canals is hardly surprising. Dental care traditionally has been more elective in nature. HIV patients who have been hospitalized would tend to be the sicker individuals whose survival is at stake. Medical management, therefore, takes precedence over dental care, however acute the dental need may be.

An unanticipated result of this study is that periodontal care was among the least commonly performed procedures, with an annualized mean of 0.08 per person, the estimate being the highest (0.20; SD=1.25) for individuals with private and public insurance (Table 1). Previous reports have shown that gingival and periodontal diseases are common in HIV-infected adults, with a prevalence of 31 percent for HIV-related gingivitis, and 4 percent to 85 percent for HIV-related periodontitis (26,27). Our findings suggest that many HIV-infected individuals are lacking appropriate periodontal care.

Use of services such as ambulatory visits and psychological counseling predicted use of specific dental services. At least two explanations for

these results are possible. One explanation is that individuals more likely to use these services are generally those who realize the importance of keeping healthy, including dental health, and who take better care of themselves. Another explanation is that use of ambulatory or counseling services brought the individual in contact with a health professional who recommended they see a dentist for their oral health needs. Previous studies have reported that 42 percent of HIV patients who received dental care sought care following referral by their primary medical care provider (8). Based on these results, other health care professionals should be encouraged to counsel high-risk patients.

The aforementioned predisposing and enabling factors predicting the use of specific dental services in this special population of HIV patients are similar to those that predict use of medical or dental care in the general population. Where dental care is concerned, it seems that disparities and disadvantaged groups with poor access still exist along the lines of race, education, income, and health insurance, irrespective of the overlying disease in the population such as HIV. Hence, public policy efforts should focus on removing or minimizing the effects of these factors, regardless of the disease. It may not be enough to simply target individuals who are HIV positive, but necessary to find ways of reducing barriers experienced by subpopulations of HIV-positive individuals along the lines of race and education levels.

From the results of this study, particularly those for extractions, it appears that disadvantaged groups get services such as extractions, examinations, x-rays, but not restorative or rehabilitating services. An analogy can be created between medical and dental services. Dental extractions are to dentistry what an emergency room (ER) visit is to medicine. The factors that predict ER visits are similar to those that predict having an extraction, such as having no college education, an income less than $1,300 per month, and public insurance (2). Furthermore, the direction and the magnitude of the variables are also similar. A possible explanation for the finding that HIV-infected people with public insurance are more likely to get an extraction than others is that Medicaid, in many states, does not pay for routine adult dental care, including cleaning, but will pay for emergency services, including extractions.

With few exceptions, the magnitude of the associations seen in this study, although statistically significant, were not very large. They are, however, consistent with those seen in previous studies of HIV patients (6,8,10,11).

New antiretroviral regimens for treating HIV disease require rigorous adherence to medication dosing schedules (28). With efforts to help HIV-positive individuals become more adherent to medications, it is possible that their medication adherence may carry over to other health-related behaviors, including dental care. Future studies are needed to monitor the effects of adherence to medication regimens on the use of dental services. With hope on the horizon for a prolonged life, the will to live may increase overall adherence in patients with HIV disease.

The ACSUS study was conducted in the early 1990s. Although the treatment and management of HIV disease have changed since the survey was done, no evidence shows that dental access or utilization have changed during this same period. No dramatic or other changes in policy have occurred since these data were collected (11). In fact, we expect that more and more HIV-positive individuals will need better access to dental care and use more dental services.

Limitations of the ACSUS data reported by Berk et al. (17), and the steps taken to minimize them, are applicable to our study. ACSUS data were taken from a sample of patients, and therefore only include persons who had entered the medical care system. These patients, however, need not have entered the dental care system. The dental results therefore may be more generalizable than the medical results. Also, the study helps identify and understand which types of patients are more likely to experience problems with access and use of different dental services.

The use of specific dental services reported in this study were self-reported and, as previously discussed, no efforts were made to verify their responses with records from the individual's dental provider. The reliability of the data is therefore a concern. The results could be biased estimates, resulting in underestimation of the results. Unlike medicine, where an individual could get treatment in nontraditional settings, no such opportunity exists in dentistry.

To summarize, sociodemographic factors and those associated with medical care use were the main factors that predicted use of specific services in this study. Whites, individuals with more than a high school education, medical insurance, and those who received medical services such as ambulatory visits and psychological counseling were more likely to receive specific dental services compared to blacks, Hispanics, and individuals with an inpatient hospital admission. These results indicate that public policy with respect to the use of specific dental services should be similar to those that would be used in the general population. Thus public policy should seek to identify and remove barriers experienced by those who are of lower socioeconomic status, blacks or Hispanics, and those who lack health insurance. This strategy is particularly important in HIV disease, as the epidemic is increasingly affecting more individuals in these sociodemographic groups.

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PRESS RELEASE
AMERICAN BOARD OF DENTAL PUBLIC HEALTH DIPLOMATES

Dr. Robert H. Dumbaugh announced the names of the dentists who passed the certification examination given in April 2000 and who are now diplomates of the American Board of Dental Public Health. They are: Dr. Philippe A. Bilger, Wellington, Florida; Dr. Jeffrey Chaffin, Fort Sam Houston, Texas; Dr. Michael Mahshigian, San Francisco, California; Dr. H. Whitney Payne, Portland, Oregon; Dr. Edward S. Peters, Chestnut Hill, Massachusetts; Dr. James N. Sutherland, Highlands Ranch, Colorado; Dr. Jeanine R. Tucker, Chugiac, Alaska; and Dr. Maria Rosa Watson, Baltimore, Maryland.

The examination in 2001 will be held in Portland, Oregon, from April 27–29 at the Portland Marriott Hotel Downtown. The dates and place for the 2002 examination have not as yet been determined. The deadline for receiving applications for the 2001 examination is September 15, 2000. If declared board eligible, the case reports for the 2001 examination will be due January 1, 2001. Anyone desiring information about attaining board eligibility or to request an application form and supporting documents may contact Dr. Stanley Lotzkar, 1321 NW 47th Terrace, Gainesville, FL 32605 or by contacting him at stanl@atlantic.net or fax (352) 367-8430.

Dr. Dumbaugh also announced the new officers of the ABDPH. They are: Dr. Robert H. Dumbaugh, president; Dr. Brian A. Burt, vice president-auditor; Dr. Caswell A. Evans Jr., treasurer; Dr. Raymond A. Kuthy, director; Dr. Robert J. Collins Jr., director; and Dr. Teresa A. Dolan, director-elect.