Dental Care Access and Use Among HIV-Infected Women

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ABSTRACT

Objectives. This study sought to identify predictors of dental care use in HIV-infected women.

Methods. In a cross-sectional survey of HIV-infected women enrolled in the northern California site of the Women's Interagency HIV Study, dental care use and unmet need were assessed in relation to selected variables.

Results. Among 213 respondents, who were predominantly Black and younger than 45 years, 43% had not seen a dentist and 53% (among dentate women) reported no dental cleaning in more than a year (although 67% had dental insurance coverage, mainly state Medicaid). Nine percent were edentulous. Among nonusers of dental care, 78% reported that they wanted care but failed to get it. Barriers included fear of and discomfort with dentists, not getting around to making an appointment, and not knowing which dentist to visit. Multivariate analysis showed that lack of past-year dental care was associated mainly with unemployment, a perception of poor oral health, and edentulism.

Conclusions. HIV-positive women appear to be underusing dental care services. Fear and lack of information regarding available resources, in addition to unemployment and perception of poor oral health, may be important barriers. (*Am J Public Health.* 1999; 89:834–839)

The availability of effective treatments and prophylactic regimens to combat HIV-related opportunistic infections makes access to medical care essential for HIV-infected patients. Access to oral and dental care is also important. Inadequately functioning dentition resulting from decayed or missing teeth, periodontal disease, or oral soft tissue lesions may alter the quality of life and jeopardize the general health of medically compromised patients. Furthermore, preventive dental care is less expensive than treatment.[1–3] There is evidence, however, that many HIV-infected persons in the United States feel that they have unmet dental treatment needs. In a sample of 857 symptomatic HIV-infected persons from 9 US cities, more than half reported a need for dental care, and the demand for dental care was higher than for any other health-related service.[4] Dental care also ranked among the services in greatest unmet need in a study of 209 adults with HIV disease in California[5] and in a study of nearly 2000 adults recruited from 10 large US cities.[6] The majority of participants in these studies were men.

We conducted a survey of HIV-infected women residing in the San Francisco Bay area. Our main objectives were to determine the frequency with which the study population used dental care services and to explore this outcome in relation to several potential explanatory variables.

Methods

Study Sample

We recruited subjects for this cross-sectional survey from a group of 336 HIV-infected women enrolled in the northern California site of the Women's Interagency HIV Study from May 1, 1995, through August 31, 1996. The Women's Interagency HIV Study is a prospective multicenter investigation of the natural history of HIV infection among adult women in 5 large US cities with high AIDS prevalence. In northern California, HIV-infected participants were recruited at 4 San Francisco Bay area AIDS clinics that provide primary care services to a large proportion of women living with HIV infection in this region (University of California, San Francisco, Medical Center; San Francisco General Hospital; Alameda County Medical Center in Oakland; and Alta Bates Hospital in Berkeley).[7] Participants were also recruited from general medical clinics and other cohort studies, via word-of-mouth referral, through distribution of flyers and notices in local newsletters, and by personal contact made by outreach workers employed by a local advocacy organization (WORLD).

To determine the extent to which study participants were representative of HIV-infected women living in northern California and in the United States, we compared key characteristics between enrolled women and adult women among the reported AIDS cases in northern California (1994–1996) and the United States (through 1995). Overall, the study cohort was well matched to nationally and locally reported AIDS patients with respect to race, age, and his-

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tory of injection drug use (data available on request).

Participants in the Women's Interagency HIV Study are followed at 6-month intervals, and informed consent to take part in our survey was obtained by project assistants at the time of the baseline visit or at 1 of the first 2 follow-up visits.

Variables and Measurements

A trained interviewer administered a standardized questionnaire in a 25-minute telephone interview. For participants who did not have access to a telephone, we made arrangements for an interview via telephone at one of our study sites. After the interview, each participant received a small cash compensation ($10) and a brochure about clinics (by county of residence) that deliver free or low-fee dental care to HIV-infected patients. We designed the questionnaire to assess the frequency of and factors associated with use of both dental and medical care services over the 1-year period preceding the interview. We adapted measures of dental care use from the 1989 National Health Interview Survey[8] and the 1975/76 US population household survey conducted by the Center for Health Administrative Studies.[9] This report presents findings from the survey's dental care component.

We used the behavioral model developed by Andersen and colleagues, in which predisposing, enabling, and need variables are explored in relation to use of health care services over a given period of time.[10–13] The predisposing factors (which reflect an individual's propensity to seek care) measured in this survey were race, age, education, employment, family size, health status, health beliefs, and dental fear. The enabling variables we considered were annual income and dental insurance status. We assessed need through a series of questions on various oral disease symptoms experienced in the previous year, perceived oral health, and dentate status and use of dentures. The medical component of the questionnaire included a series of questions on health beliefs in relation to HIV that were adapted from an existing instrument.[14] We obtained data on general health status and most sociodemographic variables from the Women's Interagency HIV Study database.

TABLE 1—Characteristics of a Sample of HIV-Infected Women Recruited From the Northern California Women's Interagency HIV Study (n = 213)

Characteristic	Sample, No.[a] (%[b])	No Dental Use, %	P[c]
Predisposing variables			
Race/ethnicity			
Black (non-Hispanic)	115 (54)	50	
White (non-Hispanic)	64 (30)	33	
Hispanic	24 (11)	46	
Other/unknown	10 (5)	30	.1
Age, y			
19–34	69 (32)	45	
35–44	104 (49)	42	
45–60	40 (19)	43	.9
Education			
Less than high school	64 (30)	42	
High school graduate	83 (39)	45	
Some college	66 (31)	42	.9
Current employment			
Employed (part time or full time)	41 (19)	20	
Unemployed	171 (81)	49	.001
No. of children living with respondent			
0	154 (72)	42	
1	36 (17)	36	
≥2	23 (11)	65	.07
Injection drug use			
≤1 y ago	41 (19)	61	
>1 y ago, ≤15 y ago	89 (42)	34	
Never used	83 (39)	45	.01
AIDS-defining illness			
Current or past	47 (22)	41	
Never	166 (78)	51	.2
Enabling variables			
Annual household income, $			
≤6 000	46 (22)	59	
6 001 to 12 000	111 (54)	44	
>12 000	49 (24)	27	.006
Dental insurance			
Medi-Cal (California state Medicaid)	132 (63)	46	
Private insurance	9 (4)	33	
No coverage	69 (33)	38	.4
Need variables			
Perceived oral health			
Good to excellent	109 (51)	31	
Fair to poor	104 (49)	56	.001
Reported oral symptoms			
Yes	160 (75)	41	
No	53 (25)	49	.3
Dentate status			
All teeth missing	19 (9)	74	
Some teeth missing	124 (60)	39	
No teeth missing	63 (31)	43	.02

[a]May not sum to total sample size (n = 213) for certain characteristics because of missing data.
[b]May not sum to 100% because of rounding.
[c]χ^2 test.

Statistical Analysis

We used proportions to summarize sample characteristics and frequency of use of various dental care services, and we computed χ^2 tests to compare sociodemographic characteristics between the women from the local Women's Interagency HIV Study sample who did not participate in our survey and those who did. We also compared women interviewed via their home telephone with those interviewed through an internal telephone at our study site both in terms of their use of dental care in the previous year and in terms of various sociodemographic variables.

We used contingency table methods and χ^2 statistics to explore the association between use of dental care services in the previous year and predisposing, enabling, and need variables. To explore these associations while controlling for potential confounders, we fit logistic regression models to the following outcomes: (1) no use of dental care services vs 1 or more dental visits in the previous year and (2) no dental cleaning (as a proxy for lack of preventive dental care) vs 1 or more cleanings in the

previous year among dentate women. We also fit a logistic regression model to examine predictors of unmet dental need, which was measured by asking the respondents whether they had felt they needed dental care in the previous year but had failed to get it.

The initial logistic model for each outcome included all independent variables that were associated with the outcome at the .1 level of significance in the contingency table analysis, along with suspected confounders. We based model selection on comparison of deviances (using χ^2 tests) and on comparison of regression parameter estimates among nested models. We assessed goodness of fit with the Hosmer–Lemeshow statistical test.[15]

Results

Study Sample

Among 336 HIV-positive women enrolled in the Women's Interagency HIV Study, 249 (74%) agreed to participate in this survey, and we were able to reach 213 (63%) for an interview. Women from the interagency study who participated in our survey did not significantly differ from those who did not with respect to age ($P = .6$), injection drug use ($P = .6$), education ($P = .9$), employment status ($P = .1$), or health care insurance status ($P = .9$). The percentage of White women was slightly higher among our survey participants (30%) than among nonparticipants (20%; $P = .06$), whereas the percentage of women with an AIDS-defining illness was lower (participants, 22%; nonparticipants, 37%; $P = .002$). The 19 women interviewed through an internal telephone at our study site did not differ from the other respondents with respect to race ($P = .4$), age ($P = .8$), injection drug use ($P = .8$), history of AIDS-defining diagnoses ($P = .5$), employment status ($P = .8$), or annual income ($P = .5$).

Predisposing and Enabling Factors

Most respondents were Black (54%), were younger than 45 years (81%), and had a history of using injection drugs (61%) (Table 1). One third had not completed high school, while another third had some college education. Only 19% were employed. Most had no children who lived with them.

Seventy-two percent of the respondents had a CD4+ cell count of 200 cells/μL or higher (measured within 6 months of the interview), and 78% denied ever being diagnosed with an AIDS-defining illness (Table 1). When asked about their general health beliefs, 67% of respondents thought they were more likely to stay healthy than other women with HIV infection, and 62% reported that they worried more about other problems in their lives than about their HIV infection. When asked how they felt about going to the dentist, 33% indicated that they were anxious or scared (4% said they were "so scared that it almost made them physically sick").

More than three quarters of the respondents had an annual household income of $12 000 or less, and 67% had some dental insurance coverage, most often through Medi-Cal (the Medicaid program in California) (Table 1).

Dental Care Need

Half of the respondents perceived their oral health as fair or poor (Table 1). Two thirds reported that they had experienced pain in their mouth at least once in the previous year, and 75% reported a specific oral symptom (toothache, bleeding or painful gums, swelling, or soft tissue lesion). The majority (60%) reported that they were missing some teeth (other than wisdom teeth), and an additional 9% indicated that they were edentulous. Among respondents with 10 or more missing teeth, 35% were not wearing replacement appliances and 67% were younger than 45 years. Forty-two percent reported that they had had 1 or more teeth extracted during the previous year. Forty-three percent reported that, in the previous year, they had felt they needed dental care but had failed to get it. Finally, Medi-Cal recipients were more likely to be edentulous than women without public insurance (14% vs 1%; $P = .001$). Among those who had visited a dentist, women on Medi-Cal were more likely to have had teeth extracted in the previous year than non–Medi-Cal recipients (51% vs 29%; $P = .01$).

Use of Dental Care Services and Reported Barriers Among Nonusers

Forty-three percent of the respondents reported that they had not visited a dentist in more than 1 year (Table 2). The percentage of women who reported 3 or more visits in the previous year was much higher than the percentage who reported 1 visit (34% vs 8%). Forty-seven percent of dentate women and 79% of the dentate women who visited a dentist reported having had a professional dental cleaning during the previous year.

Among the 121 respondents who had received dental care in the previous year, 59% had visited a community clinic. Only 22% knew that their care was paid for by the Ryan White CARE (Comprehensive AIDS Resources Emergency) Fund,[16] and half of these women were Medi-Cal recipients. Eighty-four percent reported that they had informed the dentist of their HIV infection. Most (83%) indicated that they could usually obtain an appointment within 2 weeks of calling the clinic, and 92% reported that once they arrived at the clinic the average waiting time to see the dentist was less than 30 minutes. These variables did not differ in relation to insurance status. However, the percentage of women with private or no dental insurance who reported they had been visiting the same dental clinic for more than 1 year (81%) was much higher than that of Medi-Cal recipients (55%; $P = .004$). Furthermore, 61% of women with Medi-Cal coverage reported that they traveled for more than 30 minutes to get to their dental clinic, as compared with 42% of noninsured or privately insured women ($P = .04$).

Among those who had not received dental care in the previous year, 78% reported they had wanted care but failed to get it. When asked to select their main reason for not visiting a dentist, 27% indicated discomfort with or fear of dentists, 21% reported that they did not get around to making an appointment or did not know which dentist to visit, and 16% selected cost or problems with their insurance coverage. Some women reported a main reason other than the choices offered, including 6 (9% of nonusers) who said they felt discriminated against, or were uncomfortable with dental care, because of their positive HIV status.

Bivariate Analyses

The prevalence of nonuse of dental care services in the previous year did not differ among racial subgroups (Table 1). However, the percentage of nonuse was significantly higher among Blacks (50%) than among Whites (33%; $P = .03$) when the other subgroups were excluded from the comparison. Similarly, the proportion of nonuse was significantly higher among women who were unemployed (vs employed) and among those who perceived their oral health as being fair or poor (vs good or excellent) (Table 1). We also observed a high prevalence of nonuse (59% or higher) among women who had 2 or more children residing with them, women who had a recent history of injection drug use, women who had an annual income of $6000 or less, and women who were edentulous.

Dentate women who were unemployed, who were currently using injection drugs, or who perceived their oral health as being fair or poor were significantly less likely to have had a dental cleaning in the previous year than women who did not have these characteristics (Table 3). Among women who had not completed high school, those who had 2 or more children residing with them, and those with an annual income of $6000 or less, low percentages (35% or less) reported a

TABLE 2—Use of Dental Care Services in a Sample of HIV-Infected Women Recruited from the Northern California Women's Interagency HIV Study (n = 213)

	Sample, No.[a] (%[b])
Time since last dental visit, y	
<1	121 (57)
≥1–<2	44 (21)
≥2–<5	32 (15)
≥5	16 (8)
Never been to a dentist	0 (0)
Use of dental care in previous year	
No use	92 (43)
1 visit	17 (8)
2 visits	31 (15)
≥3 visits	73 (34)
Dental cleaning in previous year among dentate women	
No	99 (53)
Yes	88 (47)
Dental cleaning in previous year among dentate women who reported at least 1 visit to a dentist	
No	24 (21)
Yes	88 (79)

[a]May not sum to total sample size because of missing data.
[b]May not sum to 100% because of rounding.

dental cleaning in the previous year. The proportion of women who reported having had a dental cleaning in the previous year was no higher among Medi-Cal recipients than among women without coverage. Among the subgroup of dental care users, the comparison of women who reported a dental cleaning to those who did not revealed associations similar to those found for the overall group.

The prevalence of use of dental care in the previous year among women who were interviewed through an internal telephone at our study site did not differ from the prevalence among those interviewed through their home telephone (58% vs 57%; $P = .9$). The 2 groups also did not differ in relation to having received a dental cleaning in the previous year ($P = .4$).

Multivariate Analyses

A logistic regression model demonstrated that lack of dental care (Table 4; model 1) and not having had a dental cleaning (Table 4; model 2) in the preceding year were both associated with current unemployment, more concern for problems other than HIV infection, and a perception of poor oral health. Nonuse of dental care was also associated with edentulism and with having an annual household income of $6000 or less (Table 4; model 1). The association of each independent variable with dental care use was controlled for all other covariates included in the model as well as for identified confounders. Age, race, level of education, insurance status, history of AIDS-defining illness, and fear of dentists did not contribute significantly to either model 1 or model 2. The Hosmer–Lemeshow statistic revealed no evidence that model 1 ($P = .84$) or model 2 ($P = .72$) involved a poor fit to the data. Because use of dental care was substantially lower among edentulous women, we repeated the multivariate analysis among dentate women only; unemployment, more concern for problems other than HIV infection, and perception of poor oral health were still significantly associated with nonuse in the previous year.

The analysis that we conducted to explore unmet dental need revealed that the odds of not consulting a dentist when a respondent perceived an oral problem were 4 times higher in women who felt anxious or scared about dentists than in those who did not (Table 4; model 3). Women with an annual income of $12 000 or less and women who reported more concern for other problems in life than for HIV infection were also more likely to report an unmet dental need within the previous year. The Hosmer–Lemeshow statistic revealed no evidence of poor model fit ($P = .97$).

Discussion

In this sample of HIV-infected women, 43% had not visited a dentist in the previous year. This is comparable to proportions reported by other investigators in various populations.[17–21] However, the measure of past-year use vs nonuse may not accurately reflect use and access, because it does not take into account the type of care received (emergency visits vs routine care). The higher percentage of women who reported 3 or more dental visits in the previous year (34% vs 8% who reported 1 visit) may reflect a high number of emergency visits rather than better access. A measure of preventive dental care received in the previous year may be a better indicator of utilization and access.

Among the 132 Medi-Cal recipients in our sample, the low percentage of women who received a dental cleaning and the high prevalence of edentulism and past-year dental extractions are disturbing. In a comparison of the use of medical and dental care among Rhode Island residents, Kronenfeld[22] found that Medicaid recipients were significantly less likely to report a regular source of dental care than the other respondents. Damiano et al.[23] estimated that in the late 1980s, only 15% of general dentists in California accepted adults with Medi-Cal as new patients. They showed that Medi-Cal patients had to travel longer distances and that their wait for a first appointment was, overall, 40% longer than that among privately insured patients.

Another explanation for the low level of use among Medi-Cal recipients is that some may not be aware of their eligibility to receive basic dental care, including 1 cleaning per year. Because of their low income level, the majority of our respondents were eligible to receive free care under the Ryan White CARE Act.[16] Medi-Cal recipients who are HIV infected are also entitled to this benefit for procedures not covered under the state policy. Only 22% of past-year users reported that their care was paid for by the Ryan White CARE Fund. This percentage is likely to be somewhat underestimated because some women may not know that the dental care they received was funded by the Ryan White CARE Act. However, it suggests the need to better inform HIV-infected populations, their primary care providers, and social workers about available benefits. In addition, clinics that deliver free care to HIV-infected patients under the Ryan White CARE Act should be monitored with respect to factors that may interfere with easy access, such as waiting time for appointments and in the clinic, number and types of providers, and clinic policies regarding broken appointments. Finally, even though fees reimbursed to dentists for care given to Medi-Cal patients have increased since Damiano and colleagues published their report, there may be a need to further increase these reimbursements.

Previous studies have suggested high levels of unmet dental demand in HIV-infected populations in the United States,[4–6,24] and more than half of the nonusers in our study reported that in the previous year they had felt they

TABLE 3—Use of Preventive Dental Care Services in the Previous Year in a Sample of Dentate HIV-Infected Women Recruited From the Northern California Women's Interagency HIV Study (n = 187), by Sociodemographic and Health Characteristics

Characteristic	No.[a]	Dental Cleaning, %	P[b]
Predisposing variables			
Race/ethnicity			
Black (non-Hispanic)	98	39	
White (non-Hispanic)	59	54	
Hispanic	21	52	
Other/unknown	9	78	.05
Education			
Less than high school	53	34	
High school graduate	74	49	
Some college	60	57	.05
Current employment			
Employed (part time or full time)	40	73	
Unemployed	146	40	.001
No. of children living with respondent			
0	135	47	
1	32	56	
≥2	20	35	.3
Injection drug use			
≤1 y ago	33	21	
Never or >1 y ago	154	53	.001
AIDS-defining illness			
Current or past	37	35	
Never	150	50	.1
Enabling variables			
Annual household income, $			
≤6000	41	29	
6001 to 12000	92	43	
>12000	47	70	.001
Dental insurance			
Medi-Cal (California state Medicaid)	107	46	
Private insurance	9	67	
No coverage	68	49	.5
Need variables			
Perceived oral health			
Good to excellent	92	67	
Fair to poor	95	27	.001

[a]Edentulous women (n = 19) were excluded from this analysis, and data on edentulism were missing for 7 women.
[b]χ^2 test.

needed dental care but had not received it. Little is known about the barriers that interfere with access to dental care among HIV-infected persons. As stated by Grembowski and colleagues in their review of the dental care process, a wide variety of factors—behavioral, cultural, geographic, and structural—aside from the financial aspect influence an individual's ability to obtain care.[25] Therefore, evaluation of a population's access to care is complex, and numerous conceptual approaches have been proposed.[26]

We selected Andersen's model[10–13] to explain use of dental care among HIV-infected women because it is well recognized and has been used in many studies of health care utilization, including studies assessing dental care use.[19–21] Overall, these studies have shown that low income, low education, unemployment, being Black, having fewer teeth, having a negative attitude toward oral health, and being in poor general health are predictors of low dental care utilization. Similarly, our model revealed that the best predictors of nonuse of dental care in the previous year were edentulism, current unemployment, and having a perception of poor oral health. The odds of visiting a dentist or receiving a dental cleaning in the previous year were also lower among women who reported more concern for other problems in their lives than for HIV infection.

When we fitted a model to explain the high level of unmet dental need reported by our respondents, we found that fear of dental care and a lower income were strongly associated with this outcome. This is consistent with the respondents' choice of discomfort with or fear of dentists as the most common reason for not visiting a dentist when needed. Thus, fear and anxiety related to dental care appear to constitute a significant barrier in this group of high-need patients. In a previous study, dental anxiety was shown to be an important barrier to dental care use in an elderly population.[27] Another survey of 1010 randomly selected Seattle residents revealed that 25% of the women and 16% of the men interviewed reported a level of dental fear ranging from "somewhat afraid" to "terrified."[28] That study showed a high correlation between dental fear and low prevalence of use, delays in making appointments, and missed appointments. Furthermore, individuals with a high level of dental fear were more likely to perceive themselves in poor oral health and to be edentulous. These findings suggest a need to educate dental professionals, both through dental schools and through continuing education, in the management of patients with dental fear.

The main limitation of this survey is that even though our sample is representative of the larger group of women participating in the northern California Women's Interagency HIV Study with respect to sociodemographic characteristics, it is not necessarily representative of the general population of HIV-infected women and may reflect behaviors of only a select group with early-stage HIV disease. In an effort to broaden our sample representativeness, we are planning to extend this survey to the other Women's Interagency HIV Study sites (including 4 major US cities) and to conduct follow-up interviews to explore changes in dental care use patterns in relation to progression of HIV disease. This baseline survey, however, provides useful information for planning strategies to improve use of dental care by HIV-infected women at the local and regional levels. It suggests a need to better inform HIV-infected patients and their primary care providers regarding available benefits and to better educate dental professionals in managing fearful patients. There may also be a need to further increase Medi-Cal fees reimbursed to dentists, thereby encouraging providers to accept patients with Medi-Cal into their practices. □

Contributors

C. Shiboski and H. Palacio developed the study design and the survey instrument with R. Greenblatt, principal investigator of the Northern California Women's Interagency HIV Study; they also contributed to data collection and analysis. J. Neuhaus contributed to the analysis of the data. All 4 authors contributed to the interpretation of survey results and to writing the paper.

TABLE 4—Multivariate Analysis Examining Use of Dental Care Services and Unmet Dental Need in the Previous Year in a Sample of HIV-Infected Women Recruited from the Northern California Women's Interagency HIV Study (n = 213)

Predictor	Adjusted Odds Ratio	95% Confidence Interval	P
Model 1 (outcome: no dental visit vs 1 or more dental visits in previous year; n = 199)			
Predisposing variables			
Current unemployment	3.0	1.2, 8.0	.02
More concern for other problems than for HIV infection	2.1	1.1, 4.2	.03
Having ≥2 children at home	2.6	0.9, 8.0	.09
Enabling variables			
Annual income ≤$6000	2.5	1.1, 5.6	.03
Need variables			
Perception of poor oral health	2.5	1.3, 4.9	.007
Edentulism	4.4	1.4, 14.0	.01
Oral symptom in previous year	1.8	0.8, 4.0	.1
Model 2 (outcome: no dental cleaning vs 1 or more dental cleanings in previous year; n = 180)			
Predisposing variables			
Current unemployment	3.4	1.4, 7.9	.005
More concern for other problems than for HIV infection	2.7	1.3, 5.5	.007
Enabling variables			
Annual income ≤$6000	2.2	0.9, 5.3	.07
Need variables			
Perception of poor oral health	4.8	2.4, 9.4	<.001
Model 3 (outcome: unmet dental need vs no unmet need; n = 204)			
Feeling anxious or scared when going to the dentist	4.2	2.2, 8.2	<.001
Annual income ≤$6000[a]	5.8	2.2, 15.0	<.001
Annual income $6001 to $12000[a]	3.2	1.4, 7.2	.005
More concern for other problems than for HIV infection	1.8	0.9, 3.5	.07

Note. Some observations were excluded because data were missing for certain explanatory variables. Edentulous women were excluded from model 2. Hosmer–Lemeshow goodness of fit test: model 1, $P = .84$; model 2, $P = .72$; and model 3, $P = .97$.
[a]Relative to those with an annual income >$12000.

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The study protocol was approved by the Committee on Human Research at the University of California, San Francisco. All participants provided written informed consent at the time of enrollment.

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References

1. Oral Health Coordinating Committee, Public Health Service. Toward improving the oral health of Americans: an overview of oral health status, resources, and care delivery. *Public Health Rep.* 1993;108:657–672.
2. Gisselsson H, Birkhed D, Bjorn AL. Effect of a 3-year professional flossing program with chlorhexidine gel on approximal caries and cost of treatment in preschool children. *Caries Res.* 1994;28:394–399.
3. Holloway PJ, Clarkson JE. Cost:benefit of prevention in practice. *Int Dent J.* 1994;44:317–322.
4. Capilouto EI, Piette J, White BA, Fleishman J. Perceived need for dental care among persons living with acquired immunodeficiency syndrome. *Med Care.* 1991;29:745–754.
5. Lenker SL, Lubeck DP, Vosler A. Planning community-wide services for persons with HIV infection in an area of moderate incidence. *Public Health Rep.* 1993;108:285–293.
6. Bonuck KA, Arno PS, Green J, et al. Self-perceived unmet health care needs of persons enrolled in HIV care. *J Community Health.* 1996;21:183–198.
7. Kedes DH, Ganem D, Ameli N, Bacchetti P, Greenblatt R. The prevalence of serum antibody to human herpesvirus 8 (Kaposi sarcoma-associated herpesvirus) among HIV-seropositive and high-risk HIV-seronegative women. *JAMA.* 1997;277:478–481.
8. Chyba M. Questionnaires from the National Health Interview Survey, 1985–89. *Vital Health Stat 1.* 1993;No. 31:263–265.
9. National Opinion Research Center. Questionnaire. In: Aday LA, Andersen R, Fleming GV, eds. *Health Care in the US: Equitable for Whom?* Beverly Hills, Calif: Sage Publications; 1980:315–413.
10. Andersen RM. *A Behavioral Model of Families' Use of Health Services.* Chicago, Ill: Center for Health Administration Studies, University of Chicago; 1968. Research Series No. 25.
11. Aday LA. A framework for the study of access to medical care. In: Aday LA, Andersen RM, eds. *Development of Indices of Access to Medical Care.* Ann Arbor, Mich: Health Administration Press; 1975:1.
12. Andersen RM. Revisiting the behavioral model and access to medical care: does it matter? *J Health Soc Behav.* 1995;36:1–10.
13. Andersen RM, Davidson PL. Ethnicity, aging, and oral health outcomes: a conceptual framework. *Adv Dent Res.* 1997;11:203–209.
14. Gielen AC, Faden RR, O'Campo P, Kass N, Anderson J. Women's protective sexual behaviors: a test of the health belief model. *AIDS Educ Prev.* 1994;6:1–11.
15. Lemeshow S, Hosmer DW Jr. A review of goodness of fit statistics for use in the development of logistic regression models. *Am J Epidemiol.* 1982;115:92–106.
16. Schneider DA, Hardwick KS, Marconi KM, Niemcryk SJ, Bowen GS. Delivery of oral health care through the Ryan White CARE Act to people infected with HIV. *J Public Health Dent.* 1993;53:258–264.
17. Cook J, Owen P, Bender B, et al. Dental service use and dental insurance coverage—United States, Behavioral Risk Factor Surveillance System, 1995. *MMWR Morb Mortal Wkly Rep.* 1997;46:1199–1202.
18. Manski RJ, Goldfarb MM. Dental utilization for older Americans aged 55–75. *Gerodontology.* 1996;13:49–55.
19. Hayward RA, Meetz HK, Shapiro MF, Freeman HE. Utilization of dental services: 1986 patterns and trends. *J Public Health Dent.* 1989;49:147–152.
20. Newman JF, Gift HC. Regular pattern of preventive dental services—a measure of access. *Soc Sci Med.* 1992;35:997–1001.
21. Aday LA, Fortholer RN. A profile of Black and Hispanic subgroups' access to dental care: findings from the National Health Interview Survey. *J Public Health Dent.* 1992;52:210–215.
22. Kronenfeld J. Access to dental care. A comparison of medicine/dentistry and the role of regular care. *Med Care.* 1979;17:1000–1011.
23. Damiano PC, Brown ER, Johnson JD, Scheetz JP. *Access to Dental Care for Medi-Cal Recipients.* Berkeley, Calif: California Policy Seminars, University of California; 1990.
24. Greene VA, Chu SY, Diaz T, Schable B. Oral health problems and use of dental services among HIV-infected adults. *J Am Dent Assoc.* 1997;128:1417–1422.
25. Grembowski D, Andersen RM, Chen M. A public health model of the dental care process. *Med Care Rev.* 1989;46:439–496.
26. Petersen PE, Holst D. Utilization of dental care services. In: Cohen LK, Gift HC, eds. *Disease Prevention and Oral Health Promotion. Sociodental Sciences in Action.* Copenhagen, Denmark: Munksgaard; 1995:341–379.
27. Elter JR, Strauss RP, Beck JD. Assessing dental anxiety, dental care use and oral status in older adults. *J Am Dent Assoc.* 1997;128: 591–597.
28. Milgrom P, Fiset L, Melnick S, Weinstein P. The prevalence and practice management consequences of dental fear in a major US city. *J Am Dent Assoc.* 1988;116:641–647.