

The Effect of an HIV/AIDS Educational Program on the Knowledge, Attitudes, and Behaviors of Dental Professionals

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Abstract: The Pacific AIDS Education and Training Center (PAETC) developed and tested over time a curriculum to meet the changed HIV/AIDS-related needs of dental health professionals. The objective of this study was to evaluate the HIV-related knowledge, attitudes/beliefs, and behaviors among the participants of a CE training course based on this curriculum, both before and six weeks after the completion of the course. The project recruited 106 participants who were dental health professionals over a ten and a half year period (1992-2003). The dental participants consisted of 79 percent dentists and 21 percent dental hygienists or dental assistants. The sample was 67 percent male, 33 percent female, 45 percent Caucasian, and 24 percent Asian. An adapted questionnaire was used before and after the training to assess the educational needs of the participants and evaluate the success of the program in meeting those needs. Approximately 81 percent of the participants completed both questionnaires. After the course, the participants significantly changed their knowledge, attitudes/beliefs, and behaviors (65 percent, 86 percent, 55 percent respectively, all at $p=.0001$). Overall, the educational program was successful in increasing and promoting the HIV/AIDS-related knowledge and attitudes/beliefs of the participants and enhancing their commitment to infection control and HIV risk screening behaviors.

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Recent global statistics indicate that the human immunodeficiency virus (HIV) epidemic is not abating. The most recent available statistics for the year 2004 indicate that another 3.1 million lives were lost due to the Acquired Immuno-deficiency Syndrome (AIDS) epidemic. This number was offset by an estimated 4.9 million new human HIV infections. Thus the total estimated global number of people living with the virus is 39.4 million.¹ In the United States over one million people (estimates range from 1,039,000 to 1,185,000) are now living with HIV infection.² Since California is the most populous state in the United States and a frequent entry point for immigrants, the HIV/AIDS epidemic continues to pose one of state's most serious public health challenges. As of April 30, 2005, 136,944 Californians have been diagnosed with AIDS since 1981, and 79,777 (approximately 58 percent) of those individuals have died.³

Since the usual transmission modality for HIV is through an individual's contact with infected blood or other body fluids, it is essential that every effort

be made to protect both health care workers and patients from serious and potentially life-threatening exposure in dental practices.⁴ HIV transmission could occur from patient to dental provider, from dental provider to patient, and from one patient to another. The greatest opportunity for transmission is from a patient to a dental provider because of the provider's frequent exposure to patient blood and blood-contaminated saliva during dental procedures.⁵ The Centers for Disease Control and Prevention (CDC) estimated that, in the United States, up to 5,000 HIV exposures may occur annually among health care workers⁶; however, in the history of the HIV epidemic, there has been only one instance of HIV transmission from dental provider to patient.^{5,7}

Fears of occupational transmission of HIV may have a significant impact on infection control practices among health care workers.⁸ To help allay fears and remove barriers to care, the CDC introduced the concept of universal precautions: developing dental infection control protocols⁹ that focused primarily on reducing the risk of transmission of bloodborne

pathogens among dental health care personnel and patients. Newer CDC guidelines⁵ integrate and expand the elements of “universal precautions” into a standard of care designed to protect health care personnel and patients from pathogens that can be spread by blood or any other body fluid, excretion, or secretion. These new measures are called “Standard Precautions,” with resulting guidelines that promote a safe working environment and efforts to assist dental practices in developing and implementing infection control programs. The guidelines are critical in caring for all patients in every practice, but they must be accompanied by continuing education to improve compliance.¹⁰ The goal of the educational program described in this article was to develop a better understanding of infectious and bloodborne diseases and the medical/dental management of the care of infected dental patients.¹¹

The city of Los Angeles enacted the nation’s first AIDS antidiscrimination law in August 1985. Today, AIDS discrimination is illegal throughout the United States under the Americans with Disabilities Act of 1990 and the Federal Rehabilitation Act of 1973, as well as many state and local statutes. Dentists are legally required to treat all HIV-infected patients. For instance, asymptomatic HIV patients should never be refused care merely because they have HIV. Schulman states, “Asymptomatic patients, by definition, present no clinical situations as a result of their HIV infection that might be beyond the scope of a dentist’s competency and training.”¹² Furthermore, there are ethical and legal obligations among health care workers to protect patients in health care settings from any avoidable harm including exposure to HIV infection.⁴ However, the legal aspects of HIV-related issues such as HIV counseling, testing, and referral of an at-risk patient when suspicion is aroused by medical history and oral exam have not been extensively emphasized in most U.S. dental schools’ curricula.¹³

It is not a surprise then that many agree that there is a need for better professional education concerning HIV/AIDS throughout the world. A survey among dentists in California showed that dentists need and desire greater awareness and knowledge about AIDS and infection control.¹⁴ Another study among health professionals in Singapore found that many respondents have little knowledge of HIV/AIDS-related conditions and are unprepared to treat this population.¹⁵ Education about HIV-related patient issues including infection control training

and office protocols that assume all patients are potentially infectious has been called for in Japan.¹⁶ In the United States, most dental educators report a lack of confidence in the ability of graduating students to conduct HIV counseling, testing, and referral in dental practices and attributed this to insufficient training.¹³ More than that, only 65 percent of dental graduates consider HIV risk screening to be part of their professional role (vs. 48 percent of dental hygiene graduates). Interestingly, those students were more confident in their professional roles regarding other health screening or promotion activities such as cancer screening, tobacco cessation, and diet counseling.¹³

Throughout the epidemic, the importance of providing continuing dental education programs that cover a wide variety of topics relative to HIV (i.e., oral lesions, medical issues, medications, psychological changes, legal and ethical issues, risk assessment, and infection control principles) have been recommended.¹⁷ Programs housed in AIDS Education and Training Centers (AETCs), which were originally legislated by the 1987 appropriations bill of the United States Congress and further expanded by the Ryan White CARE Act of 1990, are mandated to provide training to dental providers among other members of the health care team. The AETCs currently support a network of eleven regional centers (and more than 130 local performance sites) that conduct targeted, multidisciplinary education and training programs for health care providers treating persons with HIV/AIDS. The AETCs, which serve all fifty states, the Virgin Islands, Puerto Rico, and the six U.S. Pacific jurisdictions, have a mission to improve the quality of life of patients living with HIV/AIDS through the provision of high-quality professional education and training.¹⁸

The Clinical Training Program for Dental Practitioners in the care of HIV-infected patients is one of the Pacific AETC’s (PAETC) activities. The overall goal of the program is to train dental practitioners to recognize the early, intermediate, and late oral signs and symptoms of HIV/AIDS infection, to manage all aspects of their patients’ oral health needs, and to understand the patients’ overall medical status, adherence practices, and mental health and behavioral issues so that the practitioner will be competent in providing quality care to HIV-infected patients.^{19,20} These mandates are met through a variety of programmatic activities that range from lectures of varying lengths delivered to audiences large or small from

one discipline or many to one-on-one consultation. Additionally, clinical mini-residencies were offered.

The purpose of this study was to evaluate the knowledge, attitudes/beliefs, and behaviors of dental practitioners before and after a clinical dental continuing education training program designed specifically for the care of HIV-infected patients. A questionnaire administered before the training program and approximately six weeks after the completion of the program has been used to conduct this program evaluation. The program was and continues to be conducted by the dental training component of the Pacific AIDS Education and Training Center (PAETC).

Methods

The continuing education curriculum for the training sessions was developed by a cadre of PAETC faculty and tested on dentists who were members of the PAETC Dental Steering Committee representing community clinics, county health facilities, dental school faculty, and private practitioners, all engaged in the care of HIV-infected patients. Once this group was satisfied that all topics relevant to the management of HIV-infected dental patients were clearly covered in the curriculum, the program was offered to the dental community (including dental students). Dentists, dental hygienists, and dental students learned of these Dental PAETC trainings through continuing education notices, postings on the PAETC website, mailings of specific brochures to those with D.D.S./D.M.D. and DH licenses, word of mouth, postings in dental society newsletters, etc. Although it was not a requirement, dentists were encouraged to bring their entire office staff for these trainings and were advised that we would request each attendee to complete pre- and post-test questionnaires to better direct the educational program to the participants' needs and assess the effectiveness of the course.

This questionnaire was developed to assess baseline knowledge, attitudes/beliefs, and behaviors of the enrollees and the impact of the training on these same elements. The questionnaire was based on materials published by Gerbert et al. that randomly surveyed dental providers in California on HIV dental care-related topics.^{14,21} For the questionnaire used in this project, we incorporated most of the questions used in the prior study as they were stated. A few of the questions were originally written as negative statements, and with advice from the Steering Committee, we rewrote most of those as positive

statements to avoid confusion. For example, "I do not know when to refer patients with AIDS to physicians for medical problems" was changed to "I know when to refer patients with AIDS to physicians for medical problems." Also, we included additional questions that were currently relevant to the HIV epidemic such as "Dental professionals should be part of the health care team for persons with AIDS," and we modified terminology where appropriate (e.g., changing "AIDS/ARC" to "HIV-infected" and "AIDS"). The questionnaire was used with all dental team members attending the training: dentists, dental hygienists, and their staff dental assistants, as well as dental students.

The questionnaire consisted of three sections. The first assessed knowledge of HIV/AIDS and at-risk populations. The second asked questions revealing the respondents' attitudes toward HIV/AIDS individuals and their beliefs in their related professional skills utilized when providing necessary dental care to those individuals. The third series of questions asked for a self-report of certain behaviors in their present routines, including specific infection control practices and screening for HIV risk.

The completion of the pre-training questionnaire was requested as a part of the registration for the training program. Although strongly encouraged, lack of completion of the pre- or post-test did not preclude an individual from enrolling in and attending the training program. All enrollees who agreed to participate in this program were asked to mail in their completed pre-test or to arrive at the training site thirty minutes early, whereupon they were given the pre-test. Once all pre-tests were completed and collected, the program began. The post-test was mailed out on average approximately six weeks subsequent to course attendance and followed by one phone call reminder if needed.

The questionnaire contained sixty-four questions. The participants were asked to evaluate thirty-five statements (the knowledge and attitudes/beliefs questions) on a Likert scale ranging from 1 to 7 (strongly disagree to strongly agree). The participant score is a simple nonweighted sum of the numerical evaluations for each statement on the 1-7 scale. The other twenty-nine questions dealt with self-reported behaviors and typically asked the subject to indicate whether or not he or she performed a certain activity. An index was developed to score the participants' HIV-related behaviors. Each positive behavior was given one point when there were only two options

(yes/no) in a behavioral statement such as “my infection control procedures include autoclaving or chemoclaving hand instruments.” If the options were ordinal, the point would be given only if the participant scored in the highest positive category for the behavioral statement such as “I asked for relevant medical history in 76-100% of the cases” (which was the highest option) compared to any other options with less than 75 percent of the cases. The participant’s behavioral score is the sum of the scores in each of these twenty-nine behavioral statements. To increase the discriminative power and to allow for comparisons with previous studies, percentages of the participants scoring on the different statements were calculated after collapsing the seven-level Likert scale into two levels (“strongly agree” vs. any other levels of agreement or disagreement). When the statement was negatively written, the two levels were “strongly disagree” vs. any other levels of agreement or disagreement.

The main goal of the analysis was to investigate the changes in the knowledge, attitudes/beliefs, and behaviors of the participants after attending the program and whether those changes were confounded by predictors such as type and level of dental education, type and site of practice, sex, age, ethnic background, and type/duration of the training received.

Participating dental students and participants who did not complete post-training questionnaires were excluded from all analysis. Descriptive statistics were generated including means, standard deviations, and medians for continuous variables, and their distributions were examined using histograms and Kolmogorov-Sminrov normality tests. Frequency tables were generated for categorical variables and analyzed using chi square procedures. Pearson’s and Spearman’s correlation coefficients, paired t-tests, Wilcoxon matched-pairs signed-ranks tests, Kruskal-Wallis tests, and McNemar tests were used as appropriate to compare the pre-test and post-test scores. SAS System v9.1© was used for data analysis.

The data subsequently reported in this article was collected over a ten and half year time frame from 1992 to 2003. During that time and as a result of feedback via the post-test questionnaire and consultations with the PAETC Dental Steering Committee, the program evolved from a four-day intensive program with a clinical component and multiple real and standardized patient interactions²⁰ to a one-day program that was typically didactic. The study was classified by the USC IRB as an in-house program

evaluation with approval unnecessary to retrospectively analyze the ten and a half year data set.

In our attempts to keep the training program relevant, the curriculum was changed considerably over the period being examined relative to the pedagogic style, content, and duration of training. In the late 1980s, our initial offerings were directed at dentists and consisted of one- or two-hour lectures focusing on dental management of HIV patients or all-day courses that provided a variety of different expert speakers covering disease progress and classification, dental management, recognition of common oral lesions and their treatments, and infection control topics, among others. However, we realized early on that the conventional lecture type of CE course was not adequate to improve the comfort level of practitioners relative to providing care to HIV-infected patients. As a result, we developed a four-day mini-residency program that would provide experiential components in addition to the didactic segments. Attendance and observation at HIV medical clinics, interaction of all attendees with a “standardized patient,” and supervised dental practice were added. The entire dental team was invited to attend these trainings so that dentists could actually interact with their own staff during the experiential components. The enrollment in these mini-residencies was kept small (six to eight people per mini-residency) in order to better facilitate the interchange between the faculty and the attendees in small group discussions and to handle the logistics of the standardized patient interaction and the clinical experiences. The faculty were all members of the PAETC team and recognized leaders in working with HIV-infected patients/clients.

This new curriculum was begun in 1992, and initially we offered the training on four consecutive days and provided twenty-eight continuing education credits. By 1995, we had modified the training so it would occur over a one-month period with the activities being arranged one day per week. The basic content of the mini-residency stayed the same although we did add two new segments: 1) a session on HIV antidiscrimination law led by the supervising attorney of the AIDS/HIV Discrimination Unit of the Los Angeles City Attorney’s Office; and 2) Internet searching of reputable sources so that practitioners could keep up with the latest developments in issues related to HIV once the course was over.

We continued this four-day mini-residency until the year 2000 when, in response to numerous requests for a shorter program, we returned to a one-

day course with a clinical observation segment. For these one-day clinical sessions we eliminated the medical clinic observation sessions and the standardized patient interaction. Instead, the clinical session became one in which faculty facilitated interaction between trainees and HIV-infected patients. These patients were invited to participate in the clinical education program because we knew from prior experiences that they had intraoral lesions and/or a willingness to talk about themselves and the impact of HIV on their lives, their goals and aspirations, their experiences in accessing dental care previously, and other relevant topics. As by this time the vast majority of HIV-infected patients were well controlled and modifications to dental therapy were much less of an issue, we were able to devote more time to other HIV-related topics such as the changing epidemiology of the disease; co-morbid findings including hepatitis and tuberculosis; the implications of other sexually transmitted diseases in the HIV-infected; laboratory tests and their meanings; retroviral medications, side effects, and adverse reactions; research data relative to the changing prevalence of oral lesions; HIV risk assessment and other behavioral issues such as adherence; and infection control protocols. We encouraged audience interaction with each speaker, all of whom were recognized experts in their relevant topics, through scheduling time for questions and answers and keeping speakers available after lectures and during breaks.

Our overall enrollment in the clinical trainings over the ten and a half years of this study equaled 279 trainees, with 130 attending the four-day residency and 149 attending the one-day course.

Results

The project was successful in recruiting 106 dental health professionals from August 1992 to March 2003 who completed the pre-test prior to participating in this PAETC dental training program. The response rate to the study evaluation was high with eighty-six participants (81 percent) returning their post-test forms. Most of the dental health professional participants were dentists (79 percent), and 21 percent were dental hygienists or dental assistants (DH/DA). Most of the dentists were general practitioners (68 percent), working in inner cities or urban areas (66 percent), and approximately one-third of the participants were women. Furthermore, 45 percent were Caucasian, 24 percent were Asian,

10 percent were African-American, and 21 percent were Hispanic (Table 1). Most of our subjects (46 percent) enrolled early in the clinical program of four days in one week; 22 percent enrolled later in the program of four days over one month; and after 2000, 32 percent enrolled in the one-day training program. Although the age range of the participants was between twenty-four and eighty years, the sample was dominated by relatively young participants and the median age was thirty-nine years. The mean age was forty-one years with a 95 percent confidence interval of 37.5-43.5 years.

Eighty-six percent of the dentists in our sample indicated that they had already treated HIV-infected patients before the educational program, whereas all DH or DAs had already treated or helped in the treatment of known HIV-infected patients. After our program, an additional six dentists or 9 percent of the participating dentists ($p=0.014$) indicated that they were treating HIV-infected patients, and the mean number of patients treated by the respondents according to their own best estimates rose from seventy-four to 142 among dentists ($p=0.076$) and from seventeen to sixty-three among DH/DA ($p=0.066$).

All configurations of the training program had a positive impact on the participants, which was unrelated to the type/duration of training received or enrollment time. Ninety-nine percent of the participants reported that they gained additional knowledge,

Table 1. The participants' characteristics

Variable	Category	N (total=86)	%
Degree	DDS or DMD	68	79.07
	DH or DA	18	20.93
Sex	Male	58	67.44
	Female	28	32.56
Ethnic Background	Caucasian	37	45.12
	African American	8	9.76
	Asian	20	24.39
	Hispanic	17	20.73
Type of Practice*	General Dentistry	45	68.18
	Others	21	31.82
Site of Practice*	Rural	8	12.90
	Suburban	13	20.97
	Urban	19	30.65
	Inner City	22	35.48

*Dentists only

acquired more positive attitudes/beliefs, or improved their infection control or HIV risk screening behaviors. However, only 31 percent of the participants improved simultaneously and not necessarily equivalently in all of these three areas.

Knowledge

The participants had a high (positive) baseline level of HIV-related knowledge. At pre-testing, participants reached 90 percent of the maximum possible score in the knowledge section of our instrument. After the educational program, 65 percent of the participants demonstrated improvement in terms of their HIV-related knowledge. The participants scored a statistically significant 3.23 points higher in the knowledge section of the instrument ($p=0.0001$) (Table 2).

There were no statistically significant differences between the dentists and DH/DAs in terms of their levels of improvement after the program. However, the DH/DAs' HIV-related knowledge at baseline was higher than this knowledge among dentists (81.10 vs. 85.17 points; $p=0.036$).

Improvement after the training varied in relation to the different components of the HIV-related knowledge questionnaire. For example, an additional 16 percent of the participants knew that a positive antibody test means that a person has been exposed to the AIDS virus ($p=0.002$), and an additional 15 percent believed that the sexual partners of hemophiliacs were at increased risk for AIDS ($p=0.009$). Changes in knowledge related to the transmission of the AIDS virus in saliva also reflected a positive change toward more accurate information ($p=0.003$) (Table 3).

Attitudes and Beliefs in Related Professional Skills

The attitudes/beliefs section demonstrated the most substantial change among the three components of the pre- and post-tests. The participants began with a moderately high baseline level of positive HIV-related attitudes/beliefs, achieving 77 percent of the maximum possible score in this section. After the educational program, 86 percent of the participants had changed their attitudes/beliefs toward HIV-related practices and HIV-infected patients. On the post-test, the participants scored 12.33 points higher in the attitudes/beliefs section of the instrument, which represented a statistically significant change ($p=0.0001$) (Table 2).

There was no statistically significant difference between the dentists and DH/DA in terms of their baseline scores before the program or their levels of change after the program. However, the attitudes/beliefs of general practitioners toward HIV-related issues changed more than those of specialists (15.4 vs. 9.3 points; $p=0.036$). The HIV-related attitudes/beliefs of Asian respondents changed significantly and more than Caucasians (18.25 points vs. 10.97 points; $p=0.031$) and Hispanic and other minority groups (18.25 points vs. 7.35 points; $p=0.004$). Attitudinal changes after the training varied in relation to the different topics. For example, an additional 43 percent of the participants strongly agreed that they now believed they knew when to refer AIDS patients to a physician ($p=0.0001$), and an additional 40 percent strongly agreed that they now knew how to screen for HIV ($p=0.0001$), while an increase of

Table 2. The participants' pre- and post-test scores and the percentages of those who changed in the predicted direction

	Variable	Percentage of Participants Who Changed in the Predicted Direction	Mean	SD	Median	p-value (t-test or sign test)
Knowledge	Pre-Test	-	81.95	7.57	84.00	-
	Post-Test	-	85.19	6.92	87.50	-
	Change	65.12%	3.23	6.99	3.00	0.0001
Attitudes/Beliefs	Pre-Test	-	118.40	14.68	120.00	-
	Post-Test	-	130.72	12.06	131.00	-
	Change	86.05%	12.33	12.00	12.50	0.0001
Behaviors	Pre-Test	-	23.30	2.68	24	-
	Post-Test	-	24.68	2.18	25	-
	Change	54.65%	1.38	2.56	1	0.0001

*Maximum desired changes are 31, 39, and 14 points for the knowledge, attitudes/beliefs, and behaviors respectively.

Table 3. Pre- and post-test differences in the percentages of participants who scored the most desired answer on the knowledge and attitude sections of the questionnaire (T=True, F=False)

Statements	% Diff	Sig.	p-value
Knowledge			
The AIDS virus can be transmitted through saliva. (F)	17.44	**	0.003
A positive antibody test means that a person has been exposed to the AIDS virus. (T)	16.28	**	0.002
The sexual partners of hemophiliacs are at increased risk for AIDS. (T)	15.12	**	0.009
Reducing the number of sexual partners overall will help reduce risk of contracting AIDS. (T)	12.79	*	0.016
Dental infection control measures for Hepatitis B provide adequate protection against transmission of the AIDS virus. (T)	12.79	*	0.028
The virus HIV is the cause of AIDS. (T)	11.62	*	0.012
Oral manifestations of AIDS include lesions of Kaposi's sarcoma characterized by red, blue, or purple plaques or nodules. (T)	10.46	**	0.007
"Hairy" leukoplakia is white with a corrugated or hairy surface. (T)	8.14		0.144
Individuals at risk for contracting AIDS include hemophiliacs, homosexual and bisexual men, and intravenous drug users. (T)	8.14	*	0.035
AIDS virus infection has occurred among all age groups for the population at risk. (T)	8.14		0.144
The AIDS virus infection is transmitted in semen. (T)	3.49		0.317
Hemophiliacs may have been exposed to the AIDS virus. (T)	3.49		0.467
Attitudes			
Intravenous drug users who share needles are at increased risk for contracting AIDS. (T)	-1.17		0.564
I know when to refer patients with AIDS to physicians for medical problems (nondental). (T)	43.03	***	0.0001
I know how to screen for HIV. (T)	39.53	***	0.0001
I do not know how to determine if patients are at risk for HIV. (F)	34.89	***	0.0001
I already have the skills I need to effectively and safely treat people with HIV and AIDS. (T)	29.07	***	0.0001
I have a right to ask patients about their sexual practices or preferences. (T)	25.58	***	0.0001
I am willing to work with staff who are fearful of AIDS and HIV-infected patients. (T)	18.61	**	0.002
I would be fearful if I had to treat persons with HIV. (F)	16.28	**	0.001
Due to blood screening procedures, there is now little risk of exposure to the AIDS virus via blood transmissions. (T)	15.12	*	0.02
I don't want to accept as patients people in the AIDS high risk groups, e.g., IV drug users, homosexuals, hemophiliacs. (F)	15.11	**	0.005
I prefer to refer persons at risk for HIV or persons with HIV to other dental professionals. (F)	11.63	*	0.012
Working effectively with persons with HIV requires interpersonal skills many dental personnel lack. (T)	11.63	*	0.041
I would feel at risk for HIV if I had to treat persons with HIV. (F)	10.47	*	0.039
Infection control procedures will be a financial burden to my office. (F)	10.46	*	0.05
If I treat people with HIV and AIDS, my other patients may be reluctant to continue in my care. (F)	9.3		0.059
I feel an obligation to do a thorough oral screening with persons at risk for AIDS. (T)	8.14		0.108
Dental professionals have a responsibility to treat people with HIV and AIDS and those at risk. (T)	8.14		0.071
If I treated patients with HIV and AIDS, I would be placed at increased risk. (F)	6.98		0.134
It would be difficult to deal with staff fears about patients with AIDS. (F)	6.98		0.109
Dental professionals have the right to ask patients whether they have taken the AIDS antibody test and, if so, what the results were. (T)	6.97		0.289
People with AIDS or the AIDS virus should be quarantined. (F)	4.65		0.157
Dental professionals should be part of the health care team for persons with AIDS. (T)	4.65		0.206
I need to learn all I can about infection control. (T)	0		1

Statements are answered on a Likert scale from 1 to 7.
 *significant at .05; **significant at .01; ***significant at .001

35 percent of the participants strongly disagreed that they did not know how to determine if patients are at risk for HIV ($p=0.0001$).

Behaviors

The measured behaviors among participants were related to infection control procedures and the practitioner's performed activities to screen for HIV risk (Table 4). The participants also had a relatively high baseline level for behaviors pertinent to treatment of HIV-infected patients (80 percent of the maximum possible score in the behaviors section). After the educational program, 55 percent of the participants reported that they used infection control procedures more frequently or started to apply the principles of HIV risk screening to their patients. The participants scored a statistically significant 1.38 points higher after the training in the behaviors section of the instrument ($p=0.0001$) (Table 2). There were no statistically significant differences between the dentists and DH/DAs in terms of their baseline scores before the program or their levels of improvement after the program. The changes in behaviors scores trended toward being slightly and negatively associated with age (i.e., the greater the age of the dentist, the lower the behavioral score) ($p=0.062$) with Spearman's correlation coefficient of 25.

More than 90 percent of the dentists and DH/DAs reported that they employed infection control procedures pre- and post-test with all types of patients including those who are not known to be at risk, those who are at risk, and those who are already HIV-infected. At the pre-test, more than 90 percent of the dentists reported that they were committed to infection control procedures except for the frequent laundering of gowns (82 percent), wearing protective garments (87 percent), and immediate disposing of needles used for injections (88 percent). Approximately 75 percent reported screening of patients. At post-testing, more than 90 percent of dentists reported that they adhered to all of the control procedures with wearing of protective garments reaching a statistically significant level of change with a p -value of 0.034. However, at the post-test, only 82 percent of the dentists reported screening of patients, which represented a small change from pre-testing. There were no significant changes in the hygienists' or assistants' scores in the infection control area whether analyzed jointly or separately.

The program promoted the application of HIV risk screening principles as well, with 44 percent of

the dentists asking the patients if they feel at risk for HIV after the training compared to 29 percent at baseline ($p=0.033$). Thorough exploration of the patients' past use of recreational drugs became a more common practice after the training (50 percent vs. 22 percent with a p -value of 0.0003) (Table 4). No significant findings were found among the DHs in this area of screening. Also, the DAs' responses in this area were not analyzed due to the lack of applicability of some screening actions to their scope of work.

Discussion

Our continuing education program was effective in changing the knowledge, attitudes/beliefs, and behaviors for most of the participants in the desired direction. The range of changes/improvement that the participants achieved in each or all areas of their HIV-related knowledge, attitudes/beliefs, and behaviors is likely a reflection of the diversity of their background, education, and experience. Our sample represents dental professionals from different sociodemographic backgrounds and levels of clinical expertise; however, we appreciate the fact that those dentists working in rural areas were less represented in our study than dentists from urban and suburban areas (rural dentists represented 13 percent of the participants). There were no gender differences between dentists and DH/DAs in their HIV-related knowledge, attitudes/beliefs, or behaviors. This supports the earlier statewide survey among dental health professionals in California that found that the attitudes toward HIV/AIDS-related issues did not differ by gender and that dentists and dental hygienists shared the same level of attitudes toward HIV-related matters.²¹

Since the program did not have eligibility or selection criteria beyond being a member of the dental profession for those who participated in the training, we tend to believe that those who participated had a higher level of interest in improving their expertise in caring for HIV/AIDS patients than the general population of dental professionals; therefore, our results at baseline might be positively biased. This argument could be supported by the fact the program impact on the respondents was not different by the type of training received or enrollment time throughout the program. An additional limitation of our study is the small numbers of participating dental hygienists and dental assistants. In our analysis, we combined these two groups of participants, thus possibly obscuring

Table 4. Frequencies and percentages of participants who perform infection control procedures/HIV risk screening by type of dental professional

Components of the Behavioral Evaluation	DDS or DMD		Dental Auxiliaries+	
	Pre N (%)	Post N (%)	Pre N (%)	Post N (%)
Infection Control Procedures				
Autoclaving or chemoclaving hand instruments	66 (97)	66 (97)	18 (100)	18 (100)
Autoclaving or chemoclaving handpieces and attachments	65 (96)	66 (97)	17 (94)	18 (100)
Using disposables whenever possible	63 (93)	66 (97)	18 (100)	17 (94)
Frequent laundering of gowns, jackets, etc.	56 (82)	61 (90)	15 (83)	14 (78)
Screening of patients	51 (75)	56 (82)	16 (89)	15 (83)
Wearing protective gloves	65 (96)	67 (99)	18 (100)	18 (100)
Wearing protective garments*	59 (87)	65 (96)	18 (100)	18 (100)
Wearing a mask for splash procedures	65 (96)	65 (96)	18 (100)	18 (100)
Wearing eye protection for splash procedures	65 (96)	67 (99)	17 (94)	18 (100)
Immediately disposing of needles used for injections	60 (88)	61 (90)	17 (94)	17 (94)
Changing gloves after each patient	64 (94)	67 (99)	18 (100)	18 (100)
Covering light handles or disinfecting them when touched	63 (93)	65 (96)	17 (94)	17 (94)
Washing hands before putting on gloves	62 (91)	66 (97)	15 (83)	17 (94)
Washing hands after removing gloves	65 (96)	67 (99)	17 (94)	18 (100)
Disinfecting counter tops	64 (94)	67 (99)	17 (94)	18 (100)
HIV Risk Screening				
I ask patients if they feel at risk for HIV.*	20 (29)	30 (44)	0 (0)	3 (33)
I do not screen patients for HIV.	8 (12)	4 (6)	0 (0)	1 (11)
I list for patients in the high-risk groups for AIDS and ask them if they belong to any of the groups.	10 (15)	13 (19)	2 (22)	2 (22)
I get a thorough sexual history.	3 (4)	7 (10)	0 (0)	0 (0)
I get a thorough history of the patient's use of recreational drugs.**	15 (22)	34 (50)	1 (11)	1 (11)
I get a thorough medical history.	59 (87)	63 (93)	9 (100)	9 (100)
I do a thorough oral screening in case symptoms of HIV are present.	46 (68)	53 (78)	7 (78)	7 (78)
I believe that screening for HIV is not necessary in my practice.	3 (4)	2 (3)	1 (11)	0 (0)

*Dental auxiliaries include DH/DA for the infection control procedures section and DH only for the screening components section.

*Sig. at 0.05 (for changes among dentists or DH after the training).

**Sig. at 0.001 (for changes among dentists after the training).

similarities or differences between dentists and dental hygienists in particular.

Given that our sample had greater representations of minority dentists than the 2001 nationwide estimation of active dentists described by Valachovic,²² we were most interested in comparing our population's baseline scores with the statewide population surveyed using the first version of this questionnaire.¹⁴ Since we incorporated a number of changes into the questionnaire as previously described, we were not able to compare the questionnaires exactly. Instead we chose to examine the

three questions in our study that demonstrated the greatest change in the percentage of participants who chose what we considered to be the most desirable answer (strongly agree or strongly disagree) between pre- and post-test. The largest change in a desirable direction (43.03 percent) occurred for the attitudes/beliefs statement, "I know when to refer patients with AIDS to physicians for medical problems." In the original survey by Gerbert, which used the negative form of the statement ["I do not know when to refer patients with AIDS to physicians for medical problems (nondental)"], 30.8 percent of the participants

chose a category on the Likert scale indicating some level of agreement (slightly, moderately, or strongly) compared to 22.1 percent of the participants in our study at baseline and 0 percent after the training who indicated that they did not know at these same levels when to refer a patient with AIDS to physicians.

Our education program had a major effect on the participants' ability to screen for HIV-infected patients as measured by the pre-test/post-test differences in scores for the statement "I know how to screen for HIV" that resulted in 39.5 percent of the participants responding more positively (or strongly agreeing) on the post-test to this question than they had on the pre-test (from 19.8 percent to 59.3 percent; $p=0.0001$). Our statement is the reciprocal of Gerbert's original question ("I do not know how to screen for AIDS/ARC").¹⁴ Collapsing the three categories of agreement into one score, Gerbert found that 46.2 percent did not know how to screen for HIV vs. our finding of 30.2 percent at baseline and 5.8 percent after the training. This question measured one of the most important goals of the training program and resulted in one of the highest improvements in the knowledge and attitudes/beliefs section of the instrument. Since one of our major goals is to train more dentists in the recognition of the signs and symptoms of HIV infection in this continuing epidemic, we feel it is a major success of our program that there was a nearly 40 percent improvement for those who completed the PAETC dental training course in their confidence in screening patients for HIV risk.

The third question with the greatest change between pre- and post-test scores in our study (34.89 percent; $p=0.0001$) was "I do not know how to determine if patients are at risk for HIV." This question was not worded differently from that presented in the original questionnaire by Gerbert in which 49 percent of the study population agreed that they did not have the skills needed to assess risk for HIV.¹⁴ In the current study, 18.6 percent of the participants reported that they were not able to determine if a patient was at risk for HIV at baseline, and 7 percent felt that way after the training, again collapsing the slightly, moderately, and strongly agree categories.

Whether the higher baseline scores of our population as compared to those scores in the original study by Gerbert¹⁴ were due to the higher presence of minorities, the length of time that elapsed during data collection versus when the prior study was accomplished, or simply the lack of representativeness of our self-selected population is unknown. Certainly, over the length of the epidemic, it would

be anticipated that practitioners' grasp of knowledge, professional attitudes/beliefs, and behaviors would become more positive toward HIV-infected patients as more scientific information about the disease occurs in professional schools and journal articles and more practitioners role model treatment provision. Given all these developments, higher baseline performance scores of our respondents relative to Gerbert's were expected. In fact, we were concerned that many practitioners would begin the program so well versed in many aspects of HIV/AIDS content and patient management principles that it would be unlikely to see desired changes simultaneously in all areas of knowledge, attitudes/beliefs, and behaviors. Yet we did find statistically significant desired changes in all three for 31 percent of the respondents. Interestingly the attitudes/beliefs section started with the lowest baseline value of 77 percent of the maximum possible score and showed the largest increase (12.33 points) in the post-test score results, reflecting an improvement in the practitioner's comfort in knowing when to refer to physicians for medical problems and how to screen for HIV, including assessing risk. As previously reported, it was these questions that resulted in the biggest differences between pre-test and post-test scores for the entire survey. Although one can find information on infection control and basic medical facts about HIV/AIDS in other CE courses, it is less likely that issues affecting attitudes/beliefs related to caring for HIV/AIDS patients are dealt with in detail outside of AETC-sponsored programs. Therefore the significantly more positive attitudinal outcomes suggest that the attendees to our programs appear to have absorbed this message.

The finding that, during the period of the study, best estimates of the numbers of HIV/AIDS patients treated by the practitioners approximately doubled for the dentists and nearly quadrupled for the dental hygienists may in fact be a reflection of a greater awareness of the diversity of people infected or suspected to be infected with the HIV virus rather than a vastly expanded HIV/AIDS patient population base. As is true with all self-reported retrospective data relying on the respondent's memory, it should be viewed conservatively.

Although the HIV/AIDS epidemic has been with us for over twenty years, studies continue to demonstrate that knowledge, attitudes/beliefs, and behaviors about HIV/AIDS among dental professionals varies by location, time, and population, with some dental practitioners more knowledgeable and

more willing to treat HIV/AIDS patients than they were in previous years or than their colleagues in different geographic areas seem to be.^{23,24} Often knowledge, attitudes, and behaviors are influenced more by the media than by professional training, thus resulting in practitioners who are hesitant to perform dental treatment on HIV-infected patients.²⁵ Educational training courses in HIV and AIDS have been found to be valuable in improving the dental care providers' knowledge of HIV and its oral manifestations, promoting more positive attitudes of providing care towards HIV-infected patients, and improving the dental care providers' infection control practices.^{26,27} HIV/AIDS-related continuing education courses also improve the participants' ability to communicate with HIV-infected patients and to counsel staff who are reluctant to provide treatment.²⁶ From the patient's perspective, training of dentists and other dental personnel to interact with HIV/AIDS patients reduces patients' psychological distress and helps to manage any physical discomfort.²⁸

Age- and population-based differences need to be considered in planning educational programs in the care of HIV-infected patients. A Canadian study found that although dentists over sixty years old had the highest compliance with hand washing, they were the least compliant with other infection control procedures such as the sterilization of handpieces, the use of rubber dams, and HBV immunization. However, this group was more concerned about infection control among HIV-infected patients than were younger dentists.²⁹ In our study, there was a nonsignificant trend toward age being implicated as a factor in the behavioral findings, with those practitioners of older ages being slightly less likely to reply positively to the behavioral questions. This lack of statistical significance may be due to the preponderance of younger practitioners in the study.

Despite the rapid development in the HIV-related knowledge and health practices from 1992 to 2003, the use of the same instrument for a long period of time may have limited our ability to detect more significant effects of the program. The fact that we were able to discover a number of significant outcomes as a direct result of our regularly revised training program indicates that many of the basic statements used in our instrument were valuable in assessing the effectiveness of these types of programs based on the pre-test/post-test methodology. We do however recommend that programs conducting training activities over prolonged periods regularly review any assessment instrument utilized and include ques-

tions concerning new knowledge, societal changes in attitudes/beliefs, and advances in practices.

The overall positive findings in all three areas of knowledge, attitudes/beliefs, and behaviors lend validation to the impact of the PAETC Dental Clinical Training Program. This data should be replicated through additional studies that employ other data collection methods such as observation, chart reviews, interviews, etc. instead of relying solely on self-reported responses.

The HIV/AIDS epidemic continues seemingly unabated, but the mysteries related to the biology of the disease are being unraveled, and complicated medical treatment protocols are now being adopted. However, of equal importance is the need to provide care for HIV patients who are living longer as a result of medical treatment innovations such as HAART (Highly Active Antiretroviral Therapy) and attempting to maintain their overall health, including their oral health. In addition to training received during professional school, it is necessary to have multi-dimensional continuing education initiatives that will increase the knowledge of dental professionals about the condition and promote more positive attitudes and behaviors toward HIV/AIDS patients, thus ensuring that HIV-infected patients will receive the very best oral health care.

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