

Dental Students' HIV/AIDS-Related Knowledge, Attitudes, and Intentions: Impact of the U.S. Health Resources and Services Administration's Community-Based Dental Partnership Program

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Abstract: Access to oral health care for vulnerable populations is one of the concerns addressed by the U.S. Health Resources and Services Administration HIV/AIDS Bureau's Community-Based Dental Partnership Program (CBDPP). The program introduces dental students and residents at several dental schools to care for vulnerable patients through didactic and clinical work in community-based dental settings. This study of the dental students and residents in this program answered three questions: 1) What are their HIV knowledge, attitudes, and behaviors? 2) How has participation in the CBDPP impacted their knowledge, attitudes, and behaviors? 3) Has the intervention affected their work placement decisions and attitudes after graduation, particularly with respect to treating people living with HIV and other underserved populations? A total of 305 first- through fourth-year dental students and first- and second-year residents at five dental schools across the United States completed surveys before and after a community-based rotation and following graduation. Response rates at each of the five schools ranged from 82.4 to 100 percent. The results showed an increase in the participants' knowledge and positive attitudes regarding treatment for patients with HIV and other vulnerable populations post-rotation compared to pre-rotation. Results after graduation found that most respondents were practicing in private settings or in academic institutions as residents but were willing to treat a diverse patient population. These findings support the role of training programs, such as the CBDPP, for expanding the dental workforce to treating vulnerable populations including people living with HIV/AIDS.

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Access to adequate oral health care is a struggle for many Americans—the most vulnerable including minorities, people with special health care needs, the uninsured and publicly insured, the homeless, and those in lower

socioeconomic brackets.¹ People living with HIV/AIDS (PLWHA) are included in these vulnerable populations. Based on a statewide needs assessment of patients receiving their services, Ryan White HIV/AIDS programs “consistently rate dental care

as a top unmet need” in the HIV/AIDS population.² Likewise, in a recent national study, 48.2 percent of 2,469 HIV-positive patients experienced unmet oral health needs.³ Several barriers contributed to this unmet need. Almost 54 percent reported they could not afford going to the dentist at all, while another 8.6 percent could not find an HIV-friendly dentist; 65.0 percent had no dental insurance, 20.6 percent had not visited a dentist for over five years, and 38.6 percent had no usual place for dental care.³

Workforce knowledge, attitudes, and intentions regarding vulnerable populations can have an effect on the oral care of PLWHA. However, studies have shown that those working in or pursuing careers in oral health care may have a lack of knowledge and negative attitudes toward treating vulnerable populations. In Seacat and Inglehart’s 2003 report, 44.3 percent of dental (N=315) and dental hygiene (N=89) students surveyed either did not answer or answered incorrectly questions regarding the oral manifestations of AIDS.⁴ Also, 58.4 percent of those students incorrectly answered questions regarding risk of infection from a needle stick. In 2012, Myers et al. reported that only 34.1 percent and 19.7 percent of dental students (N=220) “were able to correctly quantify the risk of HIV transmission from a needle stick injury or a mucous membrane exposure, respectively.”⁵

Many studies have analyzed the attitudes of dental providers, including one in which fewer than half of the dentists surveyed (N=330) reported they would accept PLWHAs as patients with “no hesitation,” 34 percent said they were “‘worried’ about occupational exposure to HIV infection,” and 34 percent were either undecided or disagreed that they had an “ethical responsibility to provide dental care to an HIV-positive person.”⁶ In Seacat and Inglehart’s study, 45.5 percent of students (N=404) believed that patients may leave their practice if they find out that PLWHA are treated there, while 29.5 percent were concerned that they may contract an infectious communicable disease from these patients.⁴ Conversely, 79.6 percent of the same sample believed that dentists have an obligation to treat PLWHA. Another study found that “only 65 percent of dental graduates (N=86) consider HIV risk screening to be part of their professional role.”⁷ More recently, Myers et al. found that 8.2 percent of dental students surveyed (N=220) “acknowledged an unwillingness to perform procedures on patients with HIV.”⁵

However, there is evidence suggesting that dentists’ attitudes toward treating vulnerable popula-

tions can be influenced by appropriate experiences and training. A review of the literature on disparities in oral health education found that “personal experiences with family members or friends on Medicaid before entering dental school, as well as experiences during dental school, can have a positive effect on how comfortable dentists are when treating Medicaid patients.”⁸ In another study, dentists and dental students were surveyed to determine how educational preparation correlated to intention to treat underserved patients.⁹ This study found that although 50.0 percent of the students (N=328) had an intention to treat underserved populations, only 37.0 percent of the alumni (N=234), a separate sample, actually treated these patients. Likewise, only 35 percent of these alumni compared to 41 percent of the students reported feeling their dental education prepared them to treat underserved populations. This study also found significant correlations between the students’ and graduates’ perceptions of their education and their attitude toward treating vulnerable populations. The frequency of exposure to underserved patients also positively correlated with the willingness to treat this population in their dental careers. Likewise, in Seacat and Inglehart’s study, dental and dental hygiene students were surveyed regarding their educational preparation, knowledge, and attitudes about treating PLWHA.⁴ On average, the students reported having one to two classes in treating patients with infectious diseases. One significant finding was that the greater number of courses correlated with less negative attitudes toward treating PLWHA. These researchers also discovered that students who knew someone who is HIV-positive were less likely to have a negative attitude and more likely to have a professional attitude toward treating PLWHA. In fact, a 2011 Institute of Medicine report suggested that “providing students with clinical exposure in community-based settings increases the likelihood that students may return to such settings in their future careers and improves their comfort level with caring for vulnerable and underserved populations.”¹¹

The high unmet need for oral health care has also been attributed to individuals’ inability to find a dentist who accepts patients with public insurance or communication difficulties, such as health literacy or language barriers.⁸ The dental workforce is not designed to easily serve the needs of vulnerable patients, such as those living with HIV and the uninsured or underinsured. In fact, fewer than 1 percent of active dentists worked in a public health

setting in 1998,¹ and in 2010, 84 percent of dentists did not participate in “government-sponsored dental coverage plans, which are a primary source of care for low-income people.”¹⁰ Similarly, the 2009 American Dental Education Association (ADEA) Survey of Dental School Seniors found that half (50 percent) planned to work in private practice, while only 10 percent planned on entering a government service.¹¹

The difference between the number of private and public dentists may be due to the income differential between private and public dentistry. In 2009, graduating dental students had an average of \$164,000 in educational loans.¹¹ This large expense influences dental graduates to choose a private practice career, in which the largest portion of income goes toward the dentist’s salary.¹⁰ Also, “most states do not offer adult dental coverage under Medicaid,”¹⁰ and in 2007, a study found that only 26.7 percent of dentists accepted Medicaid, largely related to “low reimbursement rates and practice management issues.”⁸

As one strategy for addressing the unmet need for oral health care, the U.S. Health Resources and Services Administration (HRSA) HIV/AIDS Bureau, through its Ryan White Program, established the Community-Based Dental Partnership Program (CBDPP) in 2002 with the goal of increasing access to oral health care services for HIV-positive individuals while providing education and clinical training for dental care providers, especially those in community-based settings.^{2,12} To achieve its goals, the CBDPP works through multi-partner collaborations between dental and dental hygiene education programs and community-based dentists and dental clinics. The specific goals of this community-based dental education (CBDE) include increasing access to oral health care for PLWHA, providing dental and dental hygiene students and postdoctoral dental residents with training in the management of oral health care for PLWHA, and supporting training of the next generations of oral health providers to enable them to manage the oral health needs of PLWHA.

This article describes the results of a multisite longitudinal evaluation of five CBDPPs conducted by the Health and Disability Working Group at Boston University School of Public Health. Specifically the program evaluation examined the following questions: 1) What are the HIV knowledge, attitudes, and behaviors of these dental students and residents? 2) How has participation in the CBDPP impacted the HIV knowledge, attitudes, and behaviors of these dental students and residents? 3) Has the intervention affected their work placement decisions and attitudes

after graduation, particularly with respect to treating PLWHA and other underserved populations?

Methods

The participating sites were Boston University Henry M. Goldman School of Dental Medicine, Columbia University College of Dental Medicine, Nova Southeastern University College of Dental Medicine, University of Louisville School of Dentistry, and University of Medicine and Dentistry of New Jersey (now Rutgers School of Dental Medicine). All participating sites and the multisite evaluation center at the Boston University School of Public Health received approval to participate in the study from their respective Institutional Review Boards. Sites were self-selected after being informed by the HRSA CBDPP director about the ability to participate in the multisite evaluation. A total of 324 participants were recruited from the five university programs from 2010 to 2012.

Table 1 shows the sites’ programs and length of training provided through the CBDPP. Participants were first- through fourth-year dental students and first- and second-year dental residents. Students across the program participated in clinical externship programs in community-based health centers or outpatient hospital programs that serve PLWHA and those with other co-morbidities. Externships included part- and full-time weekly positions that ranged from four weeks to six months. Participation was one of the students’ and residents’ graduation requirements. Another key feature of the programs was the mandatory lectures as part of the curricula; these included didactic lectures on management of oral manifestations of HIV. In addition, for the residents in the clinical externship program, there were educational opportunities on specific topics related to managing an HIV-positive patient. These opportunities occurred via regularly scheduled sessions using reflection activities with the clinic director.

Procedure and Measures

Depending on the site, the pre-rotation surveys were administered prior to the start of the participants’ community-based rotation, at the time of orientation, or during the first class. A study coordinator at each site distributed the questionnaires and maintained a record of students and residents who participated. Follow-up surveys were completed approximately one month post-rotation. Approxi-

Table 1. Participating sites with trainee population, educational interventions, patient population, and total clinical training hours at each site

Site	Trainee Population	Education Intervention	Clinical Training Patient Population	Total Clinical Training Hours
Boston University Henry M. Goldman School of Dental Medicine	4 th year dental students	Review three CDs on oral health management of HIV-positive patients; shadow an infectious disease specialist once; public health project on needs of patients with HIV [†]	Mix of HIV-positive and other vulnerable populations	320
Columbia University College of Dental Medicine	Predoctoral students (years 1-4) and 1 st and 2 nd year AEGD residents	All-school forum for predoctoral and postdoctoral students and faculty members; didactic lecture series on oral health management and treatment of PLWHA with a cultural competence component for postdoctoral students; direct services to PLWHA by engaging AEGD fellows in dental clinic at Harlem United; reflections sessions for residents	HIV-positive patients	384
Nova Southeastern University College of Dental Medicine	3 rd year dental students at school clinic and 4 th year for extramural rotation	Direct clinical experience with a combination of the following: medical history review, informal lunch and learn, lecture, and permanent whiteboard	HIV-positive patients	45 and 300
University of Louisville School of Dentistry	Dental and dental hygiene students and general practice residents	Didactic courses on infection control; microbiology, biochemistry, and physiology; general pathology and oral pathology; cultural competence day; resident training and Williams Scholar rotation	HIV-positive patients	126
University of Medicine and Dentistry of New Jersey (now Rutgers School of Dental Medicine)	4 th year dental students	Dental education lecture series with courses with cultural competence component; courses include substance abuse and the HIV patient; HIV politics, gender, and religion: a global view; 30 years of research and the Berlin patient; HIV in persons over 50; HIV and oral medicine: case reports; and update on HIV medications	Mix of HIV-positive patients and other vulnerable populations	75 and 1,200

[†]Health Resources and Services Administration. Dental partnerships: Ryan White HIV/AIDS program community-based dental partnership program. Rockville, MD: Health Resources and Services Administration HIV/AIDS Bureau, 2008.

mately six months after graduation, each site sent an initial email, followed by two reminder emails, to the students and residents with a SurveyMonkey link to the post-graduation survey. All surveys were self-administered and in English, and results were sent to the multisite evaluation center for data entry and analysis. The pre/post-rotation surveys assessed participants' knowledge and attitudes, as well as their preferred method of educational activities regarding vulnerable populations, including PLWHA. The post-graduation survey assessed current practice setting, including whether the graduates were treating vulnerable populations.

The pre/post-rotation survey questions were adapted from those used by Seacat in his coauthored 2003 and 2009 articles.^{4,13} Adjustments we made to those questions reflected information collected during interviews with CBDPP faculty and staff at the five sites about the focus of the curriculum and

approach to training dental students and residents to work with HIV-positive and vulnerable populations. The knowledge assessment section was expanded to thirteen true/false items and included specific questions about prophylaxis treatment. In addition, intention to treat questions were included, and attitude items were changed to better reflect the vulnerable populations served by CBDPP students and residents. Questions addressed student demographic characteristics, knowledge of and attitudes toward treating vulnerable populations, and the educational interventions. The knowledge questions consisted of items ranging from knowledge of HIV transmission, biological effect, treatment, and epidemiology to oral manifestations of the disease. Attitudes were assessed with a twelve-item, five-point Likert scale (strongly disagree=1 to strongly agree=5) that incorporated topics such as perceptions of treating vulnerable populations, including PLWHA, substance users, and

sexual minorities; potential stigma-related impact from family and professional practices; and comfort with asking patients about their HIV risk and health history. Student preferential learning techniques were assessed using the same five-point scale.

In the post-rotation survey only, participants were also given the opportunity to make suggestions regarding program improvements with respect to student training and patient care. Two additional questions were included to assess intention to practice in future professions: I would like to pursue a job that allows me to treat HIV/AIDS patients in a specialty care setting (i.e., public health dentistry); and I will pursue a job in the private sector, but I will willingly accept patients with HIV/AIDS. The post-graduation survey assessed participants' current professional status, as well as the type and patient population of their primary, secondary, and volunteer dental practice. This survey also included open-ended questions, where graduates reported contributing factors in choosing their practice setting, satisfaction related to feeling prepared for their position by their dental education, and recommendations for additional training or education for future students.

Data Analysis

Descriptive statistics, including both univariate and bivariate analyses, were performed. To assess student knowledge, a total score was calculated with correct responses assigned the value "1" and incorrect responses, don't know responses, and skipped items given the value "0." Each participant could score a total of thirteen points (0 to 13). Pre- and post-rotation mean scores and percentage correct were computed and analyzed for trends. A paired t-test at the 0.05 alpha level was used to assess change in average knowledge score from pre- to post-rotation.

All attitude and educational intervention responses were collapsed into three categories by concatenating the strongly disagree and disagree categories, as well as the strongly agree and agree categories. This plan was decided prior to analysis, as whether an individual agreed with the statements was more telling than the degree to which he or she agreed. Participant scores were coded 2 for disagree, 3 for neutral, and 4 for agree. Participants could score between 24 and 48 on the attitude questions and 16 to 32 on the educational intervention questions. The higher a participant scored, the more positive his or her attitude. Answers were inversely coded in the cases in which negative attitudes were associated with the agree category (questions 6a, 7a, and 8a).

Pre- and post-rotation test scores were computed, and the overall trend for each attitude and educational intervention question was analyzed. McNemar chi-squared tests were used to determine trends from pre- to post-rotation for educational intervention questions, and a paired t-test was used to assess the change in pre- and post-rotation mean attitude scores.

In addition, as part of the initial analysis plan, the multisite evaluation center created categories as a tool to examine trends in participants' attitudes with regard to treating vulnerable populations. Changes in attitude were assessed as becoming more negative, becoming more positive, or remaining the same. A participant was categorized as "more positive" if the difference between post- and pre-rotation scores was positive. Similarly, a participant was categorized as "more negative" if the difference between post- and pre-rotation scores was negative. Participants whose attitude scores remained the same were recoded into three categories: those who remained negative, remained neutral, and remained positive. A participant was considered positive if he or she scored a 45 or higher on the three-point condensed scale. This score corresponds to 75 percent of the questions answered positively and 25 percent answered neutrally (nine questions with a score of 4 and three questions with a score of 3: $9*4 + 3*3 = 45$). A participant had a negative attitude if his or her score corresponded to anything less than a neutral answer for every question, so a score below 36 (twelve questions answered with a score of 3: $12*3 = 36$). A participant's attitude remained neutral if he or she had an attitude score from 36 to 44.

In addition, t-tests were conducted to determine if attitude and knowledge scores, along with the difference between post- and pre-rotation scores, differed between students and residents. A correlation between attitude and knowledge scores was also examined. Lastly, a correlation was used on participant-specific rotation data (collected only in the second year of data collection) to assess whether a relationship existed between the number of rotation hours and the change of knowledge and attitude scores. This was done in an attempt to capture differences across sites; however, no other analyses were conducted to observe this potential site difference due to large variations in sample size.

At the close of data collection for the post-graduation surveys, all questions, with the exception of three open-ended prompts, were analyzed with univariate frequencies. The open-ended questions were analyzed for common themes across students

and residents. Due to large differences in sample size, no analyses were conducted to determine differences over sites. This analysis was performed using IBM SPSS Statistics 19 software.

Results

After we excluded instances in which the participant did not complete both pre- and post-rotation surveys, there were 305 participants out of the 324 possible. Completion rates were 82.4 percent for Boston University, 91.4 percent for Columbia University, 90.7 percent for Nova Southeastern University, 97.7 percent for the University of Louisville, and 100 percent for the University of Medicine and Dentistry of New Jersey. The number of final participants and percentage of total participants by school were as follows: Boston University (n=14, 4.6 percent), Columbia University (n=32, 10.5 percent), Nova Southeastern University (n=117, 38.4 percent), University of Louisville (n=42, 13.8 percent), and University of Medicine and Dentistry of New Jersey (n=100, 32.8 percent).

A majority of the participants were students (86.9 percent) compared to residents. Most students and residents were white (56.4 percent); the remainder were Asian (21.3 percent), Hispanic (12.1 percent), black/African American (4.6 percent), American Indian/Alaska Native (0.7 percent), Native Hawaiian/Pacific Islander (0.3 percent), and other (7.5 percent). (Several participants reported more than one race/ethnicity.) Slightly more participants were male (54.1 percent) than female, and 70.2 percent spoke English as their primary language. Many participants had prior HIV/AIDS training or education (72.6 percent), while some had prior work experience with PLWHA (9.2 percent) and prior dental experience in another country (17.7 percent). Some also reported knowing a person living with HIV outside of a clinical setting (12.2 percent).

Changes in Knowledge

The mean knowledge score for the participants significantly increased by 0.48 (STD: 1.56, pre: 9.30, post: 9.78, $p < 0.001$, 95 percent CI: 0.30, 0.65) from pre- to post-rotation. Table 2 shows the percent cor-

Table 2. Participants' correct responses to HIV/AIDS knowledge questions before and after CBDE rotation, by percentage of total respondents (N=305)

Question	Pre-Rotation	Post-Rotation
1k. Saliva is a vehicle for the transmission of HIV.*	77.4%	81.3%
2k. All patients should be considered potentially infectious.**	98.0%	99.3%
3k. Standard universal precautions provide minimal protection against the transmission of HIV and other bloodborne pathogens.***	68.5%	65.6%
4k. Oral lesions found in patients with HIV may also be found in other immune-compromised patients.***	97.4%	98.0%
5k. The risk of HIV infection after a needle stick injury involving an HIV-positive patient is about 45-50%.	78.4%	78.4%
6k. Hepatitis C is more infectious than is HIV/AIDS as a bloodborne pathogen.****	87.5%	94.4%
7k. The decision whether or not to prescribe antibiotic prophylaxis to HIV-positive patients prior to invasive dental care is best determined by the patient's CD4 count and viral load.*	18.7%	25.2%
8k. The normal CD4 range for a healthy person is 300-500 mm ³ .***	48.2%	51.5%
9k. It is important to review an HIV-positive patient's diagnostic lab values, platelet, and neutrophil count before providing invasive treatment.***	96.4%	97.7%
10k. A patient's health, in general, is improving when his or her CD4 count is decreased and viral load is increased.***	95.4%	93.8%
11k. According to the CDC, women of color represent the majority of new HIV infections and AIDS cases among women in the United States.****	49.8%	69.5%
12k. Protease inhibitors prevent cells from creating new HIV virus by blocking the attachment of HIV to the healthy cell.***	31.1%	31.1%
13k. Thrush is an HIV-related opportunistic infection.****	83.6%	92.1%
Mean knowledge score for all participants****	9.30	9.78
95% Confidence Interval (0.30, 0.65)		

* $p < 0.01$ to < 0.05 ; ** $p = 0.05$ to < 0.10 ; *** $p \geq 0.10$; **** $p < 0.01$

rect for each item pre- and post-rotation. A majority of students and residents correctly identified vehicles for HIV transmission (78-81 percent post-rotation), correctly identified that oral lesions are associated with HIV and other immune-compromised patients (98 percent post-rotation, question 4k), and knew the laboratory values and clinical practice procedures when treating patients with HIV (94-99 percent post-rotation). A fair proportion of students and residents did not answer correctly questions related to HIV epidemiology (30 percent post-rotation, question 11k), how HIV medications work (69 percent post-rotation, question 12K), and the role of universal precautions in protecting against HIV (44 percent post-rotation, question 3k). Finally, a majority, approximately 75 percent, incorrectly identified the laboratory test to use prior to prescribing antibiotic prophylaxis.

Changes in Attitude

The mean attitude score for the participants significantly increased in a positive direction by 0.61 (STD: 3.56, pre: 43.73, post: 44.34, $p=0.003$, 95 percent CI: 0.20, 1.02). Table 3 shows the change in attitude for each item. Students and residents expressed a positive attitude toward questions about

treating vulnerable populations, including PLWHA (76-85 percent post-rotation), substance users (67 percent post-rotation), and sexual minorities both pre- and post-rotation (91 percent post-rotation). In addition, three-quarters expressed comfort with asking patients about their HIV-related risk behaviors (76 percent post-rotation). The notable negative questions were those regarding HIV stigma. For example, 31 percent expressed concern about contracting HIV from a patient in the pre-rotation survey, and this proportion increased post-rotation (35 percent). Fifty-five percent of the participants either remained at a positive score or had a more positive score after they completed their community-based training, while 38 percent became more negative (Figure 1). No participant had an equally negative attitude score for his or her post-rotation survey compared to the pre-rotation survey.

Two items in the post-rotation survey indicated an intention to treat vulnerable populations, including PLWHA. Twenty-seven percent (27.1 percent) ($n=236$) of students agreed that they would like to pursue a job that would allow them to treat HIV/AIDS patients in a specialty care setting, and 82.3 percent ($n=237$) agreed that they would pursue a

Table 3. Participants' attitudes about management of people living with HIV/AIDS before (baseline) and after CBDE rotation (follow-up), by percentage of total respondents (N=305)

Question		Disagree	Neutral	Agree
1a. It is important for patients to disclose their HIV/AIDS status to their dental providers.	Baseline	0.7%	4.0%	95.4%
	Follow-up	0.3%	6.3%	93.4%
2a. I am comfortable providing dental treatment for a person with a chemical dependence.	Baseline	14.2%	29.1%	56.6%
	Follow-up	11.5%	21.4%	67.1%
3a. I am comfortable providing dental treatment for a person who is gay/bisexual/transgender.	Baseline	1.3%	9.9%	88.8%
	Follow-up	1.0%	7.6%	91.4%
4a. I am comfortable providing dental treatment for a person who is HIV-positive (but not with AIDS).	Baseline	6.9%	22.4%	70.6%
	Follow-up	3.6%	11.8%	84.5%
5a. I am comfortable providing dental treatment for a person diagnosed with AIDS.	Baseline	11.5%	28.3%	60.2%
	Follow-up	7.9%	16.4%	75.7%
6a. If it became known that patients with HIV/AIDS were treated in my dental practice, some patients might leave my practice.	Baseline	28.9%	38.2%	32.9%
	Follow-up	26.6%	36.2%	37.2%
7a. I am very concerned about contracting HIV from a patient.	Baseline	35.2%	33.9%	30.9%
	Follow-up	39.8%	25.3%	34.9%
8a. I am not concerned about treating patients with HIV/AIDS, but members of my family are concerned about it.	Baseline	23.0%	32.6%	44.4%
	Follow-up	17.4%	32.8%	49.8%
9a. My knowledge of infection control procedures makes me more confident in treating HIV-positive patients.	Baseline	2.0%	16.4%	81.6%
	Follow-up	1.0%	9.8%	89.2%
10a. Dentists have a professional obligation to treat patients with bloodborne infectious diseases such as HIV/AIDS.	Baseline	2.3%	6.6%	91.1%
	Follow-up	1.6%	6.9%	91.4%
11a. I am comfortable asking patients about their health history.	Baseline	0.7%	3.3%	96.1%
	Follow-up	1.0%	5.9%	93.1%
12a. I am comfortable asking patients about their HIV-related risk behaviors.	Baseline	17.4%	17.4%	65.1%
	Follow-up	10.5%	13.1%	76.4%

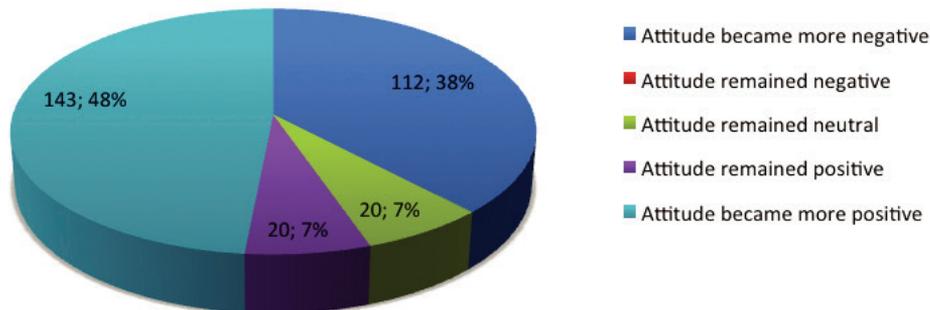


Figure 1. Post-rotation change in attitudes toward people living with HIV/AIDS, by number and percentage of total participants (N=305)

Note: There were no participants whose attitudes were and remained negative (red).

job in the private sector but would willingly accept patients with HIV/AIDS. There was no significant correlation between participant knowledge and attitude scores ($r=0.03$, $p=0.06$), nor was there a significant difference in attitude ($p=0.33$) or knowledge ($p=0.21$) scores between students and residents. There was no significant correlation between the number of rotation hours collected on participants who completed their community-based rotation in the second year of data collection and their change

in knowledge scores ($r=0.04$, $p=0.30$). There was, however, a significant, positive correlation between the number of rotation hours and change in attitude scores ($r=0.24$, $p=0.006$).

Changes in Perceptions of Educational Intervention

Table 4 shows the trend in perceptions of training or teaching intervention responses from pre- to

Table 4. Perceptions of effectiveness of educational interventions before (baseline) and after CBDE rotation (follow-up), by percentage of total respondents (N=305)

Question		Disagree	Neutral	Agree
1m. To date, my classes prepared me well for treating patients from backgrounds different from mine.*	Baseline	5.2%	24.6%	70.2%
	Follow-up	3.0%	19.1%	77.9%
2m. To date, my classes prepared me well for treating patients with HIV/AIDS.*	Baseline	10.2%	28.6%	61.2%
	Follow-up	3.0%	22.5%	74.5%
3m. The curriculum should include more education about treating patients from different backgrounds.	Baseline	11.6%	32.3%	56.1%
	Follow-up	10.9%	36.1%	53.0%
4m. The curriculum should include more education about treating patients with HIV/AIDS.	Baseline	9.5%	26.6%	63.8%
	Follow-up	10.3%	27.8%	61.9%
5m. I know what to do in the event of an occupational exposure to blood.*	Baseline	4.3%	13.2%	82.5%
	Follow-up	1.0%	9.0%	90.0%
6m. Meeting an individual who is HIV-positive would influence my decision to treat HIV-positive patients in the future.*	Baseline	38.0%	33.3%	28.7%
	Follow-up	28.1%	31.5%	40.4%
7m. Reading case reports about patients with HIV/AIDS would help me to be a better provider for these patients.	Baseline	7.2%	20.1%	72.7%
	Follow-up	8.3%	23.2%	68.5%
8m. Treating a known HIV-positive patient with clinical supervision would give me more confidence in treating HIV-positive patients in the future.	Baseline	6.6%	15.1%	78.3%
	Follow-up	5.0%	20.9%	74.2%

* $p<0.5$

post-rotation. The participants said they felt better prepared to treat patients of different backgrounds and with HIV/AIDS at post-rotation than they did before their rotation. Approximately two-thirds of the participants reported thinking post-rotation that reading case reports about and treating a person with HIV would help them treat similar patients in the future. Three-fourths of students and residents agreed post-rotation that treating an HIV-positive patient with clinical supervision increased their confidence for future practice. Only 40 percent agreed post-rotation that meeting a PLWHA would influence a decision to treat.

Post-Graduation Survey

Sixty-nine participants (23 percent) completed the post-graduation survey. Sixty percent who were matched to a completed pre- and post-rotation survey had a higher attitude score after their community-based rotation. The remaining 30 percent had a neutral score. Comparatively, the distribution of the overall sample had 48 percent with a positive attitude score after their rotation, while 48 percent had a neutral score and 2 percent had a negative score.

Table 5. Professional status, practice setting, and vulnerable populations served reported in post-graduation survey, by number and percentage of total respondents (N=69)

	Number (%)
Professional status	
Dental associate	29 (42.0%)
Dental resident	31 (44.9%)
Opened my own practice	1 (1.4%)
Not practicing/unemployed	4 (5.8%)
Other	4 (5.8%)
Primary dental practice setting	
Private dental office	31 (47.7%)
Academic dental institution	14 (21.5%)
Hospital	10 (15.4%)
Health center or clinic	8 (12.3%)
Other	2 (3.1%)
More than one setting	8 (12.7%)
Vulnerable populations served	
Homeless persons	14 (20.3%)
Incarcerated/transitioning	10 (14.5%)
Migrant or immigrant populations	27 (39.1%)
Publicly insured (e.g., Medicaid)	37 (53.6%)
Substance users	33 (47.8%)
Uninsured	27 (39.1%)
Born in the U.S.	19 (40.4%)

Therefore, there may be a slightly positive bias in the results of the post-graduation survey. This sample had an equal distribution by gender. A majority were either dental associates or dental residents and practiced in either a private or academic primary dental setting. Table 5 shows the post-graduation survey results.

Most of these participants (n=41) attributed their primary practice setting choice to opportunities for more experience (26.8 percent), financial opportunity (14.6 percent), diversity of patient population (26.8 percent), and job availability (31.7 percent). For example, one participant wanted a “pediatric dental residency that provides experience in a mixed university-hospital setting.” Another participant stated that his or her choice of setting was due to “too many underprivileged without dental care.” Another listed “community service” as the reason to work in his or her practice setting. Finally, many students referenced student loans and finances as a reason for practice setting choice.

These participants also reported that their training had prepared them for practice. Many (n=53) reported having confidence in their training (30.2 percent) and feeling prepared for their residency (15.1 percent). A few specifically noted having confidence to ask questions and take a medical history (3.8 percent). For example, one participant wrote, “In my current GPR program a number of patients are members of vulnerable populations. My experience in the [CBDPP] program made me recognize the differences in clinical treatment but specifically what questions to ask during the medical history to prepare me for treatment.”

Several of these participants reported that the curriculum prepared them for their practice (9.4 percent), with one student reporting “didactic coursework as well as clinical training has allowed a smooth transition into residency.” Many expressed feeling as though they could manage socioeconomically or culturally diverse patients regardless of disease status (22.6 percent). As one individual noted, “[CBDPP] helped me to realize that treating HIV patients is very similar to treating non-HIV patients.” Another said the program “prepared me for complications and the ability to treat medically compromised patients.”

When asked to describe any additional training or education they would recommend for future students, most of these participants (n=45) stressed externship/clinic rotations (24.4 percent), continuous education and updates (8.9 percent), more medical training regarding disease (15.6 percent), or more class time (6.7 percent). Another individual men-

tioned “further understanding on new technology and medications regarding HIV” would be helpful. One participant stated that “the more exposure to HIV patients while in dental school or residency, the more comfortable you’ll become treating them, and the better of a practitioner you’ll be.”

Discussion

In the Program

The findings in this study suggest a positive impact of the CBDPP in the training of dental students and residents on knowledge and attitudes regarding vulnerable populations. The participants’ mean knowledge score significantly increased from pre- to post-rotation. Specifically, the participants improved noticeably in their knowledge of identifying opportunistic infections, such as thrush, and other co-morbidities, such as Hepatitis C. The participants also understood the connection between oral lesions and immune-compromised patients, as well as the importance of understanding dental protocol while treating such patients and the general biology of bloodborne diseases. This awareness is important since oral lesions can identify “the first manifestation of HIV infection, and may be used to predict progression from HIV to AIDS.”²¹

The participants’ mean attitude score significantly increased from pre- to post-rotation as well. Over half of the students who participated in the program either had an increase in positive attitude or remained positive throughout their experience. At least 75 percent agreed with feeling comfortable treating patients who have HIV and AIDS post-rotation, which is slightly higher than the results found in a similar program, in which 66.2 percent of students (N=745) felt comfortable treating HIV/AIDS-positive patients.¹⁴ At least two-thirds of the participants in our study after their rotation agreed that they felt comfortable treating patients with a chemical dependence or who are gay, bisexual, or transgender.

Our findings are congruent with other studies that examined changes in knowledge and attitudes resulting from similar CBDE programs for dental students in working with HIV-positive patients.^{7,15} A previous multisite evaluation of the CBDPP found positive assessments in students’ awareness and professional growth about providing dental care to people living with HIV, reporting that the students gained “a better understanding of HIV and oral health

and increased confidence in caring for these vulnerable populations.”¹² The open and willing attitude to treat vulnerable patients is further supported by Mofidi et al.’s results in their study of senior dental students at the University of North Carolina participating in four-week community-based clinical rotations.¹⁶ Analyzing data from reflection essays completed after the rotations, these researchers found that, in addition to personal and professional growth, students expressed an enhanced awareness of the complexity of their patients’ lives and a commitment to service including a desire to make a difference and provide quality care to vulnerable populations.

However, perceived external stigma related to HIV persists among the dental students and residents in our study. We found that participants still expressed concerns about being infected with HIV from a patient despite knowledge of universal precautions. Furthermore, a proportion believed that patients would leave if their dental practice treated HIV-positive patients. A study by Myers et al. published in 2012 also found the existence of this stigma, reporting that 11 percent of participating students (N=220) agreed “that concerns about BBPE [bloodborne pathogen exposures] influenced their career choice” and 46.8 percent “agreed that such concerns had influenced the way they perform procedures.”²⁵ In addition, a study by Kuthy et al. found a negative attitude in dental students’ willingness to treat some underserved populations, specifically persons living with HIV, compared to other disenfranchised populations.¹⁷ These studies suggest that training programs still need to address preconceived notions that may be held by students when interacting with socially and culturally diverse, underserved populations if impediments in willingness to treat are to be removed.

In the Workforce

Further evidence to support the positive impact of the CBDPP is shown in our participants’ intention to treat in future practice. Over 80 percent responded that they “will pursue a job in the private sector, but will accept patients with HIV/AIDS,” and about 25 percent said that they would like to pursue practice in a specialty care setting. Previous studies also found student willingness to treat vulnerable populations after their community-based experience. When Strauss et al. evaluated dental and dental hygiene students who participated in an externship program, “56 percent of students reported that CBDE increased their interest in treating underserved patients.”¹⁸

The distinctive component of our study compared to prior research is the inclusion of participants' decisions after they enter the workforce and postgraduate training. Most prior studies investigated only the immediate outcome of community-based dental programs, but with the post-graduation survey, our study attempted to understand how these programs affect long-term outcomes. The study found that most students ended up in a private setting or in an academic setting as residents. Preference for a private over a public health setting may be due to monetary issues, such as student loans and job availability, with one of the most prevalent reasons we found for this decision being financial, related to student debt. Another common reason that the participants chose their primary practice setting was for the diversity of the patient population. Three-quarters of them post-rotation agreed that their education had prepared them well to treat socioeconomically and culturally diverse patients regardless of disease status. These results suggest that CBDPP training provided the necessary preparation and willingness to treat populations traditionally underserved by the oral health care system. In fact, one participant suggested additional training in Spanish would be helpful for future students.

Curriculum Recommendations

This study also highlighted educational methodologies for preparing future dental professionals. Post-rotation and post-graduation results found the participants perceived that externships and clinic time were effective in increasing the confidence and willingness of students and residents to treat PLWHA. These findings mirror Seacat and Inglehart's study in which students "were most positive about learning through case studies . . . and learning in the clinics by actually treating HIV-positive patients under clinical supervision."⁴

Our results also highlighted further areas to strengthen dentists' competence in treating a diverse, medically complex population, including a stronger focus on the prevention and transmission of infectious diseases and the interpretation and use of laboratory values. This study found that one-third of the participants believed standard precautions are only minimally protective against transmission of disease. This particular question differs from a previous study, which found that 91 percent of dentists (N=330) considered infection control procedures adequate.⁶ Our findings highlight the need for dental curricula

to continue to emphasize the importance of infection control procedures and the strength of universal precautions in protecting against infectious disease to address students' misunderstandings.

There is also a need for continued emphasis on basic HIV information about laboratory values with focus on CD4 levels and the function of protease inhibitors for HIV. Unlike past research, this study went beyond prevention and analyzed the participants' knowledge about HIV treatment with respect to the delivery of oral health care services. HIV has become a chronic illness, and dental providers must be aware of the effects of HIV medications and a patient's clinical status for appropriate quality of oral health care. Future curricula must include information about appropriate clinic values for treating HIV-positive patients similar to other patients with chronic illness.

Education and training curricula can provide opportunities for training students to provide culturally competent care to diverse populations. This includes how to ask questions in a non-judgmental manner as they pertain to a patient's dental care needs and affecting one's overall dental and systemic health. Dental students can also be made aware of community resources to connect patients with other appropriate services as patient needs arise.

Limitations

There were several limitations to this study. First, all five programs were self-selected and differed from each other in the number of didactic and community-based rotation training hours. This was observed in a significant correlation between the number of rotation hours and positive attitude change in participants. Also, the pre- and post-rotation surveys were self-administered at every site, which limits our ability to verify the accuracy of responses. In addition, our sample at post-graduation was small due to loss to follow-up. The post-graduation surveys were administered via university email, which many participants may not have read or utilized after graduation. Since there was no other way to track and communicate with students and residents, we were unable to obtain a large enough sample size to extrapolate statistically significant conclusions in this part of the study.

Conclusion

Despite these limitations, the study highlights important lessons and findings for the future train-

ing of dental students and residents in working with PLWHA and other vulnerable population. This is the first study to our knowledge that surveyed students after graduation about their practice and work with vulnerable populations. Thus, while our sample is small, it does reveal the impact of participating in a program like CBDPP on current professional practice. Continued work on post-graduation experience is essential to show the long-term impact of programs such as this one on access to oral health care for vulnerable populations such as PLWHA.

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