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Dental hygienists' knowledge of HIV, attitudes towards people with HIV and willingness to conduct rapid HIV testing

Abstract: *Objectives:* To normalize rapid human immunodeficiency virus (HIV) testing in the United States, expanded rapid HIV testing initiatives are needed outside the routine medical setting. The dental setting is a logical choice as almost two-thirds of Americans regularly see a dental provider each year. This study was aimed to determine the dental hygienists' knowledge of HIV, attitudes towards people living with HIV and willingness to conduct rapid HIV testing. *Methods:* A national cross-sectional survey of practicing dental hygienists and senior dental hygiene students were recruited using state dental hygiene associations, email LISTSERVS, dental hygiene programmes and continuing education conferences (n = 634). *Results:* The mean knowledge score was 10.5/13. High versus low test-scorers (75% of test questions or more answered correctly versus less than 75% answered correctly) did differ in their comfort level in counselling about sexual HIV prevention methods (P = 0.03) and comfort level in working with medically compromised patients (P = 0.04). *Conclusion:* Dental hygienists, with additional training in HIV prevention counseling and diagnostic testing, may be an appropriate profession to conduct rapid HIV testing.

Key words: dental health services; dental hygienist; human immunodeficiency virus; human immunodeficiency virus testing; oral hygiene

Introduction

Epidemiology of HIV/AIDS in the United States

An estimated 1.1 million people in the United States (U.S.) are living with human immunodeficiency virus (HIV) infection (1). One in five (18.1%) of those people is unaware of their infection (2). In 2011, 49 273 people were diagnosed with HIV infection in the 40 states with confidential name-based HIV infection reporting. In that same year, 32 052 people throughout the U.S. were diagnosed with acquired immunodeficiency syndrome (AIDS). Since the epidemic began, 1 155 792 people in the U.S. have been diagnosed with AIDS (1).

Seventy-eight percent of persons living with HIV infection were male, and 63% of the males were men who have sex with men. Undiagnosed HIV infection greatly impacts those aged 13–24 years (58.9%). Greater percentages of undiagnosed HIV infection also were observed among males with high-risk heterosexual contact (25%) and men who have sex

with men (22.1%) than among those in other transmission categories. Additionally, HIV prevalence was 1819 among Blacks or African Americans, 593 among Hispanics or Latinos, and 238 among Whites (per 100 000 population). With the introduction of antiretroviral therapy (ART), AIDS diagnoses and deaths declined substantially from 1995 to 1998 and remained stable from 1999 to 2008 at an average of 38 279 AIDS diagnoses and 17 489 deaths per year, respectively. Late diagnosis of HIV infection is common. Among persons with newly diagnosed HIV in 2008, 33% developed AIDS within 1 year of initial HIV diagnosis (3).

HIV testing in the United States

According to Kaiser Family Foundation's 2011 *Survey of Americans on HIV/AIDS*, 54% of U.S. adults, aged 18–64, report ever having been tested for HIV, including 21% who report being tested in the last year. The proportion of the public saying they have been tested for HIV at some point increased between 1997 and 2004, but has remained fairly steady since then (4). In September 2006, the Centers for Disease Control and Prevention (CDC) issued *Revised Recommendations for HIV Testing of Adults, Adolescents, and Pregnant Women in Health Care Settings*, which promotes HIV testing of all patients' aged 13–64 in healthcare settings as part of their routine medical care (5). The United States Preventive Services Task Force's (USPSTF) 2007 *Screening for HIV: Recommendation Statement* strongly recommends that clinicians screen all adolescents and adults at increased risk for HIV infection and all pregnant women (6). There was no recommendation for or against routinely screening asymptomatic adults and adolescents with no identifiable risk factors for HIV. Evidence suggests that persons testing positive for HIV (especially heterosexual and serodiscordant couples) are more likely than others to avoid risky sexual behaviour.

In October 2007, the CDC initiated the first national effort to promote routine HIV screening in various clinical and non-clinical settings, 'Expanded HIV Testing Initiative' (7). 'Expanded HIV Testing Initiative' funded 25 health departments to facilitate HIV screening and increase diagnoses of HIV infections and linkage to care among populations disproportionately affected by HIV. During the 3-year 'Expanded HIV Testing Initiative' period, an additional $111 million was provided to health departments in 25 U.S. jurisdictions that had reported 140 or more AIDS diagnoses among Blacks in 2005. During October 2007–September 2010, a total of 2 786 739 tests were conducted, and 18 432 HIV infections were newly diagnosed. The CDC currently recommends that health departments should continue to partner with clinical care providers to offer routine HIV screening, especially in populations disproportionately affected by HIV (5).

Dental hygienists and HIV testing

A primary role of the dental hygienist is as a public health advocate in the prevention and maintenance of oral health and disease (8). As clinicians, dental hygienists screen and assess oral health status and plan and implement treatment on an individualized needs basis (9). These services are significant and transition effectively to applicable skill sets for healthcare providers to administer HIV rapid tests.

Human immunodeficiency virus counselling and testing for patients seen in dental facilities through use of rapid oral fluid-based tests are most likely to be accepted by the dental profession and general public if viewed as an important health screening activity within the scope of dentistry (10). Patton *et al.* (10) conducted a study using a mail survey of the fifty-four U.S. dental schools (85% response rate), which assessed the teaching and practice of HIV risk screening, as well as the opinions of dental educators regarding HIV counselling and testing, and a possible role for oral fluid-based HIV antibody testing in dental offices. Most respondents believed HIV counselling and testing in dental practice for at-risk patients would make a positive contribution to the public and the profession. Perceived benefits included early identification of HIV infection so the patient could access life-prolonging antiretroviral medications, greater integration of oral and systemic health efforts, contribution to general health promotion and education, and provision of a public health service.

To assess the potential for incorporating rapid HIV testing into routine dental hygiene care, we implemented a pilot survey to hygiene students and hygienists practising in the New York City (NYC) metropolitan area. The survey was then validated and implemented on a national level. The overarching goal of this project was to assess knowledge of HIV, attitudes towards people living with HIV and willingness to conduct rapid HIV testing among dental hygienists to determine whether this profession could potentially add rapid HIV testing to the list of clinical services offerings.

Study population and methodology

Following a thorough review of the literature, two survey instruments were chosen to measure knowledge of HIV and attitudes towards people living with HIV. The knowledge survey was adapted from HIV Knowledge Questionnaire initially designed for populations with low literacy levels. This measure has strong internal consistency across samples (α = 0.75–0.89), test–retest stability across several intervals (rs = 0.76–0.94) and strong association with a much longer, previously validated measure (rs = 0.73–0.97) (11). The final survey used included 13 questions assessing knowledge. The HIV Attitudes questions were derived from a scale originally developed for psychiatry residents and proved successful when performing both face and content validity measures (12). Inclusion criteria for the study included being a U.S. resident and a practising dental hygienist. Subjects were recruited by making phone calls using a purchased list of dentists practising in NYC, in-person recruitment efforts at local continuing education symposia and through NYC area dental hygiene schools. There are three dental hygiene programmes in NYC: Hostos Community College, New York University and New York City

College of Technology. Student surveys were administered in senior year clinical courses at all three schools to ensure that student subjects were at the very end of their training and about to enter the professional domain. All participants were compensated with a $5 Starbucks gift card.

Surveys were administered online using CampusLabs, an online survey system, and monitored by trained research co-investigators and assistants along with the principal investigator. Surveys were collected from September 2011 to January 2012. This research was approved by the Long Island University and City University of New York (representing Hostos Community College and New York City College of Technology) Institutional Review Boards, and a letter of permission was received from New York University to implement the survey at the College of Dentistry.

Statistical analysis

Subjects were first assessed in terms of mean knowledge test score (total possible = 13 correct). Individuals who answered 75% or more of the questions correctly were placed into a category of 'high test-scorers', while those who answered less than 75% of the test questions correctly were placed into the 'low score' group. Those with high test scores were compared with those with low test scores in terms of their attitude towards working and interacting with patients with HIV, as well as their prior exposure to caring for patients with HIV, and their self-rated knowledge level on HIV. Associations between groups were tested using a chi-squared statistic for categorical variables and a *t*-test for continuous variables. Attitudes were measured as scores on a 3-point Likert scale and were analysed as categorical variables. Age-, gender- and race-adjusted odds ratios and their 95% confidence intervals (CIs) were estimated using unconditional logistic regression models. Statistical significance was assessed using a two-sided test at the $\alpha = 0.05$ level for all studies.

Results

As seen in Table 1, the mean age of 630 participants who provided their age was 46.1 (SD 15.8). 97.3% of the 629 respondents who reported their gender were female, and 69.9% of the 623 respondents who reported their race were White. The vast majority of respondents had attended some level of college, and 21.9% ($n = 139$) had attended graduate school. Given a test of 13 questions on HIV knowledge, the mean test score in the group was 10.5 (SD 1.8).

As seen in Table 2, 74.9% ($n = 475$) of the respondents achieved a score of 75% or higher on the knowledge test, and these individuals were divided into a group titled 'high scorers'. The remaining 25.1% of individuals with scores under 75% were placed into the 'low scorers' group.

Table 3 shows the demographic details of the high and low score groups. There was no statistically significant difference between the groups in terms of age, years of practice, gender or attainment of a graduate education. The high-scoring group had a higher proportion of White participants than the low-scoring group (73.3% versus 60.4%, $P = 0.01$).

Table 4 shows the differences between the high and low score groups in their attitudes towards individuals who are HIV infected. Given the three possible responses associated with each attitude statement (disagree, neutral or agree), the breakdown of responses did not significantly differ between those with low and high test scores for most statements. The two test score groups did differ in their comfort level in

Table 1. **Demographic information of all participants**

$n = 634$*	%	Mean	SD
Age ($n = 630$)	–	46.1	15.8
Gender ($n = 629$)			
Female	618	97.3	–
Male	11	1.73	–
Race ($n = 623$)			
Asian	35	5.5	–
Black/African American	30	4.7	–
Hispanic/Latino	20	3.2	–
Hawaiian/Pacific Islanders	77	12.1	–
Native American	17	2.7	–
White	444	69.9	–
Education ($n = 623$)			
High school	58	9.2	–
Associates degree	214	33.8	–
Bachelor's degree	212	33.4	–
Master's degree	127	20.0	–
Doctoral degree	12	1.9	–
Graduate School ($n = 623$)			
Yes	139	21.9	–
No	484	76.3	–
Knowledge test score	–	10.5†	1.8

*The total n is 634. Each individual variable has an adjusted n listed to account for missing responses.
†Total possible = 13.

Table 2. **Separation of population into 'high' and 'low' test scores**

Score category	$n = 634$	%
75% or more correct (high scores)	475	74.9
Under 75% correct (low scores)	159	25.1

Table 3. **Demographic differences between 'high' and 'low' test scores**

	Participants with 'high' scores		Participants with 'low' scores		
	$n = 475$	%	$n = 159$	%	*P*-value
Age	45.8	15.1	46.8	17.8	0.53
Years in clinical practice	21.5	19.3	21.5	22.4	0.97
Race (White)	348	73.3	96	60.4	0.01
Gender (Female)	465	97.9	153	96.2	0.22
Grad degree (yes)	113	23.8	26	16.4	0.11

Table 4. **Differences in attitudes towards patients with human immunodeficiency virus (HIV) between 'high' and 'low' test-scorers**

ITEM		Disagree		Neutral		Agree		Chi-square *P*-value	OR (95% CI)†	*P*-value
		n	%	*n*	%	*n*	%			
I feel comfortable counselling about sexual HIV prevention methods	High scores	133	28.00	142	29.89	197	41.47	0.03*	1.85 (1.20, 2.85)	0.01*
	Low scores	63	39.62	45	28.30	50	31.45			
I feel comfortable managing oral HIV complications	High scores	93	19.58	117	24.63	263	55.37	0.33	1.25 (0.78, 2.00)	0.36
	Low scores	33	20.75	46	28.93	78	49.06			
I believe there is a broad range of normal sexual behavior and homosexuality falls within this range	High scores	93	19.58	108	22.74	269	56.63	0.19	1.38 (0.86, 2.21)	0.18
	Low scores	35	22.01	45	28.30	77	48.43			
If I could refer my patients with HIV without risk of professional recrimination, I would.	High scores	193	40.63	85	17.89	192	40.42	0.06	0.94 (0.62, 1.42)	0.76
	Low scores	58	36.48	39	24.53	59	37.11			
I feel comfortable coming into social contact with people with HIV infection	High scores	30	6.32	44	9.26	399	84.00	0.02*	0.96 (0.43, 2.17)	0.92
	Low scores	8	5.03	29	18.24	120	75.47			
I feel comfortable working with medically compromised patients.	High scores	38	8.00	59	12.42	375	78.95	0.04*	1.74 (0.95, 3.19)	0.07
	Low scores	18	11.32	31	19.50	108	67.92			
Patients with HIV should be quarantined to stop spread of infection.	High scores	433	91.16	24		15	3.16	0.03*	0.42 (0.18, 1.00)	0.04*
	Low scores	134	84.28	13	8.18	10	6.29			
I feel comfortable doing oral hygiene exams with patients with HIV.	High scores	32	6.74	30	6.32	409	86.11	0.11	0.84 (0.38, 1.88)	0.67
	Low scores	8	5.03	18	11.32	132	83.02			
Dental hygienists have a responsibility to treat patients with HIV.	High scores	12	2.53	13	2.74	447	94.11	0.24	0.49 (0.11, 2.22)	0.35
	Low scores	2	1.26	8	5.03	148	93.08			
Dental hygiene students should be able to opt out of treating patients with HIV.	High scores	358	75.37	64	13.47	50	10.53	0.02*	0.56 (0.33, 0.97)	0.04*
	Low scores	99	62.26	35	22.01	23	14.47			

*$P < 0.05$.
†High scorers to agree versus disagree (adjusted for age, race and gender).

counselling about sexual HIV prevention methods ($P = 0.03$), comfort level in coming into social contact with patients with HIV infection ($P = 0.02$) and comfort level in working with medically compromised patients ($P = 0.04$), their opinion of whether patients with HIV should be quarantined to stop the spread of infection ($P = 0.03$) and in whether dental hygiene students should be allowed to opt out of being able to treat patients with HIV ($P = 0.02$).

Table 4 also shows the age-, race- and gender-adjusted odds ratios comparing high and low test-scorers in terms of agreeing versus disagreeing with each attitude statement. Those with high test scores were more likely than those with low test scores to feel comfortable about counselling about sexual HIV prevention methods (OR = 1.85, 95% CI: 1.20–2.85). Additionally, those with high test scores were less likely than those with low test scores to feel that patients with HIV should be quarantined to prevent the spread of infections (OR = 0.42, 95% CI: 0.18, 1.00) and to feel that dental hygiene students should be allowed to opt out of being able to treat patients with HIV (OR = 0.56, 95% CI: 0.33, 0.97).

Table 5 shows that those with high versus low test scores did not statistically differ in their opinions of whether dental offices should offer HIV testing and whether they would personally be willing to obtain training on testing or conduct testing. They also did not differ statistically on whether they received information on management of patient with HIV in training or whether they treated patients with HIV as a dental hygiene student. A majority (58.53%) of the high-scoring group did indicate that they would be willing to conduct HIV rapid tests if allowed by their supervisor. The two groups did differ on their self-rated knowledge levels ($P < 0.001$).

Discussion

This study is the first national survey targeting the dental hygienists' knowledge and attitudes towards people living with HIV and their willingness to conduct rapid HIV testing. Increased knowledge about HIV is associated with an increased comfort level in working with medically compromised patients and in counselling about sexual HIV prevention methods. A majority of the high-scoring knowledge group did indicate that they would be willing to conduct HIV rapid tests. Thus, dental hygienists, with additional training in HIV prevention counseling and diagnostic testing, may be an appropriate profession to conduct rapid HIV testing (13).

To date, there are no previously published reports regarding hygienists' willingness to conduct rapid HIV testing. However, with the recognition that an estimated 1.2 million people are living with HIV infection in the United States and that late diagnosis is common, it is understandable that the CDC in 2006 issued recommendations that individuals aged 13–64 along with pregnant women be tested for HIV while in a healthcare setting receiving routine medical care (14). NYC's Department of Health and Mental Hygiene established 'The Bronx Knows' and 'Brooklyn Knows' HIV testing programmes that together identified approximately 5000 HIV-positive individuals. These two pilot project initiatives demonstrated that when HIV becomes a routine part of prevention and care, the

Table 5. **Differences in categorical variables between 'high' and 'low' test-scorers**

		High score		Low score			
		n = 475	%	*n* = 159	%	OR (95% CI)†	*P*-value
Do you think dental offices should offer rapid human immunodeficiency virus (HIV) testing	Yes	138	29.05	35	22.01	0.91 (0.49, 1.70)	0.77
	No	85	17.89	22	13.84		
	I don't know/not sure	160	33.68	46	28.93		
	Missing	92	19.37	56	35.22		
Would you be willing to get trained/certified in conducting HIV rapid tests?	Yes	274	57.68	70	44.03	0.69 (0.31, 1.55)	0.37
	No	44	9.26	9	5.66		
	I don't know/not sure	63	13.26	23	14.47		
	Missing	94	19.79	57	35.85		
If your supervisor gave you the choice, would you be willing to conduct HIV rapid tests?	Yes	278	58.53	68	42.77	0.81 (0.36, 1.85)	0.62
	No	39	8.21	9	5.66		
	I don't know/not sure	67	14.11	26	16.35		
	Missing	91	19.16	56	35.22		
Did you treat patients with HIV while a dental hygiene student?	Yes	98	20.63	32	20.13	0.73 (0.44, 1.22)	0.22
	No	269	56.63	73	45.91		
	I don't know/not sure	68	14.32	32	20.13		
	Missing	40	8.42	22	13.84		
Did you receive information on managing patients with HIV/acquired immunodeficiency syndrome (AIDS) in your dental hygiene training?	Yes	232	48.84	64	40.25	0.89 (0.49, 1.98)	0.68
	No	152	32.00	39	24.53		
	I don't know/not sure	20	4.21	13	8.18		
	Missing	71	14.95	43	27.04		
Self-rated knowledge	Advanced	80	16.84	7	4.40	CHISQ <0.001*	–
	Intermediate	271	57.05	73	45.91		
	Low	112	23.58	69	43.40		
	Missing	12	2.53	10	6.29		

*$P < 0.05$.
†High scorers to agree versus disagree (adjusted for age, race and gender).

number of people knowing their status increases and the stigma of surrounding HIV and testing declines, and early treatment may begin (15). Furthermore, the venue for conducting HIV testing can be both in a medical and dental care setting.

Dental hygienists provide oral health care that includes patient management screening, assessing, planning and implementing an individualized and appropriate patient care plan; this involves recognition and management of oral disease exhibited in association of HIV/AIDS (16). Future rapid HIV testing in the dental setting would be advantageous because screening technology allows individuals to learn their HIV status in 20 min, within the time frame that a patient is treated by a dental hygienist. Dental hygienists are in the ideal position to conduct rapid HIV testing with additional training on interpretation and significance of the results. Available counselling resources for individual follow-up must be established, which requires further study to determine how this can be accomplished. Clearly, an increase in the identification of undiagnosed cases and relationship between oral and systemic diseases place the dental hygienist in an ideal position to serve the public and impact early detection and treatment of HIV (17).

This study has three main limitations. First, a convenience sample was used. Due to the fact that there is no complete sampling frame (that includes email addresses) of registered dental hygienists in the U.S. and this was a predominantly online survey, we used a multi-strategy recruitment approach as described in the Methods section. Second, generalizations are limited to those individuals participating in the study. All data were self-reported; therefore, these data should be interpreted carefully. There may be something inherently different about responders versus those who did not respond. Finally, the majority of responses were collected online, and with an older study population, the use of the Internet may be less in this group compared with others.

It is noteworthy that when looking at high versus low test-scorers as two separate categories of survey responders, the two groups differed in their opinion of whether patients with HIV should be quarantined to stop the spread of infection and in their opinion of whether dental hygiene students should be allowed to opt out of being able to treat patients with HIV, indicating that knowledge about HIV may be specifically tied to attitudes about this specific medical population. Given that those with high test scores were more likely than those with low test scores to feel comfortable counselling about sexual HIV prevention methods, yet the groups did not differ in their responses toward their willingness to be trained and perform HIV testing, and there may be a need to offer supplemental access to HIV education and training both in the dental hygiene curriculum and post-graduate continuing education for dental hygienists.

This national study demonstrates that dental hygienists generally have the knowledge and are willing to conduct rapid HIV testing. Additional studies are needed to explore how rapid

HIV testing can be incorporated into the dental practice setting, methods of reimbursement along with sensitivity and ethical responsibilities of pre- and/or post-test counselling.

Clinical relevance

Scientific rationale for study

Screening tools using saliva are both medical and technological advancements that identify levels of disease. Its ease of use, portability, lower cost, immediate results and patient acceptability can be utilized by providers in non-traditional settings.

Principal findings

These findings demonstrate that dental hygienists' knowledge is associated with comfort levels for HIV counselling and that the dental setting may be a site to provide HIV testing and counselling.

Practical implications

Administration of HIV testing in the dental setting may allow patients who might otherwise not get tested to do so and receive appropriate medical treatment.

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