

Knowledge of Vaccination Needs of HIV-Infected Men Who Have Sex with Men in a National Sample of “Gay Friendly” Health care Providers

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ABSTRACT Objectives: The purpose of this study was to assess knowledge levels regarding vaccination needs of healthy, HIV-infected (with CD4 counts >200 cells/mm³) men who have sex with men (MSM) in a national sample of gay friendly health providers. **Design and Sample:** Participants ($n = 92$) were sent a demographic questionnaire and case vignette asking for correct identification of vaccine needs of an HIV-infected MSM with a CD4 count >200 cells/mm³. Participants were recruited from the Gay and Lesbian Medical Associations Health Provider Index. **Measures:** Descriptive statistics and Fishers exact test were used to answer the research questions and define the sample. **Results:** The vast majority of the sample ($n = 83$; 90%) misidentified correct vaccine needs of and/or selected inappropriate vaccines for the HIV-infected MSM. Greater familiarity with the CDC *Adult Vaccination Schedule* ($p = .027$), practice specialization ($p = .004$), and administration of vaccinations within location of practice ($p = .009$) were associated with greater knowledge of the patients vaccine needs. **Conclusions:** Health care providers who prescribe vaccines to HIV-infected MSM need more education regarding their vaccine needs. Nurses can reduce disparities in HIV-infected MSM by advocating for vaccination and augmenting providers comprehension of vaccine needs of this population.

Key words: AIDS, bisexual, gay, HIV, homosexual, immunization, nurse practitioner, physician, physician assistant, vaccination, vaccine.

Background

The Centers for Disease Control and Prevention (CDC) *Adult Immunization Schedule* indicates that general vaccinations for adults include immunization against influenza, tetanus/diphtheria/pertussis (Td/Tdap), varicella, and zoster (Centers for Disease Control and Prevention, 2013). Higher risk adults have additional recommendations. Gay and bisexual men (referred to as men who have sex with men, or MSM) have higher risks of acquiring sexually transmitted infections, hepatitis A, hepatitis B, and human papillomavirus (HPV) (Mast

et al., 2006). Consequently, they should also receive vaccinations for HPV, hepatitis A, and hepatitis B (Blackwell, 2014). These guidelines are based on the unique health needs and risks that occur within this vulnerable population.

Specific recommendations for HIV-infected adults with CD4 counts >200 mm³ (CD4 percentage of 15% or greater) include vaccination against influenza, Tdap, pneumococcal, hepatitis B, HPV, MMR, and varicella (Centers for Disease Control and Prevention, 2014). For those HIV-infected adults with CD4 counts <200 mm³ (a CD4 percent-

age of less than 15%), the CDC recommends immunization against influenza, Tdap, pneumococcal, hepatitis B, and MMR (Centers for Disease Control and Prevention, 2014). The rationale for recommendations based on CD4 count is that live-attenuated vaccines are contraindicated in those who are immunosuppressed. In these individuals, they could be pathogenic and cause a variant form of the disease they are actually intended to prevent (Gelnick & Kroon, 2009).

Many MSM choose not to disclose their sexual orientation to providers. And a lack of disclosure to providers can significantly decrease the likelihood that appropriate health services get recommended to MSM patients during clinical encounters (Petroll & Mosack, 2011). Because of this, it is essential for health care providers to effectively communicate with patients regarding sexual orientation. It is also paramount that providers who prescribe vaccinations to MSM and HIV-infected adults have a solid understanding of their vaccination needs. However, very little critical inquiry has been devoted to assessing the ability of health care providers to correctly prescribe vaccines to adult populations, especially MSM and HIV-infected adults, who are considered to be at higher risk for vaccine-preventable infectious diseases.

Very little research has been conducted to assess the knowledge of health care providers regarding vaccine needs in adults. Only a small number of studies have specifically concentrated on determining the ability of providers to correctly identify which vaccines are appropriate to prescribe to various adult patient populations. An inquiry by Tan, Bhattacharya, and Gerbie (2011) compared differences in adult vaccine recommendations of primary care providers and obstetricians (OB)/gynecologists (gyn) to determine if specific recommendations varied among these two types of providers. Findings indicated non-OB/gyn primary care providers were more likely to prescribe vaccinations against Td, Tdap, hepatitis B, and MMR. This suggested lack of knowledge regarding adult vaccine needs in some of their nationally representative sample.

While the Tan et al. (2011) study specifically focused on physicians, a more recent Canadian study by Buxton et al. (2013) included nurses. These researchers compared knowledge regarding vaccine-preventable diseases, vaccines in general,

and vaccine administration and handling practices between a sample of nurses and physicians. The nurses in the study had significantly higher levels of knowledge on all of the domains assessed. The physicians scored highest on the vaccine-preventable disease domain and lowest on the general vaccine domain. The authors concluded nurses have greater exposure to concepts related to vaccination during their formal educations. In addition, physicians could benefit from continuing education regarding vaccines and their administration and handling (Buxton et al., 2013).

Vaccine-specific inquiries have also shown knowledge deficits among providers. A study by Strohfus, Collins, Phillips, and Remington (2013) highlighted the inability of providers to correctly identify proper ways to store and deliver the MMR vaccine. Only 61% of their participants earned a passing score of 80% on their evaluation of these knowledge areas. Similarly, data from Aziz, Kessler, and Huhn (2013) showed that providers treating HIV-infected individuals did not possess a solid understanding of the indications for prescribing herpes zoster (HZ) and varicella zoster vaccinations (VZV). Just 41% of their sample correctly identified the prevalence of disease in HIV-infected individuals while only 48% cited correct knowledge of vaccine potency. While a majority (66%) understood the mechanism of protection afforded through VZV, the majority (75%) did not immunize their HIV-infected patients against HZ (Aziz et al., 2013).

These studies suggest that health care providers possess major knowledge deficits regarding vaccination needs in adult populations. There are published resources available to assist clinicians in making vaccine-prescribing decisions specifically for MSM. For example, a comprehensive article by Blackwell (2014) provided extensive information for clinicians regarding unique vaccination needs in gay and bisexual men, prescribing considerations, adverse effects, and other clinically relevant data for providing care for this patient population. However, very little scholarly inquiry has been devoted to this topic in the nursing, medical, and public health literature. Data do suggest, however, that MSM are receptive to receiving vaccines.

For example, prior to its FDA approval in men, 75% of MSM in a national study indicated

they would be willing to get vaccinated against human papillomavirus (HPV) (Hollander, 2010). Similar acceptability of HPV vaccination was found in a mixed sample of HIV-infected and HIV noninfected MSM in a study by Gilbert, Brewer, and Reiter (2011). These authors found overall low knowledge levels regarding HPV disease and the relationship between HIV infection and risk for HPV in both HIV-infected and uninfected MSM in their sample. However, they suggested this could indicate that HPV prevention programs may not need to differentiate prevention strategies between MSM who are infected with HIV and those who are not (Gilbert et al., 2011). HIV-infected MSM are more likely, however, to be vaccinated against HPV (Meites, Markowitz, Paz-Bailey, Oster, & NHBS Study Group, 2014).

Based on the lack of studies found in the current relevant literature, more research is needed that specifically assesses providers' knowledge regarding vaccine needs in adults. Data are even further scarce in regards to provider knowledge of vaccine needs in high-risk adults, including MSM and HIV-infected MSM.

Research Questions

The purpose of this study was to assess knowledge levels of a national sample of "gay friendly" physicians, nurse practitioners, and physician assistants regarding vaccine needs in MSM and HIV-infected MSM. Findings can further direct scholarly inquiry, identify where these providers may need further education, and augment the scholarship devoted to vaccination as a protective intervention for the prevention of specific infections in MSM and HIV-infected MSM. Research questions included:

1. How well do "gay friendly" providers know the vaccine needs of HIV-infected MSM?
2. Do demographic variables (age, sex, race, sexual orientation, professional classification, years of practice, area of specialty practice, annual number of MSM and HIV-infected patients treated annually, provision of vaccines within location of practice, and direct marketing to the gay, lesbian, bisexual transgender [GLBT] community)

relate to the ability of providers to correctly identify the vaccine needs of HIV-infected MSM?

Methods

Design and Sample

The Gay and Lesbian Medical Association (GLMA) is a professional health care organization with a defined mission to, "ensure equality in health care for lesbian, gay, bisexual, and transgender individuals and health care providers" (Gay and Lesbian Medical Association, 2015a, p. 1). This organization includes on its Web site its Health care Provider Index (HPI) (Gay and Lesbian Medical Association, 2015b), which allows physicians, nurse practitioners, physician assistants, and other health care professionals to register their professional contact information for public access. The intent of the HPI is to assist GLBT persons in accessing GLBT-accepting ("gay friendly") providers for care.

The HPI lists providers nationally. At the time of sampling, the Index included 335 total nurse practitioner, physician, or physician assistant registrants. Every state except for Montana, New Hampshire, New Mexico, South Dakota, West Virginia, and Wyoming had registrants. The Institutional Review Board at the University of Central Florida approved the study. Over a 3-week period, every physician, nurse practitioner, and physician assistant listed in the HPI were mailed a study packet, which included the demographic questionnaire, case vignette, and a de-identified prepaid postage return envelope. No identifiers were used at any time other than the initial addressed envelopes. Fifty-two (16%) of the study packets were returned as undeliverable, bringing the potential sample down to 283, of which 92 (33%) completed packets were returned for analysis.

Measures

The demographic questionnaire asked for information related to age, sex, race, sexual orientation, profession, years of practice experience, specialty area of practice, number of MSM and HIV-infected patients treated annually, whether or not the provider marketed his or her services to the GLBT community (outside of GLMA's HPI), and whether or not they administered vaccines in their clinical

practice location. In addition, a question was asked regarding the degree to which the provider was familiar with the CDC *Adult Immunization Schedule*. This item was scored on a Likert scale, where a score of 1 indicated least familiarity and a score of 5 indicated most familiarity.

Three separate case vignettes were also provided; a short paragraph describing a patient's presentation, risk factors, and pertinent personal characteristics and vaccination history was given. Next, participants were asked to circle the vaccine (s) he or she believed was/were necessary for the patient in the vignette without using any external resources. An option stating, "no vaccines are needed" for the patient presented in the vignette was also provided. The focus of this article is the knowledge of the providers regarding vaccine needs in a 28-year-old HIV-infected gay male who is "healthy" (with a CD4 count >200 mm³).

Analytic Strategy

As research packets were returned, a paid research assistant input the coded data into a Microsoft Excel spreadsheet. Next, data were analyzed using the Statistical Analysis System (SAS) Version 9.4. Descriptive statistics were used to describe the demographic characteristics of the sample. To answer the research questions, Fisher's exact test of independence was used. This statistical test is designed to assess whether proportions for one variable are different among values of another variable; it has also been shown to be particularly valuable with smaller sample sizes (McDonald, 2014).

Results

Sample characteristics

The average participant was a White male, aged 47 who identified as homosexual. The majority of the sample ($n = 68$; 74%) was educated as a medical doctor (MD), followed by nurse practitioners ($n = 9$; 10%), and an equal number of doctors of osteopathy ($n = 7$; 8%) and physician assistants ($n = 7$; 8%). The providers had an average of 17 years of practice experience and treated a mean number of 322 gay-identified, and 173 HIV-infected, patients annually. The majority ($n = 80$; 87%) provided vaccines to patients in their place of clinical practice and marketed their services to the

GLBT community beyond GLMA's HPI ($n = 54$; 59%). Overall, familiarity with the CDC *Adult Vaccination Schedule* was high, with a majority (76%) rating their familiarity as either 4/5 [comfortable ($n = 43$; 47%)] or 5/5 [very comfortable ($n = 27$; 29%)]. Comprehensive data related to the sample's demographics can be found in Table 1

Research questions

To answer the first research question, participants' knowledge levels were measured using descriptive statistics. Specifically, participants were scored by tallying the number of correct vaccines (out of a possible total of 3) they identified as needed by the patient in the vignette. In addition to the mean correct score, the number of incorrect vaccines identified was also calculated. Two of the participants (2%) did not identify any correct vaccines while nine (10%) identified just one. Twenty-one (23%) correctly identified two of the vaccines, while 59 (64%) correctly identified all three. The overall mean score for number of correct vaccines identified was 2.5 (Table 2).

Seventeen (18%) of the participants did not identify any incorrect vaccine needs within the vignette. Thirty-one (33%) participants identified one incorrect vaccine need. Twenty-three (25%) incorrectly identified three unnecessary vaccines, while two (2%) identified four unneeded vaccines. Finally, one (1%) participant identified six incorrect vaccine needs. The mean number of incorrectly identified vaccines was 3. Approximately 10 (11%) of the participants both correctly identified all vaccine needs of the patient in addition to not identifying any incorrect vaccine needs. Thus, the majority of the sample ($n = 83$; 90%) misidentified the correct vaccine needs of and/or selected inappropriate vaccines for, the HIV-infected MSM in the vignette.

To answer the second research question, Fisher's exact test of independence was calculated for each independent variable to measure the statistical association between the demographic variables and the ability of providers to correctly identify the vaccine needs of HIV-infected MSM. Three of the demographic variables had a statistically significant association with providers' ability to correctly identify the vaccine needs of the patient in the vignette. First, the participants' area of specializa-

TABLE 1. *Sample Demographics (n = 92^a)*

Age	
Range	28–69
Mean	47
Race	
Asian	4
Hispanic	4
Pacific Islander	1
White	82
African-American	1
Sex	
Male	64
Female	25
Trans (Female to Male)	1
Sexual orientation	
Heterosexual	10
Homosexual	80
Bisexual	2
Profession	
Nurse Practitioner	9
Physician (MD)	68
Physician (DO)	7
Physician Assistant	7
Years in practice	
Range	1–47
Mean	17
Specialty	
Family practice	38
Internal medicine	20
Infectious disease	13
Public health	1
Acute care	1
Other	19
Number of gay patients treated annually	
Range	1–3,000
Mean	322
Number of HIV-infected patients treated annually	
Range	0–2,300
Mean	173
Provides vaccines at practice location	
Yes	80
No	12
Markets to GLBT community	
Yes	54
No	37
Familiarity with CDC <i>adult vaccination schedule</i>	
Range	1–5
Mean	4

Note. ^aSome data not provided.

tion was found to be statistically significant ($p = .0045$).

Those who identified their specialization as family practice ($n = 38$; 41%), internal medicine ($n = 20$; 22%), or infectious disease ($n = 13$; 14%) scored highest, while those who identified their

TABLE 2. *Summary of Major Findings*

<ul style="list-style-type: none"> • The majority of the sample ($n = 83$; 90%) misidentified correct vaccine needs of and/or selected inappropriate vaccines for the HIV-infected MSM • Statistically significant variables associated with greater knowledge of the patient’s vaccine needs included: <ul style="list-style-type: none"> ◦ Greater familiarity with the CDC <i>Adult Vaccination Schedule</i> ($p = .027$) ◦ Practice specialization ($p = .004$) ◦ Administration of vaccinations within location of practice ($p = .009$)

specialty as “other” ($n = 19$; 21%) scored lowest. Another statistically significant variable was the administration of vaccinations within the clinical practice setting of the participant ($p = .0095$), with the majority of participants ($n = 80$; 87%) indicating they administered vaccines within their practice location. Finally, the degree to which the participant was familiar with the CDC *Adult Vaccination Schedule* was also statistically significant ($p = .0271$). Those indicating a greater degree of familiarity with the schedule scored higher than those who indicated a lower degree of familiarity.

Discussion

Unfortunately, the sample was not as racially diverse as the general population. African-Americans ($n = 1$; 1%), Asians ($n = 4$; 4%), Hispanics ($n = 4$; 4%), and Pacific Islanders ($n = 1$; 1%) constituted only 11% of the sample. The precise reason why the sample skewed toward Caucasians is unclear, but it is possible that there are more Caucasian registrants within GLMA’s HPI than persons of other ethnicities. Some literature suggests Caucasians have higher rates of acceptability of homosexuality and homosexual behavior than other minorities (Vincent, Peterson, & Parrott, 2009). Therefore, they might be more inclined to register with the HPI. Confirmation of this is unattainable, however, because race/ethnicity of providers is not reported within the system.

While the majority of the sample ($n = 72$; 79%) was educated as a medical doctor (MD), nurse practitioners ($n = 8$; 9%), and physician assistants ($n = 6$; 7%) collectively made up 16% of the sample, adding to its inclusiveness of alternative providers who provide services similar to that of MDs and

DOs. However, unlike the research of Buxton et al. (2013) which showed greater vaccine knowledge in nurses compared with physicians, there were no significant differences in the scores between the providers in this study.

This could be because the overall sample size was small; subsamples of the various providers were even smaller, making discrimination between the groups more difficult. DOs, for example, only made up 8% of the sample. The providers had an average of 17 years of practice experience and treated a mean number of 322 gay-identified, and 173 HIV-infected, patients annually. This indicates the sample was experienced in treating gay- and HIV-infected patients.

Surprisingly, the majority ($n = 80$; 87%) provided vaccines to patients in their place of clinical practice. This is because vaccines are often thought of as expensive to stock and preserve within a practice; and reimbursement for provision of vaccines remains low (O'Leary et al., 2014; Stephenson, 2014). The fact that the majority of the sample marketed their services to the GLBT community ($n = 54$; 59%) solidifies their commitment to reaching out to GLBT patients beyond just the GLMA HPI. In addition, the majority of the sample identified as nonheterosexual ($n = 82$; 89%). This could suggest these providers see their responsibility as gay/bisexual physicians, nurse practitioners, and physician assistants in a larger context and value their role in making an impact within the gay community of which they are members. Wohl (2012) asserted this as historically important during the early stages of the AIDS epidemic:

In the early days of AIDS, many at the forefront of HIV medical care and research were gay men and women. Often these providers had practices that included gay men and many did answer their own calls to action from their communities. (p. 3)

Participants in this study showed difficulty in collectively identifying the correct needs of the case patient and avoiding selection of unnecessary vaccines. The vast majority of the sample ($n = 83$; 90%) misidentified the correct vaccine needs of and/or selected inappropriate vaccines for the case patient. Selecting of inappropriate vaccines is an important study consideration because exposing patients to unnecessary vaccines and/or administering a vaccine to a patient after he or she has acquired immunity increases health care costs and

can increase a patient's risk for vaccine-associated adverse events.

On a positive note, the majority of the participants ($n = 59$; 63%) did correctly identify all three vaccines the patient in the case needed, suggesting most understood which risks the HIV-infected MSM case patient possessed and the vaccines needed to address some of these risks. Unfortunately, there is a serious lack of data assessing vaccine knowledge in health care providers, and even less so in-terms of HIV-infected individuals, MSM, and HIV-infected MSM.

This makes comparison of the results of this study with published data challenging. However, research suggests that nationally, adult vaccination rates are low, with significant gaps between compliance data and *Healthy People 2020* targets (Williams et al., 2015). Adult patients also tend to rely on provider recommendations for vaccinations. Consequently, the Community Preventative Task Force and the National Vaccine Advisory Committee have recommended that providers integrate needs assessment, recommendation, and offering of vaccination into every adult patient clinical encounter (Williams et al., 2015).

This study is unique in that it assessed knowledge of providers in identifying vaccine needs in HIV-infected MSM. While no other studies have focused on this high-risk group, data from nationally representative samples highlight major vaccine disparities among minority populations (Williams et al., 2015). Thus, while public health campaigns to encourage vaccination are needed for outreach to all adults, targeted, population-specific interventions for minorities are also paramount.

The participants' area of specialization was found to be a statistically significant variable ($p = .0045$). Those who identified their specialization as family practice ($n = 38$; 41%), internal medicine ($n = 20$; 22%), or infectious disease ($n = 13$; 14%) scored highest in their ability to correctly identify the vaccine needs of the patient in the case vignette.

Family practice and internal medicine practice are both rooted in primary care and disease prevention (American College of Physicians, 2015). Therefore, these clinicians may have a great deal of focus and experience in providing and recommending vaccinations to their patients. In addition, it would be expected that providers who work in infectious

disease have a greater knowledge regarding vaccinations. While board-certification status was not assessed in this study, infectious disease physicians complete additional education and clinical residency that serves to greatly augment their knowledge in this area. The American College of Physicians and Infectious Disease Society of America (2008) have also partnered to author their *Joint Statement of Medical Societies Regarding Adult Vaccination by Physicians*, which solidified their commitment to “emphasize the importance of adult vaccination against an increasing number of vaccine-preventable diseases” (p. 1)

Nurses, nurse practitioners, physicians, and physician assistants who work in the field of HIV can also enforce their competencies in treating HIV-infected patients by becoming certified as Practicing HIV Specialists through the American Academy of HIV Medicine (2015). Nurses and nurse practitioners can also achieve certification and advanced certification through the HIV/AIDS Nursing Certification Board (HANCB), earning credentials as an HIV/AIDS Certified Registered Nurse (ACRN) or HIV/AIDS Advanced Certified Registered Nurse (AACRN) (HIV/AIDS Nursing Certification Board, 2015). While participants were not asked if they possessed these credentials, it is possible that some of the participants were credentialed in this area. This could suggest greater knowledge levels of vaccine needs in HIV-infected persons in this group of providers.

Administration of vaccinations within the clinical practice setting of the participant was also significant ($p = .0095$). It is expected that those who administer vaccines within their clinical practice have a greater knowledge and understanding of those vaccines because they administer them directly to patients themselves. These providers may view close familiarity of vaccines as a major responsibility related to patient safety. Finally, the degree to which the participant was familiar with the CDC *Adult Vaccination Schedule* was statistically significant ($p = .0271$). Those indicating a greater degree of familiarity with the schedule scored higher than those who indicated a lower degree of familiarity, which strengthens the relationship between familiarities with this resource and prescribing accuracy.

Prior studies have indicated that vaccination rates in MSM remain low (Storholm et al., 2010; Thomas

& Goldstone, 2011). This study found significant knowledge gaps in providers regarding vaccine needs in this population, including MSM who are infected with HIV. This study was not designed to assess relationships between knowledge levels of providers and rates of vaccination. However, because adults rely on provider recommendations in their decisions on vaccination (Williams et al., 2015), it is possible that lack of knowledge of vaccinations in general, specific recommendations for high-risk groups, and the CDC *Adult Vaccination Schedule* in providers could be a factor driving the subpar vaccination rates in MSM.

Thus, a reasonable recommendation derived from this work could be to increase the amount of content related to vaccination in the formal educational preparation of nurse practitioners, physicians, and physician assistants. This is a recommendation echoed by Buxton et al. (2013), whose research discovered lack of vaccine comprehension in their sample of nurses and physicians. Another recommendation to increase awareness among providers in recognizing the vaccine needs of MSM and HIV-infected persons is through use of the CDC Vaccine Schedules clinical application (app) (Centers for Disease Control and Prevention, 2015) available for iPhone, Android, and other smart phone-operating platforms.

This mobile app provides clinicians with immediate access to all of the vaccination schedules recommended by the Advisory Committee on Immunization Practices. These schedules include those for children, adolescents, and adults. Also included are the schedules for persons with unique vaccine needs based on personal characteristics.

This study presented many limitations that are important to consider. The overall size of the sample was small. This makes the generalizability of the findings challenging. However, this limitation was addressed, at least partially, by utilizing a statistical method (Fisher’s exact test) that is more suitable for assessing associations between variables in studies with smaller sample sizes. In addition, those who were willing to participate in the study may have been highly motivated to do so. For example, the majority of the sample identified their sexual orientation as homosexual and the study topic pertained to gay/bisexual men’s health. Thus, motivation bias, in which those with more interest and consequently greater knowledge

in the topic are more likely to participate, was possible.

However, findings suggest this may have been minimal as most participants made errors in their selection of appropriate and/or inappropriate vaccines for the case patient. The sample was also derived from only one source. However, the GLMA HPI is the only known national registry of providers who are “gay friendly” and who utilize this online resource to inform potential GLBT patients of their GLBT-accepting practices.

Although the sample source for this study was selected from a national database, future research on this topic should be designed to capture larger sample sizes. This was a pilot study that was unfunded. Future inquiries might be able to recruit larger samples through the use of incentives. Although assessed by an outside expert for content validity, the data collection instruments and case vignettes were unstandardized. Finally, this study consisted of mainly Caucasian participants, which limited input from ethnic/racial minorities. Although the diversity of the nation’s health care workforce does not reflect the ethnic makeup of the United States (Association of American Medical Colleges, 2006), there should be an attempt to diversify samples in future work on this topic.

Preventing infectious diseases in high-risk persons is a national public health directive. Public health nurses and other clinicians must reduce health disparities by answering this call. This can be achieved through educational outreach methods, continuing education events, and by advocating for augmentation of nursing and medical curricula to include information regarding vaccine needs in MSM and those persons infected with HIV. Perhaps one of the most important suggestions for future research on this topic is rooted in the need for interventions designed to improve the knowledge of clinicians regarding vaccine needs of HIV-infected MSM.

Emerging technologies have enhanced the modalities in which continuing education materials can be provided to health care professionals. Thus, public health scientists should utilize teaching strategies that use a multimethod approach combining both online teaching with traditional face-to-face formats. Critical inquiry into which educational modes are optimal could suggest optimal strategies. Finally, the use of the CDC Vac-

cine Schedules clinical app for iPhone, Android, and other smart phone operating platforms can provide clinicians with immediate access to all of the vaccination schedules recommended by the Advisory Committee on Immunization Practices, including those for MSM and HIV-infected persons.

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