Cancer Causes & Control (2019) 30:989–996
https://doi.org/10.1007/s10552-019-01209-8

ORIGINAL PAPER

Screening for anal cancer precursors among patients living with HIV in the absence of national guidelines: practitioners' perspectives

Alexis M. Koskan[1] · **Stephanie A. Brennhofer**[2] · **Deborah L. Helitzer**[3]

Received: 7 February 2019 / Accepted: 5 July 2019 / Published online: 13 July 2019
© Springer Nature Switzerland AG 2019

Abstract

Purpose Immunocompromised populations including people living with HIV (PLWH) suffer disproportionate burden from anal cancer, a rare cancer caused by persistent infection of the anal canal with oncogenic strains of human papillomavirus. In the US, there are no nationally adopted screening guidelines for anal cancer. In the absence of such guidelines, this study explores healthcare practitioners' screening practices for early signs of anal cancer among PLWH.

Methods Between November 2017 and June 2018, the research team completed 25 interviews among a diverse sample of healthcare practitioners who provide care for PLWH.

Results Providers expressed frustration that screening and treatment guidelines for anal cancer were scant, and they varied in their screening practices. The majority of providers screened PLWH for anal dysplasia via the anal Pap smear; few providers were trained and had the medical equipment to conduct high-resolution anoscopy-guided biopsies, a more sensitive and specific screening method. Others screened through digital ano-rectal examinations (DARE) and both visually and with a DARE. Participants discussed how providers may be over-treating their patients who have high-grade anal intraepithelial neoplasia (AIN) and the role of biomarkers to determine whether the lesion is carcinogenic.

Conclusions Practitioners who provide care for PLWH are proactive in screening to help prevent and control anal cancer, a rare and slow-growing disease. Continuing to regularly surveil high-risk populations, particularly PLWH previously diagnosed with high-grade lesions, is critical to prevent and control anal cancer.

Keywords Anal cancer · Anal intraepithelial neoplasia · Human papillomavirus · Human immunodeficiency virus

Anal cancer is rare in the general population. In the United States (US), it is a cancer disparity among people who are immunosuppressed, including people living with HIV (PLWH) [1, 2]. In an analysis of 13 US cohort studies of PLWH, incidence of anal cancer was highest among HIV-infected men who have sex with men (131 per 100,000), followed by HIV-infected heterosexual men (46 per 100,000) and HIV-infected women (30 per 100,000) [2]. Also between the years 1999 and 2005, the incidence of anal cancer has continued increasing, irrespective of HIV status, by 2.1% each year [3]. In a similar time frame (1992–2003), based on anal cancer rate ratios, PLWH's rate ratio has increased from being 31 times more likely to developing anal cancer to almost 60 times more likely for developing this cancer as compared to HIV-negative populations [4].

The majority of anal cancers are caused by persistent infection of the anal canal with oncogenic strains of human papillomavirus (HPV 16 and 18), the same strains responsible for the majority of cervical cancer cases [5]. Healthcare practitioners and researchers believe that HPV infection can progress to anal cancer in a similar manner as this virus progresses to cervical cancer, given the primarily affected tissues are histologically identical [6]. Similar to the way HPV targets mucosal cells in the transformation zone of the cervix, HPV affects the mucosa of the anal transformation zone, and persistence with oncogenic strains of HPV can lead to cellular changes, also known as dysplasia [7]. Providers often use an anal Papanicolau [Pap] test (a cytology-based screening similar to a cervical Pap test) to detect anal

✉ Alexis M. Koskan
alexis.koskan@asu.edu

[1] College of Health Solutions, Arizona State University, 425 N. 5th Street, Phoenix, AZ 85004, USA

[2] Mel and Enid Zuckerman College of Public Health, University of Arizona, Tucson, AZ, USA

[3] College of Health Solutions, Arizona State University, Phoenix, AZ, USA

dysplasia. Over time, the body can either clear the dysplasia or the dysplasia can slowly progress to low-grade neoplasia (anal intraepithelial neoplasia, AIN 1) and to high-grade AIN (AIN 2 and 3), the believed precursors to anal cancer [8]. The high-resolution anoscopy (HRA)-guided biopsy is typically used to detect AIN grade. (It is important to note that high-grade AIN is synonymous with high-grade squamous intraepithelial neoplasia [HSIL] when discussing precancerous anal lesions.)

Although no randomized controlled trials have proven that treating CIN3 lesions definitively prevents cervical cancer, scientific and medical communities agree that the optimal risk-reducing strategy for preventing cervical cancer is by treating these high-grade lesions [9], regarded as true precancerous lesions [10]. Similarly, researchers and practitioners are uncertain if treating high-grade AIN definitively reduces the risk for developing anal cancer, a cancer with a much lower rate of progression, including among PLWH, from high-grade lesions to cancer [11, 12]. Currently a nationwide randomized control trial, the Anal Cancer/HSIL Outcomes Research (ANCHOR) Study is exploring anal cancer progression, and the study aims to determine whether treating HSIL (high-grade AIN) among people living with HIV reduces their risk for developing anal cancer (ClinicalTrials.gov: NCT02135419, study completion predicted for 2022).

There are no national guidelines for anal cancer screening, and past research has shown that practitioners who treat PLWH do not consistently screen for anal cancer precursors (e.g., dysplasia and AIN) [13, 14]. In a recent survey of providers working at one US community health center which serves a large number of PLWH, providers identified lack of time as the predominant anal screening barrier and lack of staffing to ensure patient follow-up after receiving abnormal results as the most common barrier to additional screening and treatment [14]. More research is needed to have a broader understanding of multiple practitioners' (who provide care for PLWH) anal cancer screening perspectives and practices. Therefore, the purpose of this study is to explore the practices related to anal cancer screening, referral, and treatment among healthcare practitioners working in a variety of settings that treat PLWH.

Methods

Recruitment

The authors received IRB approval to conduct this research. Between November 2017 and June 2018, researchers recruited and interviewed US healthcare practitioners (of one southwestern state) who provide care to patients living with HIV using a variety of strategies. They first conducted an online to find contact information for healthcare providers who specialized in infectious disease or who were associated with HIV-related service agencies. Many of the state's providers were listed on local HIV-related non-profit organizations' websites. Others were located using a search strategy which included the name of the state and the term "infectious disease." The research team compiled the names of all service providers and began calling their medical practices to request an interview. The first and second authors called the office managers to ask to schedule an interview with practitioners. The majority of participants were recruited via this strategy.

Other recruitment strategies involved attending citywide meetings for healthcare providers currently collaborating on an initiative (Fast Track Cities: 90-90-90-0) intended to increase retention in HIV care among people living with HIV and to end stigma against the virus. At this meeting, the first author presented study information and requested healthcare providers to participate in an interview related to preventing anal cancer. The research team also relied on snowball sampling for participant recruitment.

In-depth interviews

After a potential participant expressed interest in taking in the study, one of the research team members set a time and date to conduct the interview and allowed interview participants to choose whether they preferred to be interviewed in person or via phone. The day of the interview, the research team member obtained verbal informed consent before administering a demographic survey and conducting the in-depth interview. The research team utilized an in-depth interview guide developed by the first author to guide the qualitative exploration. See Table 1 for the in-depth interview questions. After completing the interviews, the research team emailed all participants a $20 Amazon e-gift card as remuneration for their shared time and expertise.

Data analysis

The research team uploaded all interview MP3 files to a professional transcription service's website for transcription. The first author verified the transcripts against the audio recordings. Prior to coding the articles, the first author read and reread four transcripts to begin understanding themes that emerged from the data. Using an inductive content analysis approach, the first and second author read the same three interview transcripts separately and met to begin creating a codebook of interview themes [15]. They created an initial set of codes and definitions for each code and coded one interview transcript together using this codebook. Separately, they coded an additional three interviews. They later met in person to compare codes, and to discuss the

Table 1 Interview guide

Screening practices
What are your current practices related to screening for anal cancer among HIV-infected populations?
In what ways may these guidelines differ by population (gay and bisexual men)?
How often are your patients recommended to screen for anal cancer?
What tests do you use to screen patients for anal cancer?
What do healthcare providers do when a patient has abnormal cytology results?
What are your protocols for screening procedures?
Triage?
Treatment?
Referrals?
If conduct high-resolution anoscopy: Which health care practitioners conduct the high-resolution anoscopy? Nurse practitioners, physician assistants, physicians?
What type of training did they have to perform this screening?
If referral-HRA: Where are patients with abnormal cytology results are referred? Who are the collaborating providers for referrals of problems not within their scope of practice?
How often are patients recommended to screen? HIV-infected patients?
Describe what happens when a patient is positive for HPV/anal dysplasia.
Setting up the screening practices
When did you begin screening HIV-infected patients for anal neoplasms?
What prompted your clinic to begin screening for this disease?
What type of training did your healthcare providers complete to begin screening patients for anal cancer?
Please explain some of the organizational policies and procedures that changed to create anal cancer screening a standard practice in your clinic
Referral
If patients receive an abnormal Pap smear and/or HRA, where are they directed to go next for follow-up care?
In what ways does your organization follow-up with patients with abnormal cytology results to ensure that they continue receiving care?
What else would you like to say about anal cancer screening?
Is there anything else you would like to say about the topic of HPV? Cancer prevention?

need to update the coding guide based on the emergence of new codes. The first author entered all coded materials into ATLAS.ti software, a qualitative program used to organize all hand-coded materials and to calculate scores of intercoder agreement. The first and second authors' coded interview transcripts yielded an acceptable intercoder agreement score (Krippendorff $\alpha = 0.736$) [16], a score used to determine coding similarities between research team members. Authors split and coded the remaining transcripts, communicating regularly to discuss the need to add new themes or combine existing themes before recoding all interview transcripts with any changes or updates to the coding guide. They synthesized the codes for each theme that emerged from participants' interview responses, and selected quotes which best illustrated these themes [17]. Consistent with qualitative data analysis standards, the research team conducted interviews until they reached data saturation and no new themes emerged for the data [18].

Results

After conducting 25 interviews, no new themes emerged from the data, and the research team completed the data collection (Table 2 describes participants' personal and professional characteristics). Three major themes emerged which include (1) the impact of the lack of anal cancer screening guidelines, (2) barriers to screening for anal cancer, and (3) treating high-grade AIN and anal cancer.

Table 2 Participant demographics

Participants ($n = 25$)	
Provider gender	Male = 15
	Female = 10
Provider age	25–34 = 4
	35–44 = 5
	45–54 = 4
	55–64 = 11
	65+ = 1
Provider type	Primary care physician = 13
	Nurse practitioner = 4
	Registered nurse = 1
	Physician assistant = 2
	Colorectal surgeon = 4
	Dermatologist = 1
Years of practice	Mean = 19.6 years (range 1–40 years)
Practice affiliation	Private practice/medical group = 10
	Public hospital clinic = 9
	Private hospital clinic = 2
	Academic hospital = 2
	Community health center = 1
	Non-profit organization's clinic = 1

Impact of the lack of anal cancer screening guidelines

Providers described how, in the absence of national anal cancer screening guidelines, medical practitioners varied in their approaches to screening for anal cancer. One provider noted feeling "lost" in terms of knowing what was the best approach to screen patients for early signs of anal cancer.

> Yeah, I struggled with that in the beginning, because there's really not a lot of specific guidelines out there. And, as I asked other providers [about how they are screening], everyone's sort of doing their own thing. I was sort of lost in a sense because I like to have specific guidelines. (Provider 4, NP)

The lack of nationally adopted anal cancer screening guidelines was particularly frustrating for providers who desired to practice evidence-based medicine. One provider commented

> It's interesting because I'm in the same boat where I didn't feel like I have those guidelines, and I've got to tell you—I have kind of gotten off the beaten path. I'm trying to follow guidelines and be evidence-based, but I'm also trying to do what is best for the person in front of me. (Provider 8, MD, Internal Medicine and Infectious Disease Specialist)

In the absence of national guidelines, some providers described following New York State Health Department's anal cancer screening guidelines. The same number of providers followed cervical cancer screening guidelines to direct their anal screening practices.

> We're using the model of cervical cancer. We don't quite have the data yet for anal cancer. And so, that is one barrier that I think needs to be addressed because it's hard to say to a patient, "Well, you know, I recommend this, even though I don't have the data. But, theoretically [given the similarities of cervical and anal cancers], it makes sense. (Provider 3, RN, PhD)

Providers described how the lack of national anal cancer screening guidelines impacted patients' health insurance, particularly their ability to seek coverage for anal Pap tests, HPV DNA testing, and HRAs. They reported how insurance coverage for the different anal cancer screening exams has been inconsistent and how, often, insurance companies considered anal cancer screening "experimental," only reimbursing clinics and patients after providers filed for insurance appeals.

> A lot of times, insurance doesn't cover it and I get a lot of kickback on it. So, that's a big problem because now insurance isn't covering it, people are less likely to do it…The anal cancer screening and they're especially not doing it if you do HPV anal cancer screenings. So, if you do it with an HPV co-testing, then they won't pay for that. It's considered experimental… I typed up a letter about the studies that have been done showing that especially in the HIV patient populations there is an extremely increased risk of anal cancer related to HPV and that routine testing has been recommended in multiple studies. It just hasn't made it to mainstream recommendations or guidelines yet. Usually, it gets covered on an appeal. (Provider 14, MD, Family Medicine)

Providers discussed the need for further research findings to direct how to manage AIN and prevent cancer. They described how these research findings should inform the formation of national screening guidelines for anal cancer. Many described how they are awaiting the outcomes of the ANCHOR Study to provide such guidance, hoping that findings from this nationwide study would shed further light on anal cancer progression and prevention.

> I think the ANCHOR Study is going to be the real key. I wish ANCHOR would end with an answer. But unfortunately, I think the truth is it's gonna take a long time because the disease [anal cancer] is slow [slow-growing], and the outcomes [of AIN clearance and progression] are variable. (Provider 20, MD, Family Medicine)

Barriers to screening for anal cancer

A majority of study providers screened their patients for anal cancer precursors at their medical practices. Their approaches to screening included anal Pap smears ($n=11$), HRA ($n=5$), digital rectal examination alone ($n=2$), and visual inspection paired with digital ano-rectal examination ($n=1$). Among those performing anal dysplasia screenings, there was no consensus on how often to screen and when to follow-up with abnormal cytology for both low- and high-grade AIN. Screening for anal dysplasia ranged from every 3 months to every 3 years. However, screening every 12 months was the most common response. The time interval for follow-up with patients also ranged from 3 to 12 months and appeared to be related to whether the patient had been diagnosed with low- or high-grade AIN.

Not all providers were comfortable conducting anal Pap smears. Some providers reported lacking confidence in anal Pap smears as a test, largely because cytology testing is not sensitive and specific. One provider described how anal Pap smears often lead to false positives. In his opinion, the likelihood of a false positive paired with the lack of data proving that screening for anal cancer and treating high-grade AIN

helped prevent cancer made him incapable of promoting anal cancer screening as a whole. This physician stated,

> There's no evidence it [screening via anal Pap smear] works. I'm very conservative when it comes to screening tests, because the vast majority of people don't benefit from it. You want to make sure that you're not harming people in the interim. And when you screen for cancer, you really should have evidence that screening decreases mortality from that cancer, because you're going to find a lot of false positives… There's gonna be a lot of over-diagnosis and a lot of harm to people who don't have any cancer. So, if you want to accept that as a population-wide harm, you better have pretty good proof that somebody is going to benefit from it, meaning lower anal cancer death rates as a result of the screening. And currently there is no such data. (Provider 21, MD, Preventive Medicine)

Another primary care physician discussed the hazard of screening for anal cancer and misdiagnosing the grade (1, 2, or 3) of an AIN lesion. This, in turn, can affect a patient's treatment. This colorectal surgeon briefly described new research findings which promote testing AIN lesions for a biomarker, p16 protein, to denote malignant transformation.

> As you may know, you have AIN 1, 2, and 3. The 1s [AIN 1] are not high-grade. The 2s and 3s [AIN 2 and AIN 3], they're supposed to be high-grade. So now, the latest stuff coming out is if you have AIN 2, you should do a p16 [biomarker] test. And if it is negative, don't consider it high-grade. If it's positive for p16, consider it high-grade. Well, the treatment for low-grade and high-grade after screening or follow-up may be very different; which, it is. So, having criteria of 2s of low-grade and high-grade is an enormous impact as to the numbers being treated in different ways. (Provider 9, MD, Colorectal Surgeon)

On the other hand, many providers discussed why they did not conduct HRAs. One reason included not having received the training to conduct an HRA. Another commonly cited reason was clinics' lack of medical equipment (anoscope or colposcope) to conduct follow-up HRAs.

> We really don't have access to the equipment. It's something that our program would like to do… to get a nurse practitioner who is trained in this [HRA] and be able to offer the same sort of services here that we offered in [name of last hospital]. But, right now, we're not screening people. And I think it's bad… We know how to do anal PAPs. That's not hard. But it's training somebody to do the HRA. You have to hire somebody and send them off to get trained or else hire somebody who is already experienced [at conducting HRAs]. (Provider 22, MD, Internal Medicine and Infectious Disease Specialist)

Many of the healthcare providers who did not conduct the HRA referred patients with abnormal anal Pap smear results to receive the follow-up HRA from one local colorectal surgeon who conducts in-house HRA at his private healthcare facility. This surgeon conducted the HRA in-clinic without using anesthetics, claiming that, most often, anesthetics were unnecessary for this procedure. He claimed,

> The reason for not doing it here in the office in my mind today is because somebody has a lot of—you examine them and they have a lot of warts and you say well I can't treat all those warts in the office although most of them I can. Or somebody just psychologically says hey I just want that there. (Provider 9, MD, Colorectal Surgeon)

The other providers who performed HRAs conducted the procedure in a surgical center, and their patients were administered anesthetics.

Treating high-grade AIN and anal cancer

Consistent with the scientific uncertainty about the topic, providers reported different experiences with patients' dysplasia and its progression to anal cancer. Among the doctors who treat high-grade AIN, six reported using electrocautery (two of whom also administered 5-fluorouracil cream in conjunction with electrocautery), another who administered imiquimod after ablating high-grade AIN, and one provider who treated these lesions via anal mapping with wide local excision.

Providers mentioned their experience that they have rarely seen patients whose AIN progressed to anal cancer. One colorectal surgeon who has been treating HSIL for 14 years attributed this lack of cancer progression to consistently screening and treating patients living with HIV for high-grade AIN. When asked if he had ever diagnosed a patient with anal cancer, this provider stated,

> No, because of the screening. We catch it early enough. I've had high-grade dysplasia which is basically one step away from that and we've gotten it and yes, he's continued to have high-grade dysplasia, but no anal cancer because we keep removing all of the abnormal lesions. (Provider 24, MD, Colorectal Surgeon)

An additional provider described using the medical visit to treat high-grade AIN (HSIL) as an opportunity to promote the HPV vaccine.

> Sometimes I tell them, well, you have HSIL. But, what strain do you have? If you have 35 as your HPV strain, you might not have [HPV] 16 or 18. So, you

> have HSIL, but if I can stop you from getting 16 and 18, which are the two worst actors in the HPV strains, then it may be that, that's [getting the HPV vaccine] actually advantageous. (Provider 17, MD, Colorectal Surgeon)

Two family medicine physicians and all four colorectal surgeons discussed treating early-stage anal cancer. Most indicated that they have only seen one to a few cases in their time as a practitioner. When providers diagnosed patients with anal cancer, more often they reported other practitioners first believed patients' symptoms (e.g., anal bleeding, rectal pain) were due to hemorrhoids as opposed to AIN 3 or cancer.

> The guy who had cancer that was missed, he had anal bleeding. I sent him to a surgeon who did an exam and said he just had a hemorrhoid, and then the bleeding persisted. So, I sent him back, and this time they found a tumor. (Provider 20, MD, Family Medicine)

A few practitioners described particularly memorable cases that have shaped their views and practices on anal cancer screening. One nurse practitioner stated,

> We had one patient with anal cancer and it was horrible. So he actually died from that. And that was very early on when I started here. And after seeing that particular patient, I burned it in my brain, like, 'Okay, we really need to be sure that all of our patients are getting screened and getting appropriate follow-up.' (Provider 3, NP)

Discussion

Although past research has discussed ways to improve providers' anal cancer screening practices [19], none, to our knowledge, have examined the role that inexplicit guidelines have on medical practice. This study found numerous ways in which healthcare providers traverse unknown territory at a time when few have the ability to conduct the HRA and treat high-grade AIN. Even without anal cancer screening guidelines, the majority of providers screened their PLWH for early signs of anal cancer or referred their patients to be screened by another provider.

Past research has questioned whether PLWH should be screened for anal dysplasia using anal Pap smears, a test that produces many false positives without diagnosing high-grade AIN [20]. The HRA has been considered the 'gold standard' for screening high-risk populations, particularly HIV-positive MSM [20]. According to this study and in concordance with past research findings, providers' barriers to using this screening methodology have included lack of proper medical equipment (anoscope) and training to conduct this examination [21]. One provider screened using both visual inspection and digital ano-rectal examination (DARE). Of the various screening methods providers described, visual inspection alone (without the use of acetic acid or Lugol's solution and magnification via anoscopy) is the least effective method to detect anal abnormalities. However, this provider and two others utilized DARE to detect early-stage anal cancers. In a systematic review of international clinical guidelines for HIV care, US-based institutions were supportive (with "moderate recommendation") of using DARE to screen for early signs of anal cancer [22]. An Australian prospective cohort study tested the acceptability (at the patient, provider, and health service levels) and cost-effectiveness of screening HIV-positive MSM for anal cancer using DARE. Results of this trial concluded that DARE is an acceptable and cost-effective anal cancer screening strategy for PLWH [23, 24]. Until researchers determine the effectiveness of treating high-grade AIN to prevent anal cancer, regular surveillance of PLWH, particularly those previously diagnosed with high-grade AIN, via HRA or DARE can reduce the likelihood that anal cancer, with its slow-growing tumors, will remain undetected and untreated.

It is important to note that due to the lack of guidelines, insurance companies treat anal cancer screening via HRA and anal Pap smear paired with HPV DNA testing as experimental. Some insurance companies reimburse practitioners for these examinations only after the practitioners have filed appeals for previous insurance denials. Mandating anal cancer screening reimbursement, especially for the HRA among PLWH, may be the best option for ensuring that high-risk patients can take advantage of these screening strategies [25].

This study adds to research related to anal cancer screening barriers [26] by synthesizing patient, provider, and clinic-level barriers to anal cancer screening based on the perspectives of providers working in a variety of healthcare settings. For patient-level barriers, lack of insurance coverage prevents patients from screening and treatment, especially for procedures deemed "experimental" due to lack of national guidelines. At the provider level, lack of guidelines illustrates providers' need to practice the "art of medicine," the attempt to provide the best care in the absence of a full understanding of disease progression. Clinic-level barriers included the lack of training medical staff and equipment, namely the anoscope or colposcope, to conduct screenings needed to detect and treat precursors to anal cancer.

Providers are still unsure if they are over-treating patients who present with AIN 2 and 3 (HSIL). Researchers and practitioner believe that the outcomes of the ANCHOR Study will help providers understand if treating and re-treating high-grade AIN actually prevents cancer. Outcomes

of this longitudinal study may conclude that providers are over-treating patients with high-grade AIN.

Providers interviewed in the study, particularly the colorectal surgeons, reported treating patients with high-grade AIN in a variety of ways including electrocautery (tissue ablation via laser), anal mapping with wide local excision, imiquimod topical cream, and 5-fluorouracil topical cream to treat high-grade AIN. Anal mapping with wide local excision, a procedure which involves taking a total of 24 biopsy specimens of the anal verge, perianal skin, and dentate line (four minor and four major points per site), sending them off for pathologic examination, and excising any detected lesions [27], is now viewed as an outdated procedure [28, 29]. Electrocautery has a higher response rate and leads to less recurrence than topical treatments such as imiquimod and 5-fluorouracil creams [29]. High-grade AIN recurrence is still common, regardless of treatment type. For example in one longitudinal study, 60% of HIV-positive MSM participants had high-grade AIN recurrence after receiving electrocautery [30]. Similar to what one provider in this study described, offering the HPV vaccine after screening for and also after treating a patient for HSIL may reduce the risk of the patient being infected with additional HPV strains for which the person has not been previously exposed. Nevertheless, the HPV vaccine is recommended as a prophylactic vaccine and is most effective when administered prior to sexual debut.

Limitations

This research study has limitations to consider. Given the methods of recruitment for this convenience sample, one research limitation may be selection bias. Only providers willing to share their time and expertise participated in the study. However, aligned with the study purpose, the research team believes they recruited a diverse sample of healthcare practitioners working at various types of healthcare facilities, with different medical training experiences, and different anal cancer screening behaviors representative of the HIV care in this region. Two study authors conducted the qualitative in-depth interviews, possibly leading to interviewer variability. The first author aimed to reduce this variability by training the second author in using the in-depth interview guide and following up responses with probes. Another possible limitation is that study authors asked practitioners if they conduct high-resolution anoscopies at their clinic without asking providers specifically about the equipment they use or the exact training they received to conduct the HRA. It is possible that providers who described conducting HRA were using medical equipment with less magnification than a colposcope or anoscope, reducing their ability to detect HSIL. Further, these providers may not have completed the Standard HRA Course offered through the International Anal Neoplasia Society, a rigorous training that teaches providers this specialized procedure. Finally, the research team conducted this study in one geographic area, a state that ranked 15th in HIV incidence [31]. Findings may not be generalizable to other US geographic regions with more experience working with PLWH.

Conclusion

The practice of anal cancer screening waits on science for further clarification on anal cancer screening guidelines. Until then, it is critical to continue surveilling high-risk populations, particularly PLWH previously diagnosed with high-grade lesions, to prevent and control anal cancer.

Acknowledgments This research was funded by a grant from the Arizona Area Health Education Centers (AHEC) Program. The content is solely the responsibility of the authors and does not necessarily represent the official views of Arizona AHEC.

Compliance with ethical standards

Conflict of interest All authors present no potential conflicts of interest.

Ethical approval This study received institutional review board approval, and all participants completed informed consent prior to participating in this study.

References

1. Shiels MS, Pfeiffer RM, Chaturvedi AK, Kreimer AR, Engels EA (2012) Impact of the HIV epidemic on the incidence rates of anal cancer in the United States. J Natl Cancer Inst 104:1591–1598
2. Silverberg MJ, Lau B, Justice AC et al (2012) Risk of anal cancer in HIV-infected and HIV-uninfected individuals in North America. Clin Infect Dis 54:1026–1034
3. Van Dyne EA, Henley SJ, Saraiya M, Thomas CC, Markowitz LE, Benard VB (2018) Trends in human papillomavirus–associated cancers—United States, 1999–2015. MMWR Morb Mortal Wkly Rep 67:918–924
4. Patel P, Hanson DL, Sullivan PS et al (2008) Incidence of types of cancer among HIV-infected persons compared with the general population in the United States, 1992–2003. Ann Intern Med 148:728–736
5. Palefsky JM (2009) Anal cancer prevention in HIV-positive men and women. Curr Opin Oncol 21:433–438
6. Palefsky J (2017) Human papillomavirus infection and its role in the pathogenesis of anal cancer. Semin Colon Rectal Surg 28:57–62
7. Berry JM, Jay N, Cranston RD et al (2014) Progression of anal high-grade squamous intraepithelial lesions to invasive anal cancer among HIV-infected men who have sex with men. Int J Cancer 134:1147–1155
8. Machalek DA, Poynten M, Jin F et al (2012) Anal human papillomavirus infection and associated neoplastic lesions in men who have sex with men: a systematic review and meta-analysis. Lancet Oncol 13:487–500

9. Castle PE, Sideri M, Jeronimo J, Solomon D, Schiffman M (2007) Risk assessment to guide the prevention of cervical cancer. Am J Obstet Gynecol 197(356):e1–e6
10. Ostör A (1993) Natural history of cervical intraepithelial neoplasia: a critical review. Int J Gynecol Pathol 12:186–192
11. Devaraj B, Cosman BC (2006) Expectant management of anal squamous dysplasia in patients with HIV. Dis Colon Rectum 49:36–40
12. Pineda CE, Berry JM, Jay N, Palefsky JM, Welton ML (2008) High-resolution anoscopy targeted surgical destruction of anal high-grade squamous intraepithelial lesions: a ten-year experience. Dis Colon Rectum 51:829–837
13. Rosa-Cunha I, Cardenas GA, Dickinson G, Metsch LR (2010) Addressing anal health in the HIV primary care setting: a disappointing reality. AIDS Patient Care STDS 24:533–538
14. Apaydin KZ, Fontenot HB, Shtasel DL, Mayer KH, Keuroghlian AS (2018) Primary care provider practices and perceptions regarding HPV vaccination and anal cancer screening at a Boston community health center. J Community Health 43:792–801
15. Kuper A, Reeves S, Levinson W (2008) An introduction to reading and appraising qualitative research. BMJ 337:404–407
16. Lombard M, Snyder-Duch J, Bracken CC (2004) Practical resources for assessing and reporting intercoder reliability in content analysis research projects. https://www.researchgate.net/profile/Cheryl_Bracken/publication/242785900_Practical_Resources_for_Assessing_and_Reporting_Intercoder_Reliability_in_Content_Analysis_Research_Projects/links/0deec52e14791a0d6f000000.pdf. Accessed 15 June 2018
17. Sutton J, Austin Z (2015) Qualitative research: data collection, analysis, and management. Can J Hosp Pharm 68:226–231
18. Ando H, Cousins R, Young C. (2014) Achieving saturation in thematic analysis: Development and refinement of a codebook. Compr Psychol 3: Article 4
19. Kwong JJ, Cook P, Bradley-Springer L (2011) Improving anal cancer screening in an ambulatory HIV clinic: experience from a quality improvement initiative. AIDS Patient Care STDs 25:73–78
20. Panther LA, Wagner K, Proper J et al (2004) High resolution anoscopy findings for men who have sex with men: inaccuracy of anal cytology as a predictor of histologic high-grade anal intraepithelial neoplasia and the impact of HIV serostatus. Clin Infect Dis 38:1490–1492
21. Sowah LA, Buchwald UK, Riedel DJ et al (2015) Anal cancer screening in an urban HIV Clinic: provider perceptions and practice. J Int Assoc Provid AIDS Care 14:497–504
22. Ong JJCM, Grulich AE, Fairley CK (2014) Regional and national guideline recommendations for digital ano-rectal examination as a means for anal cancer screening in HIV positive men who have sex with men: a systematic review. BMC Cancer 14:557
23. Ong JJ, Walker S, Grulich A et al (2018) Incorporating digital anorectal examinations for anal cancer screening into routine HIV care for men who have sex with men living with HIV: a prospective cohort study. J Int AIDS Soc 21:e25192
24. Ong JJ, Fairley CK, Carroll S et al (2016) Cost-effectiveness of screening for anal cancer using regular digital ano-rectal examinations in men who have sex with men living with HIV. J Int AIDS Soc 19:20514
25. Walhart T (2013) The application of Kingdon's Multiple Streams Theory for human papillomavirus-related anal intraepithelial neoplasia. J Adv Nurs 69:2413–2422
26. Koskan A, Leblanc N, Rosa-Cunha I (2016) Exploring the perceptions of anal cancer screening and behaviors among gay and bisexual men infected with IHV. Cancer Control 23:52–58
27. Margenthaler JA, Dietz DW, Mutch MG, Birnbaum EH, Kodner IJ, Fleshman JW (2004) Outcomes, risk of other malignancies, and need for formal mapping procedures in patients with perianal Bowen's disease. Dis Colon Rectum 47:1655–1661
28. Long KC, Menon R, Bastawrous A, Billingham R (2016) Screening, surveillance, and treatment of anal intraepithelial neoplasia. Clin Colon Rectal Surg 29:057–64
29. Richel O, de Vries HJ, van Noesel CJ, Dijkgraaf MG, Prins JM (2013) Comparison of imiquimod, topical fluorouracil, and electrocautery for the treatment of anal intraepithelial neoplasia in HIV-positive men who have sex with men: an open-label, randomised controlled trial. Lancet Oncol 14:346–353
30. Marks DK, Goldstone SE (2012) Electrocautery ablation of high-grade anal squamous intraepithelial lesions in HIV-negative and HIV-positive men who have sex with men. JAIDS J Acquir Immune Defic Syndr 59:259–265
31. Centers for Disease Control and Prevention. Arizona State Health Profile. https://www.cdc.gov/nchhstp/stateprofiles/pdf/Arizona_profile.pdf. Accessed 29 May 2018

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.