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A Viable and Simple Self-Sampling Method for Human Papillomavirus Detection among South African Adolescents

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Abstract

Background—Self-sampling for Human Papillomavirus (HPV) testing may offer improved patient acceptability, decreased cost, and greater practicality than clinician collection of specimens. HPV testing among adolescents is necessary to conduct vaccine surveillance and may play a role in cervical cancer screening among some populations.

Methods—A cross-sectional prevalence study was conducted to compare the results of self-collected and clinician-collected specimens for Human papillomavirus (HPV) testing among South African adolescent females. All participants provided self-sampled vaginal swabs and underwent clinician-collection of cervical swabs for HPV DNA analysis. The level of agreement between HPV DNA results from the two specimen collection methods was measured.

Results—The level of agreement between HPV DNA results from self-collected and clinician-collected specimens was high (κ=86.7; $p<0.001$). A high prevalence of HPV overall was found by both specimen collection methods (57%; 95% CI 0.37–0.75). Low-risk HPV (LR-HPV) types were found slightly more frequently in self-collected specimens.

Conclusion—There is a high level of agreement between the HPV DNA results from self-collected and clinician-collected specimens. Self-collection of specimens for HPV testing is a viable alternative among adolescents.

Keywords

Self-sampling; Human papillomavirus; Adolescent; Cervical cancer prevention; South Africa

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Introduction

Interest in the inclusion of Human papillomavirus (HPV) testing into cervical cancer screening and prevention strategies has grown in recent years. At the same time, greater attention has been given to self-sampling for HPV testing as a viable alternative to clinician-collected specimens. The self-sampling approach may offer greater patient acceptability [1-4], decreased cost, and improved practicality in low-resource settings and among remote populations [5]. Minimal research comparing the results of clinician-collected and self-collected specimens has been conducted among adolescents. HPV testing of adolescents is essential to conduct vaccine surveillance [6] and may play a role in cervical cancer screening among certain high-risk groups. Here we report the comparison of HPV DNA test results from self-collected vaginal specimens to clinician-collected cervical specimens among a cohort of 30 16- and 17-year-old South African females.

Methods

Between July 2010 and April 2012 we conducted a cross-sectional prevalence study in which self-collected vaginal specimens and clinician-collected cervical specimens were collected from 30 sexually active South African adolescent females between ages 16–17 years. All participants were recruited from two urban outpatient clinics. The clinics are in close proximity and serve the same adolescent community in Soweto, South Africa. Participants were invited to participate in the study during routine clinic visits. Both specimen collection methods were performed during the same visit for all study participants. For self-sampling, patients were instructed to insert a Dacron® swab (QIAGEN, Hilden, Germany) high into the vagina and twirl it for 10 seconds. Self-sampling was conducted in private. DNA extraction was conducted using Roche's MagNA Pure system (Roche, Basel, Switzerland). HPV Genotyping was conducted using Roche's Linear Array® Test (Roche, Basel, Switzerland). This detection kit amplifies target DNA utilizing the polymerase chain reaction (PCR) and is designed to detect 37 human genital HPV genotypes in cervical cells [7]. These 37 types include all oncogenic HPV types (HR-HPV) that have been identified by the International Agency for Research on Cancer (IARC) [8]. We defined HR-HPV to include all “probably carcinogenic” and “possibly carcinogenic” genotypes as designated by IARC [8].

All study participants also had specimens obtained for cytological evaluation after both specimens for HPV testing were obtained. Cervical smears for cytology analysis were reported in accordance with the Bethesda system [9].

Data analysis was conducted using R statistical software. Exact methods to assess the statistical significance of the kappa values were used due to the small sample size of 30 subjects. The p-values for the Kappa statistics are based on the hypergeometric distribution through Fisher's Exact Test.

Results

All collected specimens were β-globin positive indicating adequate sampling. We found a high prevalence of HPV overall (57%; 95% CI 0.37–0.75) and a total of 71 HPV infections among our 30 study participants. Thirty-seven infections were found among self-collected specimens and 34 were identified among the clinician-collected specimens (p=0.479). There was no significant difference in the overall detection of HR-HPV or low-risk HPV (LR-HPV) among the two collection methods (Table 1). Forty seven percent of self-collected specimens were positive for HR-HPV and 43% of clinician-collected specimens were

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positive for HR-HPV (p=0.717). A greater prevalence of LR-HPV was found among self-collected samples (33% versus 27%; p=0.412).

A high level of agreement was found between clinician-collected and self-collected samples (Table 2). The kappa statistic (κ) for HR-HPV was 0.80 (p<0.001) and for LR-HPV was 0.68 (p<0.001). Genotypes identified by both collection methods for each participant with any positive result are presented in Table 3. Overall concordance between the results for the two collection methods was 86.7%. There was exact correspondence in HPV DNA results from the two collection methods in 19 (63%) of our 30 participants (p=0.269; 95% CI 0.439–0.801). Cervical smears were normal in all participants except one who had atypical squamous cells of undetermined significance (ASCUS).

Discussion

Reported concordance rates between self-collected and clinician-collected specimens for HPV DNA analysis vary, although many have found results similar to ours. In a study of Ugandan women in which self-collected specimens were obtained using the same simple swab technique that our study utilized, Safaeian et al. [1] found a relatively high level of agreement (κ=0.75) among HIV-negative subjects with clinician-collected specimens. Deleré et al. [4] reported similarly high levels of agreement in the detection of HRHPV among German women with normal cervical smears (κ=0.78). In that study, the less simple vaginal lavage technique was used for self-sampling and specimens were obtained by women in their own homes. Similar levels of agreement between sampling methods have been identified in other studies [10-12]. In contrast, only fair levels of agreement were identified in studies of women from Ontario, Canada [13] and Greece [14] (κ=0.54 and κ=0.54, respectively). Even lower levels of agreement between the results of these sampling methods have been reported. Baldwin et al. [15] concluded that self-sampling is inadequate for HR-HPV detection after finding a Kappa statistic of just 0.45. Still, the preponderance of the evidence shows self-collection to be a viable approach to HPV testing. A 2007 meta-analysis of self-collected versus clinician-collected specimens for HPV testing found substantial overall agreement between the HPV results obtained from the two approaches (κ=0.66) and concluded that self-sampling may have a useful role under some clinical and research circumstances [5]. Self-collection methods varied among the 18 studies included in this meta-analysis. Finally, a recent mini-review of the subject concluded that self-sampling was at least as sensitive as clinician-sampling for identification of HR-HPV [16].

Interestingly, results for HR-HPV and LR-HPV differ in a number of studies including ours. Increased detection of LR-HPV among self-collected samples has been noted by several investigators [5,10,11]. In an effort to explain this phenomenon it has been postulated that some phylogenetic species of HPV may have a greater tropism for vaginal over cervical epithelium [17].

Overall acceptance of self-sampling by patients has been reported to be high [1-4,18] and may lead to improved screening coverage [16]. Although a number of different self-sampling methods have been used, there is relatively little data assessing patient preference among these methods. Lack et al. [2] found a slight preference for self-administered swabs compared to tampons and Igidbashian et al. [19] found a vaginal lavage device to be preferred over a self-sampling cervical brush device. Although acceptability of urine sampling for HPV detection has been reported to be very high [20], the sensitivity of this method has not been well established [21]. The simple swab method used in our study was favored by a large margin over lavage in the only study comparing these two techniques [22].

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HPV testing does not yet have a firmly established clinical application although intensive research is underway investigating what role it may play in cervical cancer prevention programs. While the high sensitivity of HPV testing is an asset, its relatively low specificity presents significant concerns [23]. Screening guidelines must carefully balance the sensitivity and specificity of screening in order to avoid unnecessary colposcopy and associated procedures while minimizing overlooked high-risk cervical lesions. For this reason HPV DNA testing is not currently recommended for the general adolescent population due to very low rates of persistent infection and the likelihood of spontaneous regression of low-grade cervical lesions [24,25]. Still, it is not clear whether HPV DNA testing could be an effective part of cervical cancer screening among certain high-risk adolescent groups such as those who are HIV-infected. Moreover, HPV testing and genotyping is necessary to conduct vaccine surveillance and other important epidemiologic and research efforts that ultimately inform cervical cancer screening and prevention strategies. While research into the level of agreement between self-collected and clinician-collected specimens for HPV testing has yielded somewhat mixed results, our data, although limited by sample size, add to the evidence suggesting that agreement between these methods for HR-HPV testing is relatively high. Our results also identified a trend that supports the observation that LRHPV detection is greater among self-collected specimens. While the ages of the study participants in prior research into this topic have varied widely our cohort was notably young yet still produced adequate self-collected specimens.

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References

1. Safaeian M, Kiddugavu M, Gravitt PE, Ssekasanvu J, Murokora D, et al. Comparability of self-collected vaginal swabs and physician-collected cervical swabs for detection of human papillomavirus infections in Rakai, Uganda. Sex Transm Dis. 2007; 34:429–436. [PubMed: 17075437]
2. Lack N, West B, Jeffries D, Ekpo G, Morison L, et al. Comparison of non-invasive sampling methods for detection of HPV in rural African women. Sex Transm Infect. 2005; 81:239–241. [PubMed: 15923294]
3. Jones HE, Wiegerinck MA, Nieboer TE, Mol BW, Westhoff CL. Women in the Netherlands prefer self-sampling with a novel lavaging device to clinician collection of specimens for cervical cancer screening. Sex Transm Dis. 2008; 35:916–917. [PubMed: 18665020]
4. Deleré Y, Schuster M, Vartazarowa E, Hänsel T, Hagemann I, et al. Cervicovaginal self-sampling is a reliable method for determination of prevalence of human papillomavirus genotypes in women aged 20 to 30 years. J Clin Microbiol. 2011; 49:3519–3522. [PubMed: 21813722]
5. Petignat P, Faltin DL, Bruchim I, Tramèr MR, Franco EL, et al. Are self-collected samples comparable to physician-collected cervical specimens for human papillomavirus DNA testing? A systematic review and meta-analysis. Gynecol Oncol. 2007; 105:530–535. [PubMed: 17335880]
6. Mollers M, Scherpenisse M, van der Klis FR, King AJ, van Rossum TG, et al. Prevalence of genital HPV infections and HPV serology in adolescent girls, prior to vaccination. Cancer Epidemiol. 2012; 36:519–524. [PubMed: 22906483]
7. Chranioti A, Aga E, Margari N, Kottaridi C, Pappas A, et al. Performance evaluation of manual and automated (MagNA pure) nucleic acid isolation in HPV detection and genotyping using Roche Linear Array HPV Test. Infect Dis Obstet Gynecol. 2011; 2011:931281. [PubMed: 21785558]
8. Bouvard V, Baan R, Straif K, Grosse Y, Secretan B, et al. A review of human carcinogens--Part B: biological agents. Lancet Oncol. 2009; 10:321–322. [PubMed: 19350698]

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9. Solomon D, Davey D, Kurman R, Moriarty A, O'Connor D, et al. The 2001 Bethesda System: terminology for reporting results of cervical cytology. JAMA. 2002; 287:2114–2119. [PubMed: 11966386]
10. Petignat P, Hankins C, Walmsley S, Money D, Provencher D, et al. Self-sampling is associated with increased detection of human papillomavirus DNA in the genital tract of HIV-seropositive women. Clin Infect Dis. 2005; 41:527–534. [PubMed: 16028163]
11. Jones HE, Allan BR, van de Wijgert JH, Altini L, Taylor SM, et al. Agreement between self- and clinician-collected specimen results for detection and typing of high-risk human papillomavirus in specimens from women in Gugulethu, South Africa. J Clin Microbiol. 2007; 45:1679–1683. [PubMed: 17409209]
12. Kahn JA, Slap GB, Huang B, Rosenthal SL, Wanchick AM, et al. Comparison of adolescent and young adult self-collected and clinician-collected samples for human papillomavirus. Obstet Gynecol. 2004; 103:952–959. [PubMed: 15121570]
13. Karwalajtys T, Howard M, Sellors JW, Kaczorowski J. Vaginal self sampling versus physician cervical sampling for HPV among younger and older women. Sex Transm Infect. 2006; 82:337–339. [PubMed: 16877589]
14. Agorastos T, Dinas K, Lloveras B, Font R, Kornegay JR, et al. Self-sampling versus physician-sampling for human papillomavirus testing. Int J STD AIDS. 2005; 16:727–729. [PubMed: 16303065]
15. Baldwin S, Santos C, Mendez Brown E, Nuño T, Giuliano A, et al. Comparison of type-specific human papillomavirus data from self and clinician directed sampling. Gynecol Oncol. 2005; 97:612–617. [PubMed: 15863168]
16. Snijders PJ, Verhoef VM, Arbyn M, Ogilvie G, Minozzi S, et al. High-risk HPV testing on self-sampled versus clinician-collected specimens: a review on the clinical accuracy and impact on population attendance in cervical cancer screening. Int J Cancer. 2013; 132:2223–2236. [PubMed: 22907569]
17. Castle PE, Rodriguez AC, Porras C, Herrero R, Schiffman M, et al. A comparison of cervical and vaginal human papillomavirus. Sex Transm Dis. 2007; 34:849–855. [PubMed: 17621246]
18. De Alba I, Anton-Culver H, Hubbell FA, Ziogas A, Hess JR, et al. Self-sampling for human papillomavirus in a community setting: feasibility in Hispanic women. Cancer Epidemiol Biomarkers Prev. 2008; 17:2163–2168. [PubMed: 18708409]
19. Igidbashian S, Boveri S, Spolti N, Radice D, Sandri MT, et al. Self-collected human papillomavirus testing acceptability: comparison of two self-sampling modalities. J Womens Health (Larchmt). 2011; 20:397–402. [PubMed: 21351869]
20. Sellors JW, Lorincz AT, Mahony JB, Mielzynska I, Lytwyn A, et al. Comparison of self-collected vaginal, vulvar and urine samples with physician-collected cervical samples for human papillomavirus testing to detect high-grade squamous intraepithelial lesions. CMAJ. 2000; 163:513–518. [PubMed: 11006761]
21. Enerly E, Olofsson C, Nygård M. Monitoring human papillomavirus prevalence in urine samples: a review. Clin Epidemiol. 2013; 5:67–79. [PubMed: 23516174]
22. Szarewski A, Cadman L, Ashdown-Barr L, Waller J. Exploring the acceptability of two self-sampling devices for human papillomavirus testing in the cervical screening context: a qualitative study of Muslim women in London. J Med Screen. 2009; 16:193–198. [PubMed: 20054094]
23. Petignat P, Vassilakos P. Is it time to introduce HPV self-sampling for primary cervical cancer screening? J Natl Cancer Inst. 2012; 104:166–167. [PubMed: 22271766]
24. Widdice LE, Moscicki AB. Updated guidelines for papanicolaou tests, colposcopy, and human papillomavirus testing in adolescents. J Adolesc Health. 2008; 43:S41–S51. [PubMed: 18809144]
25. American College of Obstetricians and Gynecologists. ACOG Committee Opinion No. 463: Cervical cancer in adolescents: screening, evaluation, and management. Obstet Gynecol. 2010; 116:469–472. [PubMed: 20664421]

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Table 1

Prevalence of HPV among clinician-collected and self-collected samples (N=30).

	Clinician-collected		Self-collected		p-value
	n (%)	95% CI	n (%)	95% CI	
Overall	17 (57%)	(0.37, 0.75)	17 (57%)	(0.37, 0.75)	1.000
HR-HPV	13 (43%)	(0.28, 0.66)	14 (47%)	(0.25, 0.63)	0.717
LR-HPV	8 (27%)	(0.17, 0.53)	10 (33%)	(0.12, 0.46)	0.412

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Table 2

Level of agreement of HPV DNA test results between clinician-collected and self-collected samples.

HPV Type	Clinician-collected # (%)	Self-collected # (%)	κ (p-value[a])
Any HR-HPV	13 (43.3)	14 (46.7)	0.80 (<0.001)
Any LR-HPV	8 (26.7)	10 (33.3)	0.68 (<0.001)

[a] p-values were calculated using exact methods and are not approximations

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Table 3

HPV types identified by both collection methods for each participant with any positive result.

Enrollee #	HPV results: Clinician-collected	HPV results: Self-collected
1	16, 51, 61, 70	16, 51, 61, 70
2	26, 68	68
4	None	81
8	16, 61, 62	16, 61
9	18, 73	18
10	None	56, 71
11	16, 35, 52	16, 35, 52, 61
13	58	None
14	16, 73	16, 54, 73
15	6, 45	6, 45
16	62	None
17	51, 52	51, 52
18	82	82
19	40	40
21	66	66, 68
23	None	39
24	42, 45, 52	42, 45, 52, 54, 61
27	45	45
28	61, 70, 71, 84	61, 70, 71, 84