


# Human Papilloma Virus infection and cervical cancer among women who sell sex in Eastern and Southern Africa: A scoping review

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## Abstract

**Objectives:** Women who sell sex have a high prevalence of human papilloma virus, which may cause cervical cancer. The objective of this review was to collate findings on prevalence, associated factors, screening, service provision and utilization of services in relation to human papilloma virus and cervical cancer among women who sell sex in Eastern and Southern Africa.

**Methods:** A scoping review methodology was employed. Inclusion criteria were as follows: (1) empirical papers, (2) of studies conducted in Eastern and Southern Africa, (3) published in the last 10 years, and (4) addressing women who sell sex in relation to (5) human papilloma virus and cervical cancer. A thorough search of a range of databases surfaced 66 papers. Both authors applied inclusion and exclusion criteria, resulting in 14 papers being reviewed.

**Results:** The reported prevalence of high-risk human papillomavirus virus varied between 23.6% and 70.5%. HIV seropositivity, other sexually transmitted infections and Epstein-Barr virus were associated with human papilloma virus and high-grade cervical lesions. High-risk human papilloma virus was associated with women who reported younger age at first intercourse, non-barrier contraceptive use, and no history of condom use. For screening, there was overall agreement between physician- and self-collected samples. Contradictory results were found for visual inspection with acetic acid. Screening services utilization was associated with provider's recommendation, history of sexually transmitted infections, frequency of facility visit and history of vaginal examination. A diagonal programme led to an increase in screening, attributed to the targeted services.

**Conclusions:** Context is important in planning cervical cancer services. There is a need for enhanced sexually transmitted infections and viral management within cervical cancer prevention. Women who sell sex should be empowered in self-collection of stored-dry specimens, especially in resource-constrained regions. Cervical cancer screening services should be honed to the needs of women who sell sex.

## Keywords

Africa, cervical cancer, Eastern Africa, HPV, Human Papilloma Virus, review, sex workers, Southern Africa

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## Introduction

It is estimated that 85% of the mortality from cervical cancer currently occurs in low- and middle-income countries (LMIC).<sup>1</sup> In sub-Saharan Africa, specifically, cervical cancer is a leading cause of cancer death among women.<sup>2</sup> In 2012, about 60,000 deaths from cervical cancer were estimated to have occurred.<sup>3</sup> The high incidence of, and mortality arising from, cervical cancer in this region may be

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explained by low awareness, advanced stage at presentation, and low national capacity in prevention, screening, diagnostic, and treatment options.<sup>1,4</sup>

Globally, women who sell sex (WSS) have a high prevalence of human papilloma virus (HPV) infection of high-risk types owing to high HPV exposure.<sup>5,6</sup> This, together with the cervical cancer prevention and service challenges in LMIC, puts WSS in Africa in a precarious position. A review of clinical and non-clinical facility-based sexual and reproductive health (SRH) services for WSS in Africa revealed that most interventions were localized and small-scale, operated with little coordination nationally or regionally, had scanty government support, and narrowly addressed HIV prevention, counselling and testing, and sexually transmitted infections (STIs). Broader SRH needs such as cervical cancer screening were generally ignored.<sup>7</sup>

The need for HPV and cervical cancer prevention campaigns to be tailored to WSS is increasingly recognized.<sup>6</sup> For this to occur, knowledge of the prevalence, associated factors, and current services is needed. The aim of this study is to review studies conducted on cervical cancer and WSS in the Eastern and Southern African (ESA) region.

## Methodology

The scoping review methodology<sup>8</sup> was used in this project. The research aims of the review were to identify the following issues in relation to HPV and cervical cancer in WSS in Eastern and Southern Africa: prevalence, associated factors, screening, service provision and utilization of services. The following electronic databases were searched: Academic Search Premier; Health Source: Nursing/Academic Edition; Medline; PsyArticles; PsyINFO; SocIndex; Sabinet; Web of Science; PubMed; and Google scholar. The key word search for studies was: Female sex workers (Note of terminology: most public health publications use the term 'female sex workers'. In this paper, we prefer the person-first approach, using women who sell sex; this is in line with other authors (Crankshaw et al.<sup>9</sup>) OR sex workers AND cervical cancer OR HPV AND (list of countries (Angola OR Botswana OR Burundi OR Comoros OR Democratic Republic of Congo OR Eritrea OR Eswatini OR Swaziland OR Ethiopia OR Kenya OR Lesotho OR Madagascar OR Malawi OR Mauritius OR Mozambique OR Namibia OR Rwanda OR Seychelles OR South Africa OR South Sudan OR Tanzania OR Uganda OR Zambia OR Zimbabwe)) OR Eastern Africa OR Southern Africa. The search was restricted to the last 10 years (2010–2020, plus the first 3 months of 2021) to ensure that the information is current. No language restriction was placed on the search, in case there were relevant papers in another language (most likely French or Portuguese). The search, however, only surfaced papers written in English.

The initial search produced 66 papers. After duplicates were removed, the two authors went through the papers independently, determining whether the identified studies were relevant to the research aims. Inclusion criteria were that the papers should (1) be empirical papers, (2) *specifically* address WSS in relation to (3) HPV or cervical cancer, and (4) be conducted in ESA countries. All papers that did not meet the inclusion criteria were excluded (theoretical or review papers; not about WSS; not focussed on HPV or cervical cancer; conducted outside ESA countries). Each author's assessments were compared. Where there were differences, these were resolved through discussion. The papers were quality checked through use of the mixed-methods appraisal tool (MMAT). No studies were discarded following this assessment. The result was 14 papers. Figure 1 is a flowchart of the literature search process. These papers were analysed by both authors using the research objectives as a template. As all journal articles used in this review are in the public domain, no ethics clearance was sought or needed.

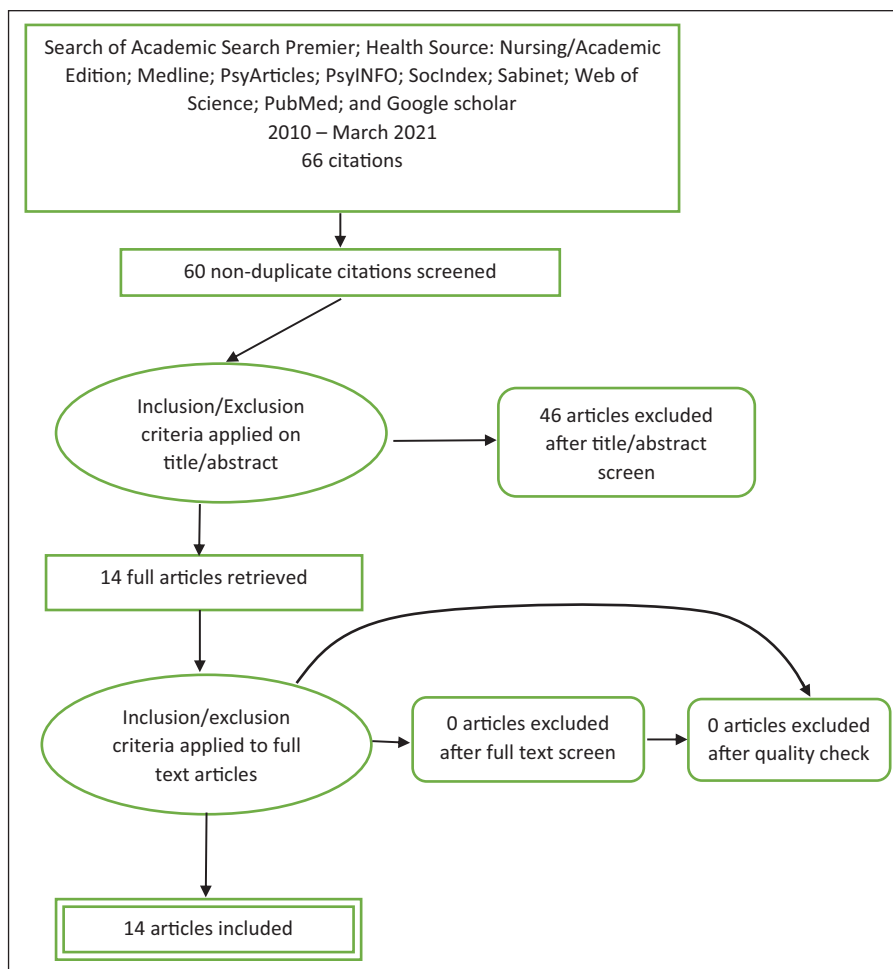
## Results

Table 1 provides a summary of the studies contained in this review.

Four studies – two conducted in Kenya, one in Madagascar, and one in South Africa – measured the prevalence of HPV among samples of WSS. Patel et al.<sup>19</sup> found that 54% of respondents in Nairobi, Kenya, were infected with a high-risk HPV (hrHPV), with HPV-16 and 52 being the most common. Sweet et al.'s<sup>22</sup> study, also conducted in Nairobi, found a lower prevalence of 23.6% for any HPV and 20.4% for hrHPV. In follow-up, however, the incident rate was 31.4% for any HPV and 24.2% for hrHPV. In a Madagascar study,<sup>21</sup> the HPV prevalence was 36.7% (HPV-52: 11.1%; HPV-31 and 39: each at 5.6%; and HPV-16 and 83: each at 3.3%). In the South African study,<sup>11</sup> high-risk and low-risk HPV prevalences were much higher at 70.5% and 60.2%, respectively.

In Kenya, Patel et al.<sup>19</sup> report that HIV sero-positivity was associated with high-grade cervical lesions, particularly among women with a lower CD4 count (below 500 cells/mm<sup>3</sup>). Similar associations were found in Sweet et al.'s<sup>22</sup> Kenyan study, with the prevalence and incidence of hrHPV being higher in HIV+ than HIV– women, and in Luchters et al.<sup>14</sup> Kenyan study in which HIV+ sex workers had almost four-fold higher prevalence of hrHPV, raised viral load and more precancerous lesions than HIV–WSS. Auvert et al.<sup>11</sup> investigated HPV as a risk factor in HIV acquisition, showing that HIV seroconversion was associated in their sample with genital high-risk HPV infection. They note a number of limitations to their study, and argue for further longitudinal studies.

Significant associations between bacterial vaginosis (BV) and HPV 58, between *Candida* spp and HPV 16 and



**Figure 1.** PRISMA diagram.

53, and between *Trichomonas vaginalis* (TV) and cervical dysplasia were found in two Kenyan studies by Menon et al.<sup>15,16</sup> respectively. The authors argue that these results underscore the need for enhanced STI management within the framework of cervical cancer prevention. In Madagascar, Smith et al.<sup>21</sup> found higher HPV prevalence among women who reported younger age at the first intercourse, contraceptive use, a history of cervical lesions, and no history of condom use. In their Kenyan study, Cameron et al.<sup>12</sup> found that Epstein-Barr virus (EBV)-positive women had a higher prevalence than did EBV-negative women of high-grade pre-cancer (15% vs 2%) and abnormal cytology (37% vs 15%), suggesting a possible role for EBV as a high-risk marker or cofactor for HPV-mediated cervical cancer development.

Screening for hrHPV and cervical cancer was addressed by a number of studies. In Kenya, Islam et al.<sup>13</sup> compared self-collected specimens versus physician-collected specimens; within self-collected specimens, they compared one stored DRY (using a Viba brush) and one stored WET (with Aptima media using an Evalyn brush). Women in the sample preferred physician collection (63.9%)

compared to self-collection (36.1%); for self-collection, they preferred DRY (46.1%) compared to WET (31.1%). The self-collected stored-dry specimens seemed to perform similarly to self-collected stored-wet specimens for the detection of high-grade squamous intraepithelial lesions (HSIL). In a follow-up study with the same cohort, Senkomago et al.<sup>20</sup> and Ting et al.<sup>23</sup> found overall agreement between physician- and self-collected hrHPV-RNA results. They argue that the results strongly support the use of hrHPV-RNA testing of self-collected specimens in resource-constrained regions where access to physicians and cytopathologists is limited.

Afzal et al.<sup>10</sup> conducted a cross sectional study using visual inspection with acetic acid (VIA), with those having positive screens being offered cryotherapy. There was a positive correlation between Pap smears and VIAs results. They argue that VIA screening could be integrated in HIV treatment, thereby addressing and treating abnormal results promptly. Namale et al.'s<sup>18</sup> research in Uganda, however, contradicts these findings. The VIA had low sensitivity in their study, even though administered by trained health workers. They argue that the VIA is not a

Table 1. Summary of studies.

Citation	Study aims	Major findings	Study recommendations
Location			
Programme	Data collection		
Study population			
Afzal et al. <sup>10</sup> South Africa	Address barriers to cervical cancer treatment, a "see and treat" approach to screening was proposed. The objective was to integrate this method into current HIV care offered by local providers and to obtain demographic and risk factor data for use in future educational and intervention programmes in the region. Screening results using visual inspection with acetic acid (VIA), and Pap smear results for the previous year at the time of programme initiation and at 12 and 18 months post-programme Assess HPV as a risk factor of HIV acquisition among FSWs in South Africa.	A total of 403 participants consented and underwent screening with VIA (306 farm workers and 97 sex workers participated). 83.9% of participants (32.9% sex workers and 100% farm workers) were HIV+. VIA was positive in 30.5% of participants, necessitating cryotherapy. There was no significant difference in VIA positivity between HIV+ farm workers and sex workers. There was a positive correlation between Pap smears and VIA's results.  HR- and LR-HPV prevalences were 70.5% (95% CI: 60.5–79.2) and 60.2% (95% CI: 49.9–70.0), respectively. Twenty-five women HIV seroconverted. Controlling for background characteristics and other sexually transmitted infections, HIV aHR increased by a factor of 1.7 (95% CI: 1.01–2.7, Plinear trend= 0.045) for an increase of one unit of the number of HR-HPV genotypes. HIV seroconversion among FSWs is associated with genital HR-HPV infection. Further investigation is warranted, including testing the possible protective effect of available HPV vaccines on HIV acquisition.	The study demonstrates successful integration of cervical cancer screening using VIA for HIV+ farm workers and sex workers into an existing HIV treatment and prevention clinic in rural South Africa, addressing and treating abnormal results promptly. An improved infrastructure and referral process for these rural and high-risk populations is still a highly unaddressed need.  Despite these limitations, these findings indicate that the hypothesis of a facilitating effect of HR-HPV on HIV acquisition requires further investigation using longitudinal data. The validation of this hypothesis could necessitate testing the potential protective effect of available HPV vaccines on HIV acquisition.
"See and treat" approach to screening at an HIV clinic HIV farm workers and at-risk sex workers attending a clinic Auwert et al. <sup>11</sup> South Africa	Cervicovaginal rinse samples, obtained before HIV- seroconversion, were genotyped into high-risk (HR-) and low-risk (LR-) HPV. HIV-adjusted hazard ratios (aHRs) and 95% confidence intervals (CI) were estimated using Cox survival analysis.		
Multicentre, randomized, placebo-controlled, triple-blinded, phase 2/3 efficacy trial of COL-1492, a low-dose nonoxynol-9 microbicide Non drug using, not pregnant, HIV-negative South African FSWs working at truck stops along a major highway			
Cameron et al. <sup>12</sup> Kenya	Examine the association between cervical Epstein-Barr virus (EBV), high risk HPV (hrHPV) and cytology in female sex workers Women (n= 332) with known cervical cytology and hrHPV mRNA results were evaluated for cervical EBV DNA by conventional polymerase chain reaction.	Baseline prevalence of hrHPV and EBV was 29% and 19%, respectively. Higher EBV prevalence was found among women with older age, HIV, hrHPV, abnormal cytology, Mycoplasma genitalium infection, smoking habits, younger age at sexual debut, and less frequent condom use. At baseline, women with EBV had a higher prevalence of hrHPV infection than did EBV-negative women (52% vs. 24%; HIV-adjusted PR: Epstein-Barr virus-positive women had a higher prevalence than did EBV-negative women of high-grade precancer (15% vs. 2%) and abnormal cytology (37% vs. 15%), although HIV- and hrHPV-adjusted associations were not significant (high-grade precancer: PR, 2.0 (0.7–5.9) abnormal cytology: PR, 1.4 (0.9–2.2). In prospective analyses, a marginal association was observed between baseline EBV detection and delayed hrHPV clearance.	The data support a possible role for EBV as a high-risk marker or cofactor for HPV-mediated cervical cancer development.
N/A			
Female sex workers (FSWs) attending a health clinic			

(Continued)

**Table 1. (Continued)**

Citation	Study aims	Major findings	Study recommendations
<p>Islam et al.<sup>13</sup> Kenya</p> <p>400 female sex workers in Kenya participated (2013–2018), of which 50% were HIV positive based on enrollment procedures</p>	<p>Compare the performance of hr-HPV mRNA testing with dry-A s compared with wet-stored self-collected specimens for detecting high-grade squamous intraepithelial lesion or more severe (<math>\geq</math>HSIL).</p> <p>Participants provided 2 self-collected specimens: One stored dry (sc-DRY) using a Viba brush (Rovers) and one stored wet (sc-WET) with Aptima media (Hologic) using an Evalyn brush (Rovers). Physician-collected specimens were collected for HPV mRNA testing (Aptima) and conventional cytology. We estimated test characteristics for each hr-HPV screening method using conventional cytology as the reference standard (<math>\geq</math>HSIL detection). We also examined participant preference for sc-DRY and sc-WET collection.</p>	<p>High-risk HPV mRNA positivity was higher in sc-WET (36.8%) than sc-DRY samples (31.8%). Prevalence of <math>\geq</math> HSIL was 6.9% (10.3% HIV positive, 4.0% HIV negative). Sensitivity of hr-HPV mRNA for detecting <math>\geq</math> HSIL was similar in sc-WET (85%; 95% confidence interval (CI) 66%–96%), sc-DRY specimens (78%; 95% CI: 58%–91%), and physician-collected specimens (93%; 95% CI: 76%–99%). Overall, the specificity of hr-HPV mRNA for <math>\geq</math> HSIL detection was similar when comparing sc-WET with physician collection. However, specificity was lower for sc-WET (66% (61%–71%) than sc-DRY (71% (66%–76%)). Women preferred sc-DRY specimen collection (46.1%) compared with sc-WET (31.1%). However, more women preferred physician collection (63.9%) compared with self-collection (36.1%).</p>	<p>Self-collected stored-dry specimens seemed to perform similarly to sc-WET for the detection of <math>\geq</math> HSIL, and could assist in screening.</p>
<p>Luchters et al.<sup>14</sup> Kenya</p> <p>N/A FSWs</p>	<p>Assess the prevalence of high-risk HPV types and HIV among FSW, and the associations between these infections and with other demographic and behavioural variables. Additionally, the complex inter-relationships between type-specific HPV viral load, HIV infection and cervical cytology are evaluated.</p> <p>A cross-sectional community-based survey in Mombasa, Kenya, enrolled 820 female sex workers using snowball sampling. After interview and a gynaecological examination, blood and cervical cytology samples were taken. Quantitative real-time PCR detected HPV types and viral load measures. Prevalence of high-risk HPV was compared between HIV-infected and -uninfected women, and in women with abnormal cervical cytology, measured using conventional Pap smears.</p>	<p>Median age of the 820 participants was 28 years (inter-quartile range (IQR) = 24–36 years). One third of women were HIV infected (283/803; 35.2%) and these women were y more likely to have abnormal cervical cytology than HIV-negative women (27%, 73/269, versus 8%, 42/503; <math>P &lt; 0.001</math>). Of HIV-infected women, 73.3% had high-risk HPV (200/273) and 35.5% had HPV 16 and/or 18 (97/273). Corresponding figures for HIV-negative women were 45.5% (229/503) and 15.7% (79/503). After adjusting for age, number of children and condom use, high-risk HPV was 3.6 fold more common in HIV-infected women (95% CI = 2.6–5.1). Prevalence of all 15 of the high-risk HPV types measured was higher among HIV-infected women, between 1.4 and 5.5 fold. Median total HPV viral load was 881 copies/cell in HIV-infected women (IQR = 33–12,110 copies/cell) and 48 copies/cell in HIV-uninfected women (IQR = 6–756 copies/cell; <math>P &lt; 0.001</math>). HPV 16 and/or HPV 18 were identified in 42.7% of LSIL (32/75) and 42.3% of HSIL (11/26) lesions (<math>P = 0.98</math>). High-risk HPV types other than 16 and 18 were common in LSIL (74.7%; 56/75) and HSIL (84.6%; 22/26), even higher among HIV-infected women. HIV-infected sex workers had almost four-fold higher prevalence of high-risk HPV, raised viral load and more precancerous lesions. HPV 16 and HPV 18, preventable with current vaccines, were associated with cervical disease, though other high-risk types were commoner.</p>	<p>Given the common occurrence of high-grade cervical lesions, especially in HIV-infected women, regular HPV screening and follow-up is essential for prevention of cervical cancer. Additional prevention measures, especially higher population-level coverage with HPV vaccine, are required. Current efforts to prevent HIV and HPV are inadequate. New interventions are required and improved implementation of existing strategies.</p>

(Continued)



Table 1. (Continued)

Citation	Study aims	Major findings	Study recommendations
Menon et al. <sup>15</sup> Kenya	Assess the prevalence of pHR and HR HPV genotypes, BV, TV, and Candida, the most important STIs in FSW, women undergoing cervical cancer screening in a private clinic, and explore associations between HR HPV genotypes and these vaginal microbiota. Clinical data	Of the FSW, 33.3% had HIV and 57.7% harboured a potential HR and HR HPV genotype. The 2 most prevalent and HPV 59 (12.20%), BV was the most common infection (48.3%), followed by <i>Trichomonas vaginalis</i> (31.4%) and <i>Candida</i> spp (19.9%). A multivariate regression revealed significant associations with both $\alpha$ -group 9 and 6; BV and HPV 58, <i>Trichomonas vaginalis</i> and HPV 31 and HPV 35; and between <i>Candida</i> spp and HPV 53 (AOR = 2.0; 95% CI, 1.1–4.0; P = 0.03) and 16.	The results underscore the need for enhanced STI management within the framework of cervical cancer prevention
N/A FSWs			
Menon et al. <sup>16</sup> Kenya	Explore the epidemiology of abnormal cytology and the pairing of pHR/HPV genotypes in HIV-negative and HIV-infected FSW.	Of the 599 FSW, who underwent cytological examination, 87 had abnormal cytology (14.5%; 95% CI: 12.0%–17.6%). A combined prevalence of HPV 16% and 18 (29.6%; 95% CI: 22.2%–37.8%) was observed in abnormal cytology. HPV 53 and 51 were the most observed pairing in FSW with abnormal cytology. Significant adjusted associations were found between abnormal cytology and <i>Trichomonas vaginalis</i> (TV), multiple HR HPV, HPV 51 and HPV 52.	The strong association between TV and cervical dysplasia and the high percentage of FSW harbouring more than one STI underscore the need for enhanced STI management within the framework of cervical cancer prevention.
N/A FSWs	Structured questionnaire: testing for HIV and HPV; cervical samples		
Muluneh et al. <sup>17</sup> Ethiopia	Identify predictors for cervical cancer screening service utilization.	Cervical cancer screening utilization was associated with providers' recommendation (AOR = 6.8; 95% CI: 2.3, 9.7), history of sexually transmitted infection (AOR = 6.9; 95% CI: 1.29, 7.2), frequency of facility visit (AOR = 4.8; 95% CI: 1.97, 11.8) and history of vaginal examination (AOR = 0.21; 95% CI: 0.1, 0.68).	Guidelines that promote integration of the screening service to the routine care and treatment (opportunistic screening) should be developed and implemented. Assigning a female cervical cancer screener and availing convenient clinic times should also be given due emphasis by the ministry and sector health offices.
N/A Sex workers attending sex workers' confidential clinic	Questionnaire	The level of cervical cancer screening service utilization was higher among women with history of STI, frequency of facility visit and providers' recommendation. The level of cervical cancer screening service utilization was lower in women with previous vaginal examination.	
Namale et al. <sup>18</sup> Uganda	Report one-year experiences of visual inspection with acetic acid (VIA) positivity among FSWs in the early detection of pre-cancerous and cancerous cervical lesions The women were screened using the VIA method (application of 3–5% acetic acid to the cervix). All VIA positive women were referred to a tertiary hospital for colposcopy, biopsy, and immediate treatment (if indicated) at the same visit according to national guidelines. Data on socio-demographic, sexual behaviour, sexual reproductive health and clinical characteristics were collected.	Of 842 women assessed for eligibility, 719 (85%) of median age 30 (IQR 26, 35) were screened, and 40 (6%) women were VIA positive. Of the 24 histology specimens analysed, 6 showed inflammation, only 1 showed cervical intraepithelial neoplasia (CIN) I, 13 women showed CIN2/3, while 4 women already had invasive cervical cancer. The overall prevalence of HIV was 43% of whom only 35% were receiving ART. In the age-adjusted analysis, VIA positivity was more likely among women who reported having > 100 lifetime partners, and HIV positive women.	A relatively low proportion of VIA positivity was found in this population. The experience from this programme implies that the VIA results are poorly reproducible even among a category of trained professional health workers. Interventions for improving cervical cancer screening should be recommended as part of HIV care for FSWs to reduce the disease burden in this population.
FSWs attending the Good Health for Women Project (GHWP) clinic			

(Continued)

**Table 1. (Continued)**

Citation	Study aims	Major findings	Study recommendations
Patel et al. <sup>19</sup> Kenya N/A FSWs	Estimate type-specific prevalence of human papillomavirus (HPV) and examined risk factors for abnormal cervical cytology among female sex workers Results of HPV tests and PAP smears Data collection	Over half (54%) were infected with a high-risk (HR) HPV type, of which HPV16 and 52 were the most common types. HIV-1 prevalence was 23% and HIV-1 sero-positivity was associated with high-grade cervical lesions, particularly among women with CD4 count less than 500 cells/mm <sup>3</sup> (odds ratio (OR) = 6.9; 95% confidence interval (CI) 1.7–24.9). Among women who had normal cytology at the time of entry into the study, the risk of having an abnormal Pap smear within one year was significantly elevated for women with multiple HPV types at study entry (adjusted odds ratio (aOR)=6.0; 95% CI: 2.3–15.7) and with a subset of HR HPV types (aOR=4.2; 95% CI: 1.6–11.2). Detection of multiple concurrent HPV infections may be a useful marker to identify women at risk of developing precancerous lesions in populations of high HPV prevalence.	Detection of multiple concurrent HPV infections may be a useful marker to identify women at risk of developing precancerous lesions in populations of high HPV prevalence.
Senkomago et al. <sup>20</sup> Kenya N/A FSWs who were aged at least 18 years, were not in the second or third trimester of pregnancy, and had an intact cervix.	Report longitudinal results from a cohort of FSWs, comparing hrHPV-RNA testing of physician- and self-collected specimens for the detection of high-grade squamous intraepithelial lesions or higher grade lesions (HSIL+) over 24 months. Self-collected cervico-vaginal specimens for hrHPV-RNA testing, and a physician collected cervical specimens for hrHPV-RNA testing and conventional cytology. hrHPV-RNA testing was conducted every 3 months, and conventional cytology every 6 months.	Overall, 350 FSWs aged 18–50 years participated. hrHPV-RNA prevalence decreased slightly from 29.9% (103/344) at baseline to 24.3% (53/218) at 24 months for physician-collected, and 28.5% (98/344) to 24.3% (53/218) for self-collected specimens. Agreement between the sampling methods appeared to increase over time (baseline κ 0.55, 95% confidence interval (CI) 0.45–0.65; 24 months κ 0.83, 95% CI: 0.74–0.91). Among 21 patients with HSIL+ over 24 months, 18 (86%) and 17 (81%) had hrHPV-RNA-positive results at baseline in physician-and self-collected specimens, respectively, and 20 (95%) had baseline hrHPV-RNA-positive results or cytology anomalies. Overall agreement between physician-and self-collected hrHPV-RNA results was moderate and appeared to increase over time. Baseline physician-and self-collected hrHPV-RNA tests were similarly strong indicators of cumulative HSIL+ over 24 months	These data support the use of hrHPV-RNA testing as a primary screening strategy in resource-limited regions where cytology is largely not available for screening, as long as women with hrHPV-RNA positive results can be assured of appropriate follow-up and treatment. Self-collection has also been shown to be an acceptable practice among women in Sub-Saharan Africa.
Smith et al. <sup>21</sup> Madagascar N/A FSWs	Estimate human papillomavirus (HPV) prevalence and type distribution among 90 female sex workers (FSWs) aged 18 to 58 years Information on sexual and behavioural characteristics was obtained via a questionnaire. Exfoliated cervical cell specimens were collected for conventional cytologic examination and HPV DNA testing by polymerase chain reaction.	The HPV prevalence in exfoliated cervical cell specimens was 36.7%. The most common HPV types found were HPV-52 (11.1%), HPV-31 and -39 (each at 5.6%), and HPV-16 and -83 (each at 3.3%). The prevalence of low-grade squamous intraepithelial lesions was 3.3%, and that of atypical squamous cells of undetermined significance was 18.9%. No high-grade lesion was found. Although associations were imprecise, the HPV prevalence was higher among women who reported younger age at the first intercourse, contraceptive use, a history of cervical lesions, and no history of condom use.	The prevalence rates of HPV and cervical lesions among FSWs in Madagascar appear higher than among FSW populations from other African countries with a relatively higher population-based prevalence of human immunodeficiency virus infection.

(Continued)

Table 1. (Continued)

Citation	Study aims	Major findings	Study recommendations
Sweet et al. <sup>22</sup> Kenya	Characterize the baseline prevalence, incidence, and genotype distribution of HPV infection in 348 female sex workers (FSWs) using a highly sensitive, type-specific DNA assay; examine the burden of HPV and HPV-associated cervical disease, stratified by HIV-serostatus Specimens for HPV testing were collected every three months and cervical specimens for cytology examinations were collected every six months.	Baseline HPV prevalence was 23.6% for any HPV and 20.4% for high-risk HPV (hrHPV) types. Most prevalent types were HPV52 (10.1%), HPV35 (2.3%), and HPV51 (2.3%). A quarter (24%) of participants were HIV-positive. HPV prevalence was higher in HIV-positive (32.1%) than HIV-negative (20.8%) participants. hrHPV prevalence was higher in HIV-positive (27.4%) than HIV-negative (18.2%) women. During follow-up, HPV IR was 3.1.4 (95% CI: 2.3.8–4.1.5) for any HPV and 24.2 (95% CI: 17.9–32.8) for hrHPV types. HPV52 had the highest IR (6.0; 95% CI: 6.5–10.3). Overall HPV and hrHPV prevalence were lower than expected, but both prevalence and incidence were higher in HIV-positive than in HIV-negative women.	The higher prevalence and incidence of HPV, and associated high-grade cervical disease observed in HIV-positive women indicates that HIV-positive women should be a priority for public health interventions to reduce ICC morbidity and mortality. Prevention strategies, including HPV vaccination, the screening and treatment of cervical precancerous lesions, are critically needed globally to prevent ICC in both HIV-positive and HIV-negative women.
Ting et al. <sup>23</sup> Kenya	Compare the performance of hrHPV mRNA testing of physician- and self-collected specimens for detecting cytological high-grade squamous intraepithelial lesions or more severe (QHSIL); and examined risk factors for hrHPV mRNA positivity in female sex workers in Nairobi. Women self-collected a cervicovaginal specimen. A physician conducted a pelvic examination to obtain a cervical specimen. Physician- and self-collected specimens were tested for hrHPV mRNA and sexually transmitted infections using APTIMA nucleic acid amplification assays (Hologic/Gen-Probe Incorporated, San Diego, CA). Cervical cytology was conducted using physician-collected specimens and classified according to the Bethesda criteria.	Overall hrHPV mRNA prevalence was similar in physician- and self-collected specimens (30% vs. 29%). Prevalence of QHSIL was 4% (n = 15). Overall sensitivity of hrHPV testing for detecting QHSIL was similar in physician-collected (86%; 95% CI, 62%–98%; 13 cases detected) and self-collected specimens (79%; 95% CI, 55%–95%; 12 cases detected). Overall specificity of hrHPV mRNA for QHSIL was similar in both physician-collected (73%; 95% CI: 68%–79%) and self-collected (75%; 95% CI: 70%–79%) specimens. High-risk HPV mRNA positivity in both physician- and self-collected specimens seemed higher in women who were younger (G30 years), had <i>Trichomonas vaginalis</i> or <i>Mycoplasma genitalium</i> infections, or had more than 8 years of educational attainment. Conclusions: Self-collected specimens for hrHPV mRNA testing seemed to have similar sensitivity and specificity as physician-collected specimens for the detection of QHSIL among high-risk women.	hrHPV self-testing have high NPV and have the potential to effectively identify women at higher risk for high-grade lesions without an initial gynaecologic examination. Limited resources may then be channelled into clinical follow-up (e.g. rescreening using a different test) of a woman who was positive by AHPV self-testing, based on specific local capacity.



reproducible test and will lead to under-estimating the burden of disease.

Afzal et al.<sup>10</sup> note in their South African study that there are long delays in addressing abnormal Pap smears. Indeed, Namale et al.<sup>18</sup> note that, despite their reticence regarding VIA, the same day linkage of the VIA screen-positives to the diagnosis and treatment facility was critical. They call for careful consideration of the feasibility of the 'screen and treat' strategy for preventing cervical cancer recommended by the WHO for low-resource countries. Patel et al.<sup>19</sup> argue that detection of multiple concurrent HPV infections may be a useful marker in identifying women at risk of developing precancerous lesions, which could affect follow-up treatment.

Cervical cancer screening service utilization is addressed in an Ethiopian study.<sup>17</sup> Utilization was associated with provider's recommendation, history of STI, frequency of facility visit, and history of vaginal examination. The Diagonal Interventions for Fast-Forward Health (DIFFER) programme was developed and piloted in India, Kenya, South Africa and Mozambique. It was aimed at improving targeted services for WSS and public health services, as well as cooperation between the two. An evaluation of the DIFFER intervention<sup>24</sup> in Mozambique showed an increase in screening in cervical cancer among WSS; this was attributed to WSS targeted outreach rather than use of public health clinics.

## Discussion

The variability in prevalence of HPV among WSS reported in the studies points to the importance of context in the reproductive health of these women. The association of HPV and HIV-sero-positivity may account for some of the contextual variability.

The association of HIV sero-positivity, other STIs and EBV with HPV and high-grade cervical lesions highlights the need for enhanced STI and viral management within the framework of cervical cancer prevention. The association with non-barrier contraceptive use and no history of condom use illustrates the importance of condom distribution and programmes encouraging use among WSS and their partners.

The overall agreement between physician- and self-collected samples for HPV screening suggests that WSS should be empowered in self-collection of stored-dry specimens, especially in resource-constrained regions where access to physicians and cytopathologists is limited. Contradictory results were found for VIA. Nonetheless, the decrease in time delay between diagnosis and treatment that VIA allows means that this possibility should be explored further.

Utilization of cervical cancer screening services was associated with provider's recommendation. Research on how and whether front-line healthcare providers refer WSS for screening could assist with improving this aspect

of the reproductive health of WSS. The findings from the DIFFER programme that targeted services improved cervical cancer screening suggests that services honed to the needs of WSS are important. These kinds of approaches, including referral for, or actual, cervical cancer screening services should be integrated into routine care and treatment.

As a scoping review, this study is limited to the research questions and methods adopted by the studies included in the review. In order to allow assessment of whether the search criteria were unduly limiting, those criteria have been reported, as have the study inclusion criteria.

## Conclusion

Context is important in planning cervical cancer services. There is a need for enhanced STI and viral management within cervical cancer prevention and consistent condom distribution. WSS should be empowered in self-collection of stored-dry specimens, especially in resource-constrained regions. Cervical cancer screening services should be honed to the needs of WSS.

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## Author contributions

Catriona Ida Macleod conceptualized the project, applied inclusion and exclusion criteria to initial search papers; co-reviewed included papers; wrote the first draft of the article; finalized the article. John Hunter Reynolds performed the search; applied inclusion and exclusion criteria to initial search papers; co-reviewed included papers; contributed to writing the article.

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