RESEARCH ARTICLE

Cervical cancer screening in a population of black South African women with high HIV prevalence: A cross-sectional study

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Abstract

Cervical cancer is largely preventable through early detection, but screening uptake remains low among black women in South Africa. The purpose of this study was to determine the prevalence and factors associated with cervical cancer screening in the past 10 years among black African women in primary health care (PHC) clinics, in Gauteng Province, South Africa. This was a cross-sectional study involving 672 consecutively recruited black women at cervical cancer screening programs in PHC clinics between 2017 and 2020. An interviewer-administered questionnaire covered socio-demographics, HIV status, sexual history, cervical cancer risk factors knowledge, and screening behaviours in the past 10 years. The mean age of participants was 38 years. More than half (63%) were aged 30–49 years. Most completed high school education (75%), were unemployed (61%), single (60%), and HIV positive (48%). Only 285 (42.4%) of participants reported screening for cervical cancer in the past 10 years. Of participants that reported receiving information on screening, 27.6% (n = 176) and 13.97% (n = 89) did so from healthcare facilities and community platforms respectively. Participants aged 30 years or more were more likely to report for cervical cancer screening as compared to other categories in the past 10 years. The study found low cervical cancer screening prevalence. This calls for health education campaigns and prevention strategies that would target individual patients' contexts and stages of behavioral change. Such strategies must also consider socio-demographic and clinical correlates of cervical cancer screening and promote better integration into PHC services in South Africa.

Introduction

Cervical cancer is an important global public health problem and ranks fourth among the leading causes of cancer-related deaths among women [1–5]. In 2018, an estimated 311,000 deaths and 570,000 new cases of cervical cancer were reported globally, with 85% of these in developing countries. Sub-Saharan Africa recorded the highest age-standardized incidence rates (ASIR) of >40 per 100 000 in 2018, compared to an ASIR of 7.2 and 26.8 per 100,000 for North and Middle Africa respectively [1].

The main risk factor for cervical cancer is infection with the Human Papilloma Virus (HPV) serotypes 16 & 18 [1, 6, 7]. Other risk factors include HIV and Chlamydia trachomatis infections, early sexual debut, multiple sexual partners, smoking, and the use of oral hormonal contraceptives [8]. The best possible protection against cervical cancer is HPV vaccination, early detection and prompt treatment of pre-cancerous conditions [5]. A well-organized population-based cytological screening programmes is therefore crucial and has been found effective in reducing both mortality and morbidity in many Europe, Australia, New Zealand, and North America [9–12]. However, morbidity and mortality remain high in many developing countries consequent to low uptake of screening and late presentations [1, 13, 14].

South Africa has also implemented a population-based cervical cancer screening program that allows for at least three cervical smears within a woman's lifetime; performed at ten-year intervals and starting from the age of thirty [15, 16]. In this free program, the national screening coverage target is set at 70% of the eligible population [17]. However, studies suggest the suboptimal performance of this program in South Africa [4, 5, 9, 10, 18]. The District Health Barometers also report a decline in national coverage from 64.5% in 2016/17 to 61.2% in 2017/18, and Gauteng province, where the current study was conducted, had one of the lowest coverage at 47.7% [19].

Several factors have been reported in the literature to influence cervical cancer screening behaviours. Socio-demographic characteristics such as older age, formal education, and high economic status have been shown to influence cervical cancer screening uptake [20–22]. A study conducted in five Sub-Saharan African countries reported the highest cervical cancer screening uptake among women with the highest socioeconomic status, older age group (40–49 years), and secondary or higher educational attainment.

By implication, the lowest cervical cancer screening uptake was reported among women with the lowest socioeconomic status and younger age group (21–29 years) [20]. These findings were also confirmed in an Ethiopian study that found that high educational status and older age increased cervical cancer screening uptake by more than six and four-fold, respectively [23]. Studies have also suggested that women with high knowledge about cervical cancer are five times more likely to go for cervical cancer screening [3, 24]. Clinical factors have also been reported associated with cervical cancer screening. An Ethiopian study found that women who have been treated for sexually transmitted infections (STI) were five times more likely to be screened for cervical cancer compared to women who have not [23]. Also, infection with HIV predicted cervical cancer screening uptake since the integration of both services makes HIV clinics to act as additional sources of information for cervical cancer risks and a platform for screening [23]. However, a South African study among HIV-positive women found only a minority of HIV-positive women (28.6%) had optimal cervical cancer screening practices [25]. Overall, in South Africa, there are sociodemographic disparities in the burden of cervical cancer and screening practices, with black women reported having a higher burden, lower screening rates, poorer access, and more lag-time in presentation for treatment, and higher complications and mortality rates [26, 27]. Understanding cervical cancer screening

behaviours among black women in South Africa is therefore a public health imperative, particularly in the context of high prevalence of risk factors such as HIV.

The reasons for the low uptake of cervical screening vary depending on the setting and are important considerations for developing meaningful and context-appropriate interventions to increase screening uptake. In a study among ethnic minorities in the UK, key barriers to cervical screening included emotional barriers (fear, embarrassment, and shame), lack of time to come for the procedure, low perceived risk, and absence of symptoms [28]. However, in the Cape region of South Africa, insufficient information from primary care providers, negative community opinions relating to the procedure, and fear of having an HIV test at the same time, were prominent barriers cited by women for poor screening practices [29].

The recently proposed Integrated screening action model (I-SAM) (Fig 1) [30] critiques that screening behaviours are complex and existing models do not provide adequate frameworks for the explanation of these behaviours. The proponents of I-SAM posited that many models focus on how people who are already engaged with the healthcare system make decisions to screen or not to, but do not adequately explore the behaviours of those who are unaware or aware but not engaged. Also, screening for many diseases is a repetitive process and explanatory models should not focus only on how screening behaviours are initiated but also on how the behaviour is maintained. Furthermore, interventions cannot be one-size-fits-all since different persons are at different stages of the screening behaviour and require interventions targeted to their behavioural stages and circumstances.

Applied to cervical cancer screening, the I-SAM implicates 3 key tasks for healthcare providers: that not all women are at the same stage of the screening journey and screening engagements and interventions need to be informed by this; that the screening behavior of a woman is influenced by the circumstances, opportunities, and constraints within her environment; and that interventions need to focus on the source(s) of the behavior and create opportunities,
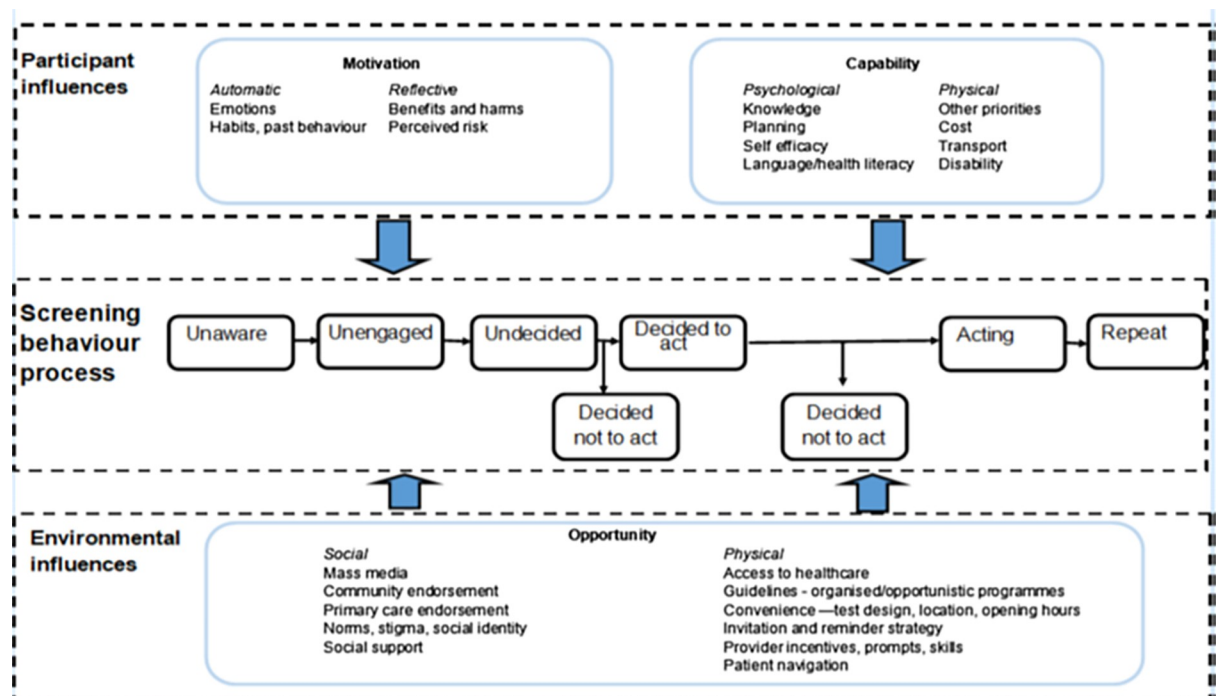

Fig 1. The integrated screening action model.

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build capability and support the woman's intrinsic motivations to make an educated decision and take action by actually doing the cervical smear test.

Although several of the studies summarized above have illuminated on factors associated with screening uptake, they are limited in their explanations of the behavioural dynamics of study participants, particularly in the context of high prevalence of risk factors such as HIV. The aim of this study was to determine the uptake and factors associated with cervical cancer screening within the past 10-years among black women attending PHC facilities in Gauteng province, South Africa. In this article, we explain the study findings using the I-SAM and inform interventions that could increase the uptake of cervical cancer screening in South African PHC and similar settings.

Methods

Study design and setting

This was a sub-study of a Cross sectional study that aimed to determine an association between smokeless tobacco (SLT) use and cervical dysplasia. We recruited consecutive women who presented to the cervical screening programs of PHC clinics across the five health districts in Gauteng province–Johannesburg, Tshwane, Ekurhuleni, Sedibeng, and West Rand, between 2017 and 2020. The clinics were randomly selected from each district cluster. The number of clinics per district was proportional in respect to the proportion each district contributed to the total provincial Pap smear count for 2013/14 [31]. Considering the primary objective of the main study, we estimated a minimum sample of 1032; assuming a 95% confidence level, 80% power, 8.4% SLT use prevalence among women and a 6.5% incidence rate of abnormal Pap smears. We adjusted upwards by 10% for inadequate smears and/ or incomplete or lost data [32, 33], resulting in a sample size of 1135. Furthermore, to reduce the effects of intra and inter cluster correlations (ICC), we calculated the Effective sample size (ESS) using the equation: ESS = mk / [1+p(m-1)], where: 1+p(m-1) equals the design effect (DE), K equals the number of clinic cluster, ESS equals the effective sample size, m equals the number of participants per cluster / clinic and p equals the ICC coefficient [34]. Assuming an ICC coefficient (p) of 0.01 and an ESS of 1135, an m of 40 participants per clinic and a total of 40 clinics (k) across the 5 districts of Gauteng province were determined and a final sample size of 1600 – forty (40) to be recruited across Johannesburg (17 clinics), Tshwane (7 clinics), Ekurhuleni (11 clinics), Sedibeng (2 clinics), and West Rand (3 clinics). However, data collection was halted due to the COVID-19 pandemic restrictions and only 749 participants were recruited across 20 clinics in the five districts–Johannesburg (315), Ekurhuleni (170), Tshwane (79), West Rand (105) and Sedibeng (80).

Recruitment of participants

We recruited consecutive women who presented to the cervical screening programs of PHC clinics across the five health districts in Gauteng province–Johannesburg, Tshwane, Ekurhuleni, Sedibeng, and West Rand, between March 2017- April 2020. Women who were eligible were approached at the vital signs station by a trained research assistant to participate in the study. The research assistants explained the nature and objective of the study to each woman and in addition, gave a participant information leaflet. Further explanation and clarifications were offered as needed. Those who indicated an interest in the study were directed to a private room where written informed consent was obtained, and the questionnaire administered. Thereafter, participants were taken to the nurse who then performed the cervical smear as per usual care or if not yet time, back to their positions on the service queue. Recruitment of participants continued until 40 participants were recruited in each clinic. Patients who were too ill

and pregnant were excluded from the study. Non-participation did not lead to disadvantages in service delivery. We did not include the information of those who did not consent to participate, which could have led to information bias the study was voluntary, hence those who did not consent to participate in the study were left in the queue.

Tool and data collection

The measurement tool was a semi-structured, researcher-administered questionnaire developed de novo based on the literature [35–39]. The questionnaire was peer-reviewed and after ethics clearance piloted at one clinic that did not participate in the main study. Data from the pilot study was not included in the main study. The questionnaire collected information on participants' demographics (age, level of education, occupational status, and marital status), tobacco use (patterns of cigarette smoking, exposure to second-hand smoke, use of snuff and chewing of tobacco leaves), gynaecological information (menarche, parity, use of Family planning methods, use of hormone replacement therapy, coitarche, and use of barrier methods), social and behavioural information (HIV, number sexual partners, knowledge, attitudes, and cervical smear screening behaviours). Trained research assistants who were fluent in English and other local languages administered the questionnaire to the participants.

Data analysis

The data was captured and analysed using Stata 16, 1 [40]. A total of 749 women were recruited for the primary objective. 77/749 (11%) were excluded from this analysis because this study focused on those women who self-identified as blacks. Black women were included because they are patrons of public health services in South Africa. Furthermore, other races were excluded from the study because their numbers were too small to provide a reliable estimate related to the objectives of the study. We used descriptive statistics such as frequencies to describe the study participants in terms of socio-demography, relevant sexual behaviour, HIV status, tobacco use, history of STI, knowledge of the risks of cervical cancer, and sources of information on cervical cancer and screening. The proportion that screened for cervical cancer in the last 10 years and the reasons for screening or not, were also determined using descriptive statistics. Associations between the cervical cancer screening uptake and sociodemographic characteristics, relevant sexual behaviour, HIV status, tobacco use, history of STI, knowledge of the risks of cervical cancer, and sources of information on cervical cancer and screening were explored using bivariate analysis. All significant exposure variables were included into the multivariable logistic regression model. We reported adjusted odds ratios, their corresponding 95% confidence intervals and p values. A p-value <0.05 was considered statistically significant.

Ethical considerations

The study was approved by the Human Research Ethics Committee (HREC) of the University of Witwatersrand, Johannesburg Certificate number M160209. Participation in the study was voluntary and participants signed written informed consent. Confidentiality was ensured and data anonymized. Permission to conduct the study was obtained from the management of the participating districts.

Results

Out of 749 of participants who were recruited, 672 were included in the analysis as they followed the inclusion criteria, 77/749 (11%) were excluded because they followed the exclusion

criteria. Majority of participants (81%) were above the age of 30 years, 75% attended at least high school, 64% unemployed. Most of the women (73%) had their early sexual debut during teenage period. Though most of the women were single (60%), seventy-five percent had one sex partner at the time of study while 88% have had two or more sex partners during their lifetime. Regardless of 57% of women receiving information about Pap smear from health facilities, only 35% had high knowledge on cervical cancer risks. The uptake of cervical cancer screening in the last 10 years was 42% (Table 1).

Cervical cancer screening uptake among different socio-demographic factors

Women who were widowed, aged fifty years or more, having primary school level of education, without a sexual partner in the last 12 months, having low level of knowledge on cervical cancer risk factors and receiving information on cervical cancer from health facility platforms were factors associated with cervical cancer screening (Table 2).

Factors associated with the uptake of cervical cancer screening in the past 10 years

Table 3 shows that women between 30–49 years old and 50 years or older, were five (CI: 2.53–8.73, p = <0.001) and ten (CI: 4.41–22.74, p = <0.001) times more likely to screen for cervical cancer when compared to 18–29-year-old women respectively. Women who were divorced (CI: 0.15–0.94, p = 0.04) and separated (CI: 0.10–0.86, p = 0.02) were less likely to report having screened for cervical cancer as compared to those who were single. Women with high knowledge on cervical cancer risk factors were less likely to report for screening (CI: 0.32–0.79, p = 0.003) as compared to those with low knowledge.

In Table 4, the most prevalent reason reported by participants for screening for cervical cancer was early first sexual experience (59.7%) followed screening as part of clinical management or periodic checkup.

In Table 5, the commonest reason for not screening for cervical cancer was lack of knowledge regarding Pap smear (35.4%).

Discussion

Cervical cancer screening is a priority public health program and despite the implementation of a free and nationwide screening program in South Africa, only 42.4% of participants in this study reported screening in the last ten years. This low screening rate is like that reported in the 2013/14 Gauteng province report [31] and suggests that there has been no significant change in the provincial coverage in the last 8 years. However, better coverage of 63.2% was reported in another study conducted in PHC facilities in Johannesburg in 2017 [41], suggesting that there may be pockets of good performances within the same province and that targeted interventions that are informed by local health systems and socio-demographic factors in each district, are probably what is needed to improve the uptake of cervical cancer screening in Gauteng province.

As shown in Table 3, the proportion of participants that screened in the past 10-years varied depending on sociodemographic factors. The increased screening coverage in older age groups aligns with results of previous South African studies and elsewhere, and may be explained by the age eligibility criterion for cervical cancer screening [24]. Also, since the incidence of cervical cancer increases with age, older women are more likely to find screening beneficial and applicable to their health needs. However, to improve coverage, younger women especially

Table 1. Socio-demographic characteristics of black women attending Pap smears in primary hea1lth care clinics in Gauteng Province, South Africa (N = 672).

Variable	Category	Total (N) = 672	%
Age	18–29	124	18.5
	30–49	416	61.9
	>50	127	18.9
	Missing	5	0.7
Education status	Did not attend school	17	2.5
	Primary school	87	12.9
	High school	504	75.0
	Post high school	60	8.9
	Missing	4	0.6
Occupation status	Unemployed	430	64.0
	Employed	238	35.4
	Missing	4	0.6
Marital status	Single	403	59.9
	Married	157	23.4
	Divorced	28	4.2
	Widowed	41	6.1
	Separated	43	6.4
HIV status	Negative	310	46.1
	Positive	319	47.5
	Missing	43	6.4
Ever treated for STD	No	482	71.7
	Yes	179	26.6
	Missing	11	1.6
Age at first intercourse (years)	10–12	14	2.1
	13–19	489	72.8
	20–29	148	22.0
	Missing	21	3.1
Current sexual partner	Yes	515	76.6
	Never	0	0.0
	Not now	154	22.9
	Missing	3	0.4
Number of lifetime sex partners	1 or none	65	9.7
	2 or more	588	87.5
	Missing	19	2.8
Number of sex partners in last 12 months	0	111	16.5
	1	502	74.7
	≥2	47	7.0
	Missing	12	1.8
Cervical cancer screening in the last 10 years	Yes	284	42.3
	No	383	57.0
	Missing	5	0.7

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those at significant risk but who may be <30-years-old and HIV-negative also, need to be targeted for screening, especially that a high prevalence of HIV and high-risk HPV infections have been reported in this population in South Africa [42].

The finding that separated and divorced participants were less likely to report screening compared to single women (Table 3). It is possible that in our study, single women perceived

Table 2. Cervical cancer screening uptake according to various factors of the participants among black women in the past 10 years attending Pap smears in primary health care clinics in Gauteng Province, South Africa (N = 672).

Characteristic	Categories	No		Yes		P value
		N	%	N	%	
Age[1]	18–29	106	85.5	18	14.5	<0.001
	30–49	227	54.6	189	45.4	
	>50	50	39.4	77	60.6	
Education status[1]	Did not attend school	11	64.7	6	35.3	0.012
	Primary school	36	41.4	51	58.6	
	High school	302	59.9	202	40.1	
	Post high school	36	60.0	24	40.0	
Marital status	Single	231	57.3	172	42.7	<0.001
	Married	84	53.5	73	46.5	
	Divorced	19	67.9	9	32.1	
	Widowed	16	39.0	25	61.0	
	Separated	37	86.0	6	14.0	
HIV status[1]	Negative	191	61.6	119	38.4	0.061
	Positive	173	54.2	146	45.8	
Number of sex partners in last 12 months[1]	0	52	46.8	59	53.2	0.037
	1	298	59.4	204	40.6	
	≥2	30	63.8	17	36.2	
	Total	380	57.6	280	42.4	
Ever treated for STD[1]	No	285	59.1	197	40.9	0.098
	Yes	93	52.0	86	48.0	
	Total	378	57.2	283	42.8	
Knowledge on cervical cancer risks[1]	Low	113	50.7	110	49.3	<0.001
	Medium	112	55.2	91	44.8	
	High	159	68.2	74	31.8	
Sources of Pap smear information[1]	Community platforms[3]	165	65.0	89	35.0	0.006
	Health facility platforms[4]	207	54.0	176	46.0	
	Missing (35)					

[1]Varying totals because of missing values

Table 3. Factors associated with cervical cancer screening in the last 10 years among black women in the past 10 years attending Pap smears in primary health care clinics in Gauteng Province, South Africa (N = 67).

Characteristic	Categories	Adjusted OR	95% CI	p value
Age (years)	18–29	1		
	30–49	4.70	2.53–8.73	**<0.001**
	Above 50	10.02	4.41–22.74	**<0.001**
Marital status	Single	1		
	Divorced	0.37	0.15–0.94	**0.036**
	Married	0.84	0.53–1.33	0.454
	Widowed	1.39	0.59–3.26	0.438
	Separated	0.30	0.10–0.86	**0.025**
Knowledge on cervical cancer risks	Low	1		
	Medium	0.80	0.51–1.26	0.345
	High	0.49	0.32–0.79	**0.003**

Table 4. Reasons for taking the cervical cancer screening test among black women in the past 10 years attending Pap smears in primary health care clinics in Gauteng Province, South Africa (N = 672).

Reason	Responses	N	%
Early first sexual experience	No	265	39.4
	Yes	401	59.7
	Missing	6	0.9
Part of periodic health check	No	498	74.8
	Yes	168	25.0
	Missing	6	0.9
Part of clinical management	No	493	73.4
	Yes	173	25.7
	Missing	6	0.9
I know women affected by cervical cancer	No	570	84.8
	Yes	96	14.3
	Missing	6	0.9
To clean the womb	No	531	79.0
	Yes	135	20.1
	Missing	6	0.9
Vaginal bleeding during sex	No	637	95.9
	Yes	27	4.1
	Missing	664	100.0
Vaginal bleeding other times	No	625	93.0
	Yes	39	5.8
	Missing	8	1.2
Other personal concerns	No	596	88.7
	Yes	68	10.1
	Missing	8	1.2

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themselves as vulnerable to the risk factors for cervical cancer because of their less stable social relationships, and therefore willing to be screened. Married, separated, and divorced women may have a false sense of security that they are having or had a stable relationship and therefore screening is not necessary for them. This category are people who are not willing to screen and therefore decided not to act based on their perception of not being at risk of cervical cancer. Such a false sense of security raises serious concerns in this population with a high prevalence of HIV (known risk factors for cervical cancer) and compounded with the fact that male partners in South Africa do not always support their partners to screen for cervical cancer [43]. Thus, the targeted interventions to increase the uptake of cervical cancer screening in this group would be motivation and capability of the participants through environmental influence like mass media and social support.

Despite having national treatment guidelines stating that every HIV women should have a Pap smear at initiation of treatment, less than half (46%) of HIV positive women screened for cervical cancer [38, 40–42]. However, this contradicts Ugandan study, which reported cervical cancer screening of 10% among HIV positive women [24], This suggests that integration may not suffice on its own but should be part of a multi-faceted strategy that incorporates activities that provide opportunities for serial health education (to increase awareness of risks and the need to engage the screening services), personalize risks during the clinical encounter (to motivate non-deciders to take a decision), explore and support self-efficacy (to increase the chances of women acting on their decision to test.t) and increase access (to optimize screening uptake when a woman has decided to test).

Table 5. Reasons for not taking the cervical cancer-screening test among black women in the past 10 years attending Pap smears in primary health care clinics in Gauteng Province, South Africa (N = 672).

Reason	Responses	N	%
I do not know what is a pap smear	No	250	37.2
	Yes	238	35.4
	Missing	184	27.4
It is unnecessary for me	No	410	61.0
	Yes	78	11.6
	Missing	184	27.4
I did not know I had to do one	No	379	56.4
	Yes	109	16.2
	Missing	184	27.4
I have not been sexually active	No	482	71.7
	Yes	6	0.9
	Missing	184	27.4
Religious or cultural reasons	No	486	72.3
	Yes	2	0.3
	Missing	184	27.4
Bad attitudes of Doctors and nurses	No	483	71.9
	Yes	5	0.7
	Missing	184	27.4
I have not been sick to warrant it	No	473	70.4
	Yes	15	2.2
	Missing	184	27.4
I am afraid of positive test results	No	437	65.0
	Yes	51	7.6
	Missing	184	27.4
I could not access the clinic for the procedure	No	478	71.1
	Yes	10	1.5
	Missing	184	27.4

The knowledge of cervical cancer risk factors was negatively associated with screening, which contradicts the findings of previous studies [20, 23, 44]. It is also possible that women who were armed with information, conceivably, do not engage in risky sexual behaviors and hence, may not see a reason to screen. Healthcare professionals may need to employ more intense person-centered health education and counseling techniques (e.g. brief motivational interviewing) [45], to support women to make a behavioral shift from just being informed or aware of the need to screen, to deciding to do the cervical smear test, irrespective of their risk perception of their sexual activity. Providing such support may increase the number who test as patients often regard their healthcare providers as credible sources of information and positive influence [46]. This is more so that in this study, most participants obtained information on cervical cancer screening from their healthcare facilities. However, health education and counseling must be tailored to individual needs and circumstances since patients are not all at the same stage of behavioral change.

Twenty percent of participants had "clean my (their) womb" as a reason for cervical cancer screening and majority did not know what Pap smear was, and hence they did not take the cervical cancer screening in the past 10 years. This reflects significant gaps in patients' knowledge and highlights the need for healthcare professionals to routinely explore patients' basic knowledge and address the misconceptions of cervical cancer screening and the need for

reinforcement of the national guidelines to healthcare workers. This is a barrier to screening and reaffirms the need for more person-centered health education and intense counseling techniques. However, providing information only, may not be sufficient to make disinclined abstainers (people who are not inclined to screen and don't) and inclined abstainers (people who are inclined to screen but fail to act) to take up screening [30], particularly so, that women who had a high level of knowledge of risk factors in this study were significantly less likely to report screening. Integrating cervical cancer screening into all PHC services and creating prompts for clinicians during clinic visits by incorporating a question on the last time an eligible woman had a cervical smear within the vital signs, could increase the screening uptake.

Summed together, this study found low uptake of cervical cancer screening and the need for a more intensive and patient-centered health education and counseling program that translates women's knowledge into screening actions in South African PHC. Using the I-SAM (Fig 1), the low screening rate possibly hinges on participants' poor health literacy (poor knowledge and lack of awareness of the risk factors for cervical cancer), few opportunities of screening (since cervical cancer screening is a vertical program and poorly integrated into other PHC programs) and poor self-efficacy (poor translation of knowledge into screening behavior) [30]. Problems in any of these areas should then be addressed. Increasing community-based campaigns and use of social media platforms may further increase awareness and disseminate information on cervical cancer, the screening process and increase screening uptake [47]. Since the intrinsic drive of each patient is crucial to acting on decisions, healthcare professionals need to be upskilled in how to motivate patients to act on their decisions by exploring emotions, habits, past behaviors, perceived benefits, harms, and risks that influence their screening behaviors.

Study limitations

Although the sample was large for a cross-sectional study, the relative under-representation of participants from some districts due to the need to stop recruitment because of the COVID-19 pandemic could limit the generalization of the study findings to all black women in Gauteng PHC facilities. We further acknowledge the potential for sampling bias when convenience sampling method is used. Since only black women's data were analyzed, the results may not be representative of the entire South African women population. However, black women by far are the patrons of public healthcare services in South Africa and are disproportionately affected by poor outcomes relating to cervical cancer, making it a public health imperative to focus on this subpopulation. The study was based on self-reports and therefore has potential for social desirability. This was addressed by the openness, transparency, and nonthreatening engagement of the trained field workers with participants. Since study participants were women who had come to the clinics for cervical cancer screening of their own volition, they were more likely to report better knowledge and screening behaviors than the larger clinic women cohort or those who had not visited the clinic. The true prevalence of screening in the past 10-years among black women in the general population would therefore be probably less than that reported in this study. Furthermore, caution needs to be exercised not to over-estimate the association between good knowledge and not screening in the last 10 years since participants with good knowledge at the time of this study but who had not screened in the past, could have had poor knowledge then, and therefore not screened in the past. The study was not able to account for how many women who were screened came for treatment according to the I-SAM model. Notwithstanding these limitations, this study provides insight into the past screening behaviors of black women in this urban PHC setting and indicates the need for targeted interventions and integrated PHC services to promote cervical cancer screening.

Conclusion

Cervical cancer screening uptake in the past 10-years among black South African women attending PHC is low. The lack of awareness of risk factors and the necessity of screening for cervical cancer call for strategies to strengthen health education and prevention programs targeted to each patient's context and stage of behavioral change. Such strategies must consider the socio-demographic and clinical correlates of cervical cancer screening in South African PHC and promote its integration into other PHC services.

Acknowledgments

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References

1. Arbyn M, Weiderpass E, Bruni L, de Sanjosé S, Saraiya M, Ferlay J, et al. Estimates of incidence and mortality of cervical cancer in 2018: a worldwide analysis. The Lancet Global Health. 2020; 8(2):e191–e203. https://doi.org/10.1016/S2214-109X(19)30482-6 PMID: 31812369

2. Nyambe A, Kampen JK, Baboo SK, Van Hal G. Knowledge, attitudes and practices of cervical cancer prevention among Zambian women and men. BMC Public Health. 2019; 19(1):1–15.

3. Ba DM, Ssentongo P, Musa J, Agbese E, Diakite B, Traore CB, et al. Prevalence and determinants of cervical cancer screening in five sub-Saharan African countries: A population-based study. Cancer Epidemiology. 2021; 72:101930. https://doi.org/10.1016/j.canep.2021.101930 PMID: 33756434

4. Bante SA, Getie SA, Getu AA, Mulatu K, Fenta SL. Uptake of pre-cervical cancer screening and associated factors among reproductive age women in Debre Markos town, Northwest Ethiopia, 2017. BMC public health. 2019; 19(1):1–9.

5. Hanske J, Meyer CP, Sammon JD, Choueiri TK, Menon M, Lipsitz SR, et al. The influence of marital status on the use of breast, cervical, and colorectal cancer screening. Preventive medicine. 2016; 89:140–5. https://doi.org/10.1016/j.ypmed.2016.05.017 PMID: 27215758

6. Meites E, Gee J, Unger E, Markowitz L. Human Papillomaviruses. 2007.

7. Taku O, Businge CB, Mdaka ML, Phohlo K, Basera W, Garcia-Jardon M, et al. Human papillomavirus prevalence and risk factors among HIV-negative and HIV-positive women residing in rural Eastern

Cape, South Africa. International Journal of Infectious Diseases. 2020; 95:176–82. https://doi.org/10.1016/j.ijid.2020.02.051 PMID: 32114194

8. Organization WH. Information centre on HPV and cervical cancer (HPV Information Centre): summary report on HPV and cervical cancer statistics in South Africa [Internet]. Geneva: World Health Organization; c2013 [cited 2013 Jun 27].

9. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global cancer statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. CA: a cancer journal for clinicians. 2018; 68(6):394–424.

10. Cox B, Skegg D. Projections of cervical cancer mortality and incidence in New Zealand: the possible impact of screening. Journal of Epidemiology & Community Health. 1992; 46(4):373–7. https://doi.org/10.1136/jech.46.4.373 PMID: 1431710

11. Jemal A, Ward E, Thun M. Declining death rates reflect progress against cancer. PloS one. 2010; 5(3): e9584. https://doi.org/10.1371/journal.pone.0009584 PMID: 20231893

12. Watson M, Saraiya M, Benard V, Coughlin SS, Flowers L, Cokkinides V, et al. Burden of cervical cancer in the United States, 1998–2003. Cancer. 2008; 113(S10):2855–64.

13. Bray F, Loos AH, McCarron P, Weiderpass E, Arbyn M, Møller H, et al. Trends in cervical squamous cell carcinoma incidence in 13 European countries: changing risk and the effects of screening. Cancer Epidemiology and Prevention Biomarkers. 2005; 14(3):677–86. https://doi.org/10.1158/1055-9965.EPI-04-0569 PMID: 15767349

14. Lott BE, Trejo MJ, Baum C, McClelland DJ, Adsul P, Madhivanan P, et al. Interventions to increase uptake of cervical screening in sub-Saharan Africa: a scoping review using the integrated behavioral model. BMC Public Health. 2020; 20(1):1–18.

15. Do Health. National guidelines for cervical cancer screening programme. Government Printers Pretoria; 2000.

16. Botha M, Dreyer G. Guidelines for cervical cancer screening in South Africa. Southern African Journal of Gynaecological Oncology. 2017; 9(1):8–12.

17. Do Health. National Guideline for Cervical Cancer Control and Management. In: Health, editor. National Integrated Sexual and Reproductive Health & Rights Policy Ed. 1: National Department of Health, Republic of South Africa, 2019 2019.

18. Aggarwal P. Cervical cancer: can it be prevented? World journal of clinical oncology. 2014; 5(4):775. https://doi.org/10.5306/wjco.v5.i4.775 PMID: 25302177

19. Massyn N, Pillay Y, Padarath A. District health barometer 2017/18. Durban: Health Systems Trust. 2019.

20. Yimer NB, Mohammed MA, Solomon K, Tadese M, Grutzmacher S, Meikena HK, et al. Cervical cancer screening uptake in Sub-Saharan Africa: a systematic review and meta-analysis. Public Health. 2021; 195:105–11. https://doi.org/10.1016/j.puhe.2021.04.014 PMID: 34082174

21. Dessalegn Mekonnen B. Cervical cancer screening uptake and associated factors among HIV-Positive women in Ethiopia: a systematic review and meta-analysis. Advances in Preventive Medicine. 2020;2020. https://doi.org/10.1155/2020/7071925 PMID: 32879739

22. Maseko T, Hui-Chuan H, Kuan-Chia L. Factors Related to Cervical Cancer Screening Experience among Women Aged 15 and above in Eswatini: The World Health Organisation STEP's Data 2014: A Household Cross Sectional Survey. West African Journal of Medicine. 2020; 37(4):355–61. PMID: 32835396

23. Ayenew AA, Zewdu BF, Nigussie AA. Uptake of cervical cancer screening service and associated factors among age-eligible women in Ethiopia: systematic review and meta-analysis. Infectious Agents and Cancer. 2020; 15(1):1–17. https://doi.org/10.1186/s13027-020-00334-3 PMID: 33292388

24. Ralston JD, Taylor VM, Yasui Y, Kuniyuki A, Jackson JC, Tu S-P. Knowledge of cervical cancer risk factors among Chinese immigrants in Seattle. Journal of Community Health. 2003; 28(1):41–57.

25. Mokhele I, Evans D, Schnippel K, Swarts A, Smith J, Firnhaber C. Awareness, perceived risk and practices related to cervical cancer and pap smear screening: a crosssectional study among HIV-positive women attending an urban HIV clinic in Johannesburg, South Africa. South African Medical Journal. 2016; 106(12):1247–53. https://doi.org/10.7196/SAMJ.2016.v106.i12.11224 PMID: 27917772

26. Tafadzwa D, Julien R, Lina B, Eliane R, Frederique C, Leigh J, et al. Spatiotemporal modelling and mapping of cervical cancer incidence among HIV positive women in South Africa: a nationwide study. International journal of health geographics. 2021; 20(1):1–12.

27. Phaswana-Mafuya N, Peltzer K. Breast and cervical cancer screening prevalence and associated factors among women in the South African general population. Asian Pacific journal of cancer prevention: APJCP. 2018; 19(6):1465.

28. Marlow LA, Waller J, Wardle J. Barriers to cervical cancer screening among ethnic minority women: a qualitative study. Journal of Family Planning and Reproductive Health Care. 2015; 41(4):248–54. https://doi.org/10.1136/jfprhc-2014-101082 PMID: 25583124

29. Momberg M, Botha MH, Van der Merwe FH, Moodley J. Women's experiences with cervical cancer screening in a colposcopy referral clinic in Cape Town, South Africa: a qualitative analysis. BMJ open. 2017; 7(2):e013914. https://doi.org/10.1136/bmjopen-2016-013914 PMID: 28213603

30. Robb KA. The integrated screening action model (I-SAM): A theory-based approach to inform intervention development. Preventive Medicine Reports. 2021; 23:101427. https://doi.org/10.1016/j.pmedr.2021.101427 PMID: 34189020

31. Government GP. Annual Report 2013/2014. 2014.

32. O'Mahony D, Banach L, Igumbor E. A comparison of cervical smear adequacy using either the cytobrush or the Ayre spatula: a practice audit. South African Family Practice. 2006; 48(9):1.

33. Mamahlodi MT, Kuonza LR, Candy S. Cervical cancer screening programme in Limpopo province: January 2007 to December 2010. Southern African Journal of Gynaecological Oncology. 2013; 5(1):4–10.

34. Killip S, Mahfoud Z, Pearce K. What is an intracluster correlation coefficient? Crucial concepts for primary care researchers. The Annals of Family Medicine. 2004; 2(3):204–8. https://doi.org/10.1370/afm.141 PMID: 15209195

35. Hank E, Hoque ME, Zungu L. Cervical precancerous lesions and cancer among patients in the gynaecology outpatient department at a tertiary hospital in South Africa. Asian Pacific Journal of Cancer Prevention. 2013; 14(8):4903–6. https://doi.org/10.7314/apjcp.2013.14.8.4903 PMID: 24083765

36. Pengpid S, Peltzer K. Attitudes and practice of cervical cancer screening among female university students from 25 low, middle income and emerging economy countries. Asian Pacific Journal of Cancer Prevention. 2014; 15(17):7235–9. https://doi.org/10.7314/apjcp.2014.15.17.7235 PMID: 25227820

37. Ekechi C, Olaitan A, Ellis R, Koris J, Amajuoyi A, Marlow LA. Knowledge of cervical cancer and attendance at cervical cancer screening: a survey of Black women in London. BMC public health. 2014; 14 (1):1–9.

38. Rosser JI, Zakaras JM, Hamisi S, Huchko MJ. Men's knowledge and attitudes about cervical cancer screening in Kenya. BMC women's health. 2014; 14(1):1–7. https://doi.org/10.1186/s12905-014-0138-1 PMID: 25416335

39. Peltzer K, Phaswana-Mafuya N. Breast and cervical cancer screening and associated factors among older adult women in South Africa. Asian Pacific Journal of Cancer Prevention. 2014; 15(6):2473–6. https://doi.org/10.7314/apjcp.2014.15.6.2473 PMID: 24761849

40. StataCorp L. Stata Statistical Software: Release Vol. 16. 2019.

41. Chisale Mabotja M, Levin J, Kawonga M. Beliefs and perceptions regarding cervical cancer and screening associated with Pap smear uptake in Johannesburg: A cross-sectional study. PloS one. 2021; 16 (2):e0246574. https://doi.org/10.1371/journal.pone.0246574 PMID: 33566798

42. Hopkins KL, Jaffer M, Hlongwane KE, Otwombe K, Dietrich J, Cheyip M, et al. Assessing national cervical cancer screening guidelines: Results from an HIV testing clinic also screening for cervical cancer and HPV in Soweto, South Africa. Plos one. 2021; 16(7):e0255124. https://doi.org/10.1371/journal.pone.0255124 PMID: 34329334

43. Adewumi K, Oketch SY, Choi Y, Huchko MJ. Female perspectives on male involvement in a human-papillomavirus-based cervical cancer-screening program in western Kenya. BMC women's health. 2019; 19(1):1–9.

44. Tchounga B, Boni SP, Koffi JJ, Horo AG, Tanon A, Messou E, et al. Cervical cancer screening uptake and correlates among HIV-infected women: a cross-sectional survey in Côte d'Ivoire, West Africa. BMJ open. 2019; 9(8):e029882. https://doi.org/10.1136/bmjopen-2019-029882 PMID: 31473620

45. Chan DN, So WK. Effectiveness of motivational interviewing in enhancing cancer screening uptake amongst average-risk individuals: A systematic review. International Journal of Nursing Studies. 2021; 113:103786. https://doi.org/10.1016/j.ijnurstu.2020.103786 PMID: 33091749

46. Maree J, Lu X, Wright S. Cervical cancer: South African women's knowledge, lifestyle risks and screening practices. Africa Journal of Nursing and Midwifery. 2012; 14(2):104–15.

47. Erwin E, Aronson KJ, Day A, Ginsburg O, Macheku G, Feksi A, et al. SMS behaviour change communication and eVoucher interventions to increase uptake of cervical cancer screening in the Kilimanjaro and Arusha regions of Tanzania: a randomised, double-blind, controlled trial of effectiveness. BMJ innovations. 2019; 5(1). https://doi.org/10.1136/bmjinnov-2018-000276 PMID: 31645991