Cervical Cancer-Related Knowledge, Attitudes, Practices and Self-Screening Acceptance Among Patients, Employees, and Social Media Followers of Major Brazilian Hospital

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Abstract

Background: Brazil has a high burden of cervical cancer, even though it is preventable, traceable and treatable. Hence, this study evaluated levels of knowledge, attitudes and practices (KAP) related to cervical cancer screening and diagnosis and acceptance of self-screening techniques among women aged 24 and greater.

Methods: A cross-sectional KAP survey was administered to n = 4206 women and spanned questions relating to cervical cancer, HPV, speculum, Pap test and colposcopy. Questionnaire was disseminated through a major hospital's social media platforms, intranet and gynecologic-oncology clinics. Logistic regressions evaluated associations between sociodemographic characteristics and knowledge, attitudes, and preventative behaviors against cervical cancer. Participants indicated willingness to try DNA-HPV self-sampling and cervix self-visualization (self-colposcopy).

Findings: Participants were mostly white individuals (70.5%) with higher education and from social classes A and B. They demonstrated superior levels of KAP than described in the literature, with over 57.8% having answered 80+% of questions correctly. KAP scores were predicted by social class, educational attainment, race, history of premalignant cervical lesions and geographic location. About 80% and 63% would be willing to try DNA-HPV self-sampling and cervix self-visualization, respectively. Interest in self-screening was associated with adequate attitude (OR = 1.85) and inadequate practice (OR = .83).

Interpretation: Adequate KAP are fundamental for the successful implementation of a self-screening program. Participants were interested in methods that provide them with greater autonomy, control and practicality. Self-screening could address barriers for under-screened women such as shame, discomfort, distance from clinics and competing commitments, enabling

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Brazil to reach the WHO's cervical cancer elimination goals. It could also decrease excess medical intervention in over-screened populations by promoting shared decision-making.

Putting Research into Context

Evidence Before This Study

Pap smear coverage is about 75% in Brazil, yet most samples are never evaluated by cytologists due to poor quality. Lack of organized, population-based screening programs results in both over- and under-screened groups. Previous studies evaluating knowledge, attitude and practices related to cervical cancer have focused on one step of the prevention cascade and have demonstrated that knowledge of HPV and HPV vaccine are limited, while most women are familiar with the Pap smear. Studies show Brazilian women find cervical cancer screening and gynecological care important. Screening adherence is mediated by socioeconomic status, educational attainment, race, marital status, and geographical region. Main reasons for non-adherence include shame, lack of gyneco-logical complaints, inadequate knowledge, lack of time, distance from clinics and other structural barriers.

Added Value of This Study

The present study sought a more comprehensive evaluation of knowledge, attitudes and practices (KAP) related to cervical cancer screening and diagnosis than previous studies, which included questions about cervical cancer, the speculum, HPV/vaccine, the Pap test and colposcopy. By using social media and other online platforms for participant recruitment, this study was able to achieve a sample size that is much larger than any other KAP study on cervical cancer in a Brazilian population. Levels of knowledge, attitude and practices were 40-80% higher than that described in the literature. Even so, approximately 15% of participants were not screened for five or more years. Limited adherence to screening was associated with low levels of knowledge and attitudes related to cervical cancer screening and diagnosis. Aside from KAP, we also evaluated the willingness of participants to perform a self-screening method for cervical cancer, imperative for over-coming barriers associated with limited screening adherence. Over 60% of participants said that they prefer a speculum-free exam, 80% responded that they would be willing to try a DNA-HPV self-sampling, and 63% were willing to try cervix self-visualization. Unlike other studies, acceptance of self-screening was evaluated in individuals who had no previous experience with the methods, but once provided with a one-sentence ex-planation of the method's safety, ease of use and efficacy, the willingness of participants to try DNA-HPV self-sampling increased to 90%. Interest in self-screening was associated with thinking cervical cancer screening and diagnosis are important and having limited adherence to screening.

Implications of Evidence From Study

Adequate levels of knowledge about the disease, under-standing the importance of screening, and willingness to try self-visualization and sampling are fundamental to successful implementation of a self-screening program. Additionally, multivariate analysis allowed for identification of which so-ciodemographic groups would benefit most from educational interventions and self-screening programs, allowing policy-makers and researchers to design evidence-based interven-tions for these groups. Regardless of sociodemographic differences and limited experience with self-screening, both DNA-HPV self-sampling and cervix self-visualization were of interest to study participants, suggesting that tools that can deliver these opportunities could be used to address barriers in cervical cancer screening. In doing so, this will increase access to women who traditionally do not seek these exams, and also promote shared-decision making via informing and enabling preferences to decrease rates of excessive medical screening and intervention.

Introduction

Cervical cancer is preventable, traceable, and has a high potential for cure if treated in the early or precursor stages. However, low- and middle-income countries are responsible for 85% of cases.[1] In Brazil, cervical cancer is the third most common female cancer and ranks fourth in mortality.[2] Each year, approximately 16 710 cases are expected,[3] with 6596 deaths reported in 2019.[4]

Challenges of Cervical Cancer Prevention in Brazil

Brazil's incidence and mortality rates are some of the highest, even in a global context. Increased mortality is driven by the majority of cases being diagnosed at Stages III or IV,[5] re-flecting flawed screening and prevention programs. Patients are lost to follow-up at each step of the cervical cancer pre-vention cascade due to lack of information, cultural barriers, organizational difficulties, and vast disparities in access.[6]

Brazil's last national education campaign raising awareness about cervical cancer ended in 2002. Vaccination efforts have been insufficient, with 49% two-dose coverage of eligible girls in 2017,[7] despite a national target of 80%. Vaccine uptake is limited since HPV vaccination is no longer offered in the school setting, and fear of side effects, parental concerns that vaccination against a sexually transmitted infection can lead to promiscuity also hinder coverage.[8]

National statistics report about 70% of women between ages 25-64 are screened with cervical cytology in Brazil, however, these rates vary greatly by geographical region and socioeconomic group.[9] Women with higher socioeconomic status in urban areas tend to have private insurance and are often overscreened due to opportunistic screening[10] and provider misinformation about current guidelines.[11] Conversely, those with lower socioeconomic status rely on the public health system (SUS) for annual screening, and have lower rates of participation due to organizational difficulties and sociocultural beliefs.[12] While cytology infrastructure is present in most urban centers and despite optimal statistics, less than 54% of the estimated cytology need is met, since almost half of Pap smear samples are never evaluated by cytologists due to poor quality.[13] Further, remote geographical areas, such as the Amazon region, lack the infrastructure necessary for an adequate screening program, and are plagued with the highest rates of cervical cancer incidence and mortality.[14] Brazil's cervical cancer landscape has been exacerbated by the COVID-19 pandemic, during which there was a 45% decrease in screening.[15] Further, lack of knowledge, shame, absence of gynecological symptoms, and structural barriers are cited reasons for non-adherence to cervical cancer screening.[12]

Colposcopy is indicated in the event of a positive cytology result. The equipment and trained personnel are not available at primary health clinics. In 2021, over 220 thousand colposcopies were performed nationwide, however, more than 46% of the procedures occurred in the wealthier Southeast region,[14] despite having the lowest rates of positive cytologies.[9] These statistics indicate that colposcopy coverage is only at 28% of estimated need.[14] Given the limited availability, women often take a long time to undergo the exam.[16] Median time between Pap testing and colposcopy was over 172 days in a study based in São Paulo.[16] Work conflicts, child caretaking commitments, and complicated transportation logistics contribute to the delay.[17] Additionally, the fear, pain, and shame that women experience around gynecological exams may be further exacerbated during colposcopy,[17] due to prolonged use of the speculum and invasiveness of procedure.

Addressing Barriers With Autonomous Screening Strategies

Considering the structural difficulties, limited access, poor cytology accuracy, and cultural barriers, the need for innovation in cervical cancer screening is evident. Hence, alternative methods, such as self-testing, that give women more accessibility, autonomy, and control during the exam may emerge as attractive solutions.

HPV-DNA testing is an alternative to cervical cytology, and it can be performed privately via self-sampling, overcoming some of the current barriers to screening. Though it has not yet been formally incorporated into Brazil's national cervical cancer prevention strategy, health authorities have indicated growing favorability towards incorporation of HPV-DNA as a primary screening method.[18] Studies have demonstrated the reliability of self-sampling vs clinician-sampling in Brazilian contexts and revealed high acceptability of self-sampling.[19] However, widespread HPV testing has low specificity, which can increase colposcopy referrals by 4-fold.[16] Traditional colposcopy allows for the diagnostic confirmation of abnormal cells in the cervix, but is not widely available, and is invasive, causing pain and discomfort. Overdetection of HPV infections can lead to excess downstream colposcopies, biopsies and ablative procedures, which are not only associated with increased healthcare spending, but also psychological distress.[20] Further, the treatment of preinvasive lesions puts women at increased risk for pregnancy complications, like preterm birth.[21]

In response, self-visualization with a portable colposcope has been proposed as an accessible alternative to triage of HPV-positive patients,[17] aiming to increase specificity, thus reducing unnecessary procedures. On the other hand, it can be employed in areas that lack colposcopy equipment and trained personnel, increasing accessibility while allowing captured images to be evaluated by experts worldwide.[17] Because the device is associated with less discomfort than the traditional speculum and colposcope, its implementation could also contribute to increasing follow-up compliance.[17] Patients with abnormal results in self-visualization would still need to undergo the traditional colposcopy with biopsy for final diagnosis.

The goal of this study was to perform a comprehensive evaluation of the knowledge, attitudes, and practices (KAP) related to cervical cancer screening, diagnosis, willingness to perform self-screening, and their associations with participants' socioeconomic status, location of residence, race, marital status, reproductive history, and history of precancerous cervical lesions.

In light of World Health Organization's call to action to eliminate cervical cancer as a public health problem by year 2030, with target to vaccinate 90% of women, screen 70% of women at least twice and treat 90% of pre-invasive and invasive lesions, self-sampling is highlighted as a useful strategy. As Brazil strives to achieve the global targets, a better understanding of the level of knowledge, attitudes, and practices of women related to cervical cancer screening is essential to implement these self-screening technologies to facilitate disease prevention and detection.

Methods

A cross-sectional study was conducted among N = 7823 women aged greater than 24 (age of screening onset) in Brazil

between August and December 2020. Data was collected using a self-administered, structured Knowledge, Attitudes and Practices (KAP) survey that was adapted and translated from a pre-validated KAP survey.[22] The survey underwent review by a panel composed of three experts with backgrounds in gynecology and global health research, then was pre-tested in a group of 15 women representative of the study population, who provided feedback on the face validity and language of questions. Following the pre-test, changes were made, and the final survey and study design underwent regulatory review and approval by Comitê de Ética em Pesquisa do Hospital Israelita Albert Einstein (HIAE) on 06/12/2020 in São Paulo, Brazil (CAAE 30589520.9.1001.0071). The reporting of this study conforms to STROBE guidelines.[23]

The questionnaire spanned sociodemographic points (age, marital status, race/ethnicity, education, socioeconomic status, location of residence) and reproductive health history. Social class was determined using the pre-validated questionnaire Critério Brasil 2019.[24] Respondents were asked several questions to help assess levels of knowledge, attitudes, and practices regarding cervical cancer, HPV, the HPV vaccine, speculum, Pap smear, and colposcopy (Supplementary Table S1). Additionally, participants were asked if they would be willing to try novel cervical cancer screening methods such as self-HPV sampling and cervix self-visualization, referencing a portable colposcope model.[17] The survey took approximately 15 minutes for participants to complete.

When administering the survey in-person at HIAE and its affiliated hospitals' gynecologic oncology clinics, women were recruited in the hospsital's waiting areas and were informed about the study and consent process (N = 18); survey response was provided on electronic tablets. Due to the COVID-19 pandemic, most participants were recruited online (N = 7805) via call to participants posted on the hospital's social media accounts and intranet. Prior to accessing survey questions, all participants provided electronic consent. Participants met inclusion criteria if they were >24 years old; pregnant women were excluded.

Knowledge was assessed by a series of questions with yes/no/I don't know or multiple choice answers (Supplementary Table S1). A total of 13 questions assessed knowledge, one being related to the speculum, three to cervical cancer, three to Pap smears, five to HPV, and one to colposcopy. One attitude question was designed for each category assessed, except the HPV vaccine, for which there were three. For practices, there were six questions, one of which assessed speculum practices, one for cervical cancer, two for Pap smears, and one for HPV vaccination. Data on colposcopy practice was not collected since they should only be performed if medically indicated. Three self-screening acceptance questions were asked: two were related to DNA-HPV self-sampling and one to cervix self-visualization.

Univariate and multivariate analyses were performed to determine which sociodemographic and reproductive health variables are statistically significant predictors of levels of knowledge, attitudes, and practices regarding cervical cancer screening and diagnosis and self-screening acceptance. Total knowledge, attitudes, and practices scores were calculated by summing cervical cancer, speculum, Pap test, HPV and colposcopy scores. One point was attributed for each "Yes" or correct answer provided, zero points were added for "No", "I don't know" or incorrect responses. Bloom's cut off points were adapted such that scores above 80% were considered adequate.[25] All analyses were conducted in R Studio.

Results

While 7823 individuals provided electronic consent, about 4206 individuals met inclusion criteria, responded to the entire survey, and were included in the analysis (Supplementary Figure 1).

Among the 4206 participants analyzed, the median age was 36 years, 70.5% self-declared as white, and 34.9% had never been married. Approximately 30% lived in the city of São Paulo, the median years of schooling was 19, which corresponds to the completion of at least university. Social class distribution based on the Critério Brasil 2019 questionnaire, indicated 32% belonged to Class B2, with an average monthly household income of US$1048.53.37% of women had a personal history of precancerous cervical lesions. The majority of participants were nulliparous, yet among those with children, only 34% had at least one vaginal delivery. See Table 1 for additional details.

Table 2 assesses the knowledge, attitudes, and practices regarding cervical cancer prevention. Nearly all participants had heard of cervical cancer (99.6%), the speculum (91.6%), Pap test (99.8%), HPV (93.5%), and colposcopy (84.1%).

Speculum

Although most women had undergone a speculum exam and 68% thought the speculum was important in their gynecological care, 61.5% would still prefer a speculum-free exam, and 59% think the speculum is a barrier to gynecologic care (Table 2).

Pap Smear

Though most participants had undergone a Pap smear, 94% thought that the screening test should be done at a shorter interval than is recommended (every three years after two consecutive negative results). While only 3.7% had not been screened for over four years, 15% had not been screened for more than 5 years after age 24 (Table 2).

HPV

More than 92% know that HPV is associated with cervical cancer; 24% had received at least one dose of the HPV vaccine. The most common reason for not having been vaccinated was being outside the recommended age (46%)

Table 1. Sociodemographic Characteristics of Study Participants (n = 4206).

	Metric	Representation (%, n)
Sociodemographic factors		
Age, n = 4083	24-30	26.72% (1091)
	31-40	39.80% (1625)
	41-50	21.30% (870)
	≥51	12.17 (497)
	Missing data	(123)
Social class (average monthly household income), n = 4164	Class D-E (US$133.78)	.86% (36)
	Class C2 (US$324.99)	4.76% (198)
	Class C1 (US$573.46)	13.50% (562)
	Class B2 (US$1048.53)	32.10% (1336)
	Class B1 (US$2096.30)	20.10% (837)
	Class A (US$4749.43)	28.70% (1195)
	Missing data	(42)
Geographic location, n = 4109	São Paulo city	29.93% (1658)
	Countryside of SP state	20.98% (862)
	Outside of SP state	38.27% (1589)
	Missing data	(97)
Race, n = 4137	White	70.50% (2948)
	Black	4.70% (197)
	Brown-skinned/pardo	21.30% (890)
	Indigenous	.14% (6)
	Asian	2.30% (96)
	Missing data	(69)
Education, n = 3749	Some elementary school	4.45% (167)
	Complete elementary school/some high school	9.15% (343)
	Complete high school/some college	28.86% (1082)
	Complete higher education	57.54% (2157)
	Missing data	(457)
Marital status, n = 4076	Married/civil union	55.40% (2258)
	Never married	34.90% (1454)
	Widower	.64% (27)
	Divorced/separated	8.00% (337)
	Missing data	(130)
Reproductive health factors		
History of precancerous cervical lesion, n = 4049	Yes	37.00% (1557)
	No	59.26% (2492)
	Missing data	(157)
Family history with invasive cervical cancer, n = 4161	Yes	14.50% (611)
	No	69.73% (2931)
	I don't know	14.70% (619)
	Missing data	(45)
History of gynecological cancer, n = 4200	Yes	2.21% (93)
	No	97.24% (4084)
	I don't know	.55% (23)
	Missing data	(6)
Children, n = 401	0	51.77% (2138)
	1	23.41% (967)
	2	17.60% (727)
	≥3	6.33% (259)
		(1)
Vaginal births, n = 1951	Yes	34.24% (668)
	No	65.75% (1283)
Menopause, n = 4204	Yes	10.70% (450)
	No	86.63% (3642)
	I don't know	2.66% (112)
	Missing data	(2)

Social class is determined using the validated questionnaire Critério Brasil 2019.
City of São Paulo corresponds to the largest city in the country with the largest Gross Domestic Product. It is the capital of the state of São Paulo (SP). SP state in this study refers to all cities in the state aside from the capital. The state has the highest human development index (IDH) in the country. Outside of SP state refers to the rest of the country.

Table 2. Assessment of Knowledge, Attitudes, and Practices Relating to Cervical Cancer Screening Among Women Who Responded to the Questionnaire (n = 4206).

	Description	Metric
Speculum outcomes		
Knowledge of speculum	Participant has heard of the speculum	No (8.4%)
		Yes (91.6%)
Attitudes speculum	Participant thinks speculum is important in gynecologic care	No (32%)
		Yes (68%)
	Would prefer a speculum-free exam if available	No (12.13%)
		Yes (61.48%)
		I don't know (26.21%)
	Think speculum is important barrier to access gynecologic care	No (58.96%)
		Yes (23.14%)
		I don't know (17.90%)
Practices speculum	Participant has undergone at least one speculum-based exam	No (2.21%)
		Yes (97.79%)
Cervical cancer (CC) outcomes		
Knowledge of CC	Participant has heard of cervical cancer	No to all (.40%)
		Yes (99.60%)
	Participant knows that main risk factor for cervical cancer is persistent HPV infection	Yes (79.44%)
	Participant knows that it can be prevented with screening	Yes (96.75%)
		Yes to all (77.58%)
Attitudes CC	Participant acknowledges that CC can be fatal if not treated	No (7.5%)
		Yes (92.5%)
Practices CC	Participant would seek medical care if detected CC symptoms	No (91.5%)
Pap smear outcomes		Yes (6%)
Knowledge of pap		No to all (.24%)
	Participant has heard of pap smear	Yes (99.81%)
	Participant knows what it is for	Yes (81.92%)
	Participant knows the recommended frequency for screening	Yes (5.23%)
	Participant thinks that the screening test should be done at a shorter interval than national guidelines recommendations	Yes (93.77%)
		Yes to all (5.23%)
Attitudes pap	Participant thinks Pap smears are important in their gynecological care	No (.78%)
		I don't know (1.07%)
		Yes (98.14%)
Practices pap		No to all (2.4%)
	Participant has been screened in the past 3 years	No (3.74%)
		Yes (96.26%)
	Participant has been screened in the last year	Yes (78.7%)
	Participant has never spent 5 consecutive years without getting one after the age of 24	No (15%)
		Yes (85%)
		Yes to all (81.54%)
HPV outcomes		
Knowledge of HPV		No to all (1.38%)
	Participant has heard of HPV	Yes (93.48%)
	Participant knows HPV is an STI	Yes (97.27%)
	Participant knows that it is related to CC	Yes (92.35%)
	Participant knows number of vaccine doses	Yes (82.50%)
	Participant knows when vaccine should be given	Yes (67.90%)
		Yes to all (25.56%)

(continued)

Table 2. (continued)

	Description	Metric
Attitudes HPV		No to all (3.02%)
	Participant would be willing to get HPV vaccine in	
	- Public clinic	Yes (89.64%)
	- Private clinic	Yes (74.15%)
	Participant would be willing to vaccinate a child between 9-14 years of age	Yes (93.2%)
		Yes to all (67.82%)
	How much would participants be willing to pay (on average) for all doses of the vaccine?	US$41.38 ± 38.50
Practices HPV	Participant has not received HPV vaccination at all	Yes (75.72%)
	Participant has received at least one dose of the HPV vaccine	Yes (24.28%)
	Participant has received complete HPV vaccination	Yes (19.58%)
Colposcopy outcomes		
Knowledge of colposcopy	Participant has heard of colposcopy	No (15.86%)
		Yes (84.14%)
Attitudes colposcopy	Participant thinks colposcopy is important in gynecologic care	No (10.16%)
		Yes (82.08%)
		I don't know (7.76%)
Acceptability of self-screening methods		
Self-HPV	Participant is willing to try DNA-HPV self-sampling	No (8.45%)
		Yes (79.86%)
		I don't know (11.69%)
	Participant is willing to try DNA-HPV self-sampling *when explained the safety, efficacy, and ease of use of the method*	No (4.62%)
		Yes (89.13%)
		I don't know (6.25%)
Self-colposcopy	Participant is willing to try cervix self-visualization at home	No (20.59%)
		Yes (63.27%)
		I don't know (16.14%)

(Supplementary Table S2). However, if eligible, 89.6% would be willing to get vaccinated through the Brazil public health system (SUS) and 93% would be willing to vaccinate a child ages 9-14.[8]

Self-Screening

About 80% of women were willing to undergo HPV self-sampling and this figure increased to 89% when the safety, efficacy and ease of use of the method was explained. Furthermore, 63% reported being willing to try self-colposcopy/self-visualization of the cervix.

Multiple logistic regressions (MLR) in Table 3 further characterize which of the participants' sociodemographic variables demonstrated significant association with adequate KAP scores. Recurrent themes for all three KAP variables include: positive relationship between history of precancerous cervical lesions and social classes A and B, and negative association for participants who live in the countryside of São Paulo. Age, personal history of gynecologic cancer, and family history of cervical cancer were not related to any KAP variables.

Knowledge. History of premalignant cervical lesions (adjusted OR = 1.40, P < .0001), having greater years of schooling (OR =1.70-2.26, P < .0001), belonging to a higher social class (OR = 3.67-5.42, P = .004-.02), never being married (OR = 1.27, P = .007), living outside of São Paulo state (OR = 1.30, P = .001) were statistically significant predictors of adequate knowledge of cervical cancer screening, while living in the countryside of São Paulo state (OR = .81, P = .04) and having one or two children (OR = .719-.802, P = .004-.029) were associated with inferior knowledge about cervical cancer screening.

Attitude. History of cervical lesion (OR = 1.40, P < .001) is associated with adequate attitude, whereas living outside of São Paulo city (OR = .56-.66, P < .001), self-identifying as Asian (OR = .59, P = .02), and being post-menopausal (OR = .66, P = .001) were related to inadequate attitude.

Practices. Women who scored higher in Total Practices tended to have a history of precancerous cervical lesions (OR = 1.81, P < .0001) and belong to social class A or B (OR = 2.66-4.93, P = .001-.04). Living in the countryside of São Paulo state (OR = .76, P = .02), identifying as brown-skinned (OR = .67, P < .0001) or Asian (OR = .49, P = .003), having had a vaginal birth (OR = .59, P < .001) or never having been married (OR = .76, P = .005) negatively influenced screening practice.

Table 3. Significant Results of Logistic Regression Analysis Between Sociodemographic and Reproductive Variables and Adequate Knowledge, Attitudes and Practices of Cervical Cancer Screening and Diagnosis (n = 4206).

		Knowledge		Attitudes		Practices	
	Total N	Adjusted Odds Ratio (CI)	Adjusted P-value	Adjusted Odds Ratio (CI)	Adjusted P-value	Adjusted Odds Ratio (CI)	Adjusted P-value
Sociodemographic factors							
Social class							
Class D-E	36	REF				REF	
Class C2	198	2.19 (.737- 8.08)	.189			1.32 (.495-3.66)	.581
Class C1	562	2.51 (.877- 9.06)	.112			1.77 (.686-4.77)	.241
Class B2	1334	3.67 (1.29-13.14)	.0241*			2.66 (1.04-7.10)	.0430*
Class B1	837	4.31 (1.51-15.50)	.0116*			2.98 (1.15-8.03)	.0250*
Class A	1192	5.42 (1.90-19.49)	.0035**			4.93 (1.90-13.3)	.00110**
Geographic location							
São Paulo city	1855	REF		REF		REF	
Countryside of São Paulo state	663	.812 (.665 - .991)	.0408*	.561 (.455-.692)	<.001***	.763 (.608-.959)	.0200*
Outside of São Paulo state	1586	1.30 (1.11 - 1.51)	.001026**	.662 (.560-.781)	<.001***	1.09 (.911-1.30)	.350
Race							
White	2943					REF	
Mixed race/brown-skinned	890					.669 (.552-.811)	<.001***
Education							
Some elementary school	167	REF					
Complete elementary school/some high school	343	1.70 (1.12- 2.61)	.032121*				
Complete high school/ some college	1082	1.96 (1.35- 2.86)	<.001***				
Complete higher education	2157	2.26 (1.58- 3.28)	<.001***				
Marital status							
Married	2255	REF				REF	
Never married	1452	1.27 (1.07-1.50)	.00689**			.755 (.621-.917)	.00462**
Reproductive health factors							
History of precancerous cervical lesion							
Yes	1556	1.40 (1.22 - 1.63)	<.0001***	1.40 (1.20-1.64)	<.001***	1.81 (1.52-2.16)	<.001***
No	2603						
Children							
0	2136	REF					
1	967	.802 (.658- .977)	.0287*				
2	726	.719 (.573- .902)	.00441**				
≥3	258	.790 (.564- 1.11)	.169				
Menopause							
Yes	441			.658 (.512-.847)	.0011**		
No	3715						
Vaginal births							
Yes	675					.590 (.463-.753)	<.001***
No	3484						

Refer to Supplementary Tables 3-5 for complete regression results.

History of spending more than 5 years without being screened was negatively associated with global KAP scores (Table 4). Practice scores were not included in the logistic regression since adherence is one of the factors contributing to practice scores. As indicated in Table 5, inferior levels of knowledge (OR = .575, P < .001) and attitudes (OR = .672, P < .001) related to cervical cancer screening are associated with higher likelihood of limited adherence to screening. Logistic regression results for limited adherence with socio-demographic and reproductive variables are listed showed that brown-skinned, belong to lower social class, be unmarried, and post-menopausal were significant predictors. When including total knowledge and attitude scores in regression, no socio-demographic or reproductive health variables were significant. Most frequent reasons listed for non-adherence included: distance from clinic (11%), shame (9%), discomfort during the exam (13%), and cost (14%) (Supplementary Table S2).

In Table 5, willingness to try DNA-HPV self-sampling is positively associated with being brown/pardo (OR = 1.35, P = .011), living in the city of São Paulo (OR = 1.40, P = .0003), and being premenopausal (OR = 1.36, P = .03). After a short explanation about DNA-HPV self-sampling, only geographic location was a significant predictor, where living in São Paulo city was associated with greater acceptance. No sociodemographic and reproductive variables were associated with self-colposcopy interest. However, adequate attitude (OR = 1.85, P < .001; OR = 1.66, P < .001) and inadequate practice (OR = .830, P = .03; OR = .75, P = .003) were predictors of both self-colposcopy and self-HPV acceptance, respectively (Table 5).

Discussion

Cervical cancer incidence and mortality in Brazil remains high, despite recent domestic and global efforts to eliminate the disease, most notably through the World Health Organization's initiative to eliminate cervical cancer as a public health problem by year 2030, with target to vaccinate 90% of women, screen 70% of women at least twice and treat 90% of pre-invasive and invasive lesions. A systematic review

indicates that addressing knowledge gaps is essential to promote early detection with the goal of disease elimination.[26] Further, self-screening methods are attractive for addressing some barriers such as shame, discomfort during the exam, lack of time, and distance from clinics. Yet, adequate knowledge, willingness to try the method, and understanding its importance are requirements for successful implementation of self-screening techniques. This study evaluated KAP levels regarding cervical cancer screening and diagnosis among patients, social media followers, and employees of a major university hospital in São Paulo, Brazil. No other studies have sought such comprehensive KAP evaluation related to cervical cancer screening and diagnosis in a Brazilian population. It also stands out for its use of social media for participant recruitment, which has been under explored by researchers but holds great potential.[27]

Knowledge

Levels of knowledge among participants were superior to those described in the literature. Although 70% of our study participants answered 4+ out of five HPV knowledge questions correctly, two studies from different Brazilian regions showed that only 40% knew about HPV and that over half never heard about an HPV vaccine.[28,29] Demographic analysis of our sample also indicated an overwhelming representation of better educated and higher social class individuals than similar studies.[28,30-32] Additionally, the majority of our study participants were hospital social media followers, indicating that they routinely seek health-related information.

About 92% of our sample had adequate knowledge of HPV's association with cervical cancer, while only 5.2% knew cytology could be performed every 3 years after two consecutive negative results. Conversely, 57% of hospital, school and university employees in another study were aware of how cervical cancer develops and 66% knew the recommended screening interval.[32] The discrepancy between knowledge of screening intervals may be attributed to policy changes enacted in 2017 that increased the interval,[33] but many physicians still employ the less updated guidelines with more frequent, opportunistic screening.[10]

Table 4. Multiple Logistic Regression Analysis Between Total Knowledge, Attitude, and Practice Scores and Limited Adherence to Pap Smear, Self-HPV Screening Acceptance, and Self-Colposcopy Acceptance (n = 4206).

	Spent 5+ Years Without Undergoing Pap Test	Self-HPV Screening Acceptance	Self-Colposcopy Acceptance
	Adjusted OR (95% CI), P Value	Adjusted OR (95% CI), P Value	Adjusted OR (95% CI), P Value
Adequate knowledge	.575 (.481-.687) P < .001***	1.01 (.858-1.179) P = .941	1.082 (.936-1.25) P = .285
Adequate attitudes	.672 (.562-.805) P < .001***	1.66 (1.41-1.95) P < .001***	1.85 (1.58-2.17) P < .001***
Adequate practices		.752 (.623-.903) P = .0025**	.830 (.700-.982) P = .0311*

Table 5. Logistic Regression Analysis Between Sociodemographic and Reproductive Variables and Self-Screening Acceptance (n = 4206).

		Self-HPV Acceptability					Self-Colposcopy Acceptability	
	Total N	N (%)	X² (p)	Or (CI)	Adjusted OR (CI)	Adjusted P-value	N (%)	X² (p)
Sociodemographic factors								
Age								
24-30	1091	889 (81.48%)	4.97 P = .174	REF	REF		597 (67.15%)	3.66 P = .30
31-40	1625	1282 (78.89%)		.849 (.699-1.03)	.872 (.705-1.08)	.20	864 (53.17%)	
41-50	870	677 (79.08%)		.797 (.639-.995)	.778 (.612-.990)	.041 *	451 (51.84%)	
≥51	497	321 (64.59%)		.960 (.719-1.29)	1.08 (.784-1.51)	.64	216 (43.46%)	
Social class								
Class D-E	36	27 (75%)	14.8 P = .011*	REF	REF		19 (52.78%)	2.59 P = .76
Class C2	198	168 (84.84%)		1.867 (.765-4.25)	2.46 (.715-7.43)	.13	96 (48.48%)	
Class C1	562	458 (81.49%)		1.468 (.635-3.10)	1.75 (.538-4.87)	.31	301 (53.56%)	
Class B2	1334	1089 (81.63%)		1.482 (.651-3.07)	2.02 (.629-5.56)	.20	698 (52.32%)	
Class B1	837	659 (78.73%)		1.234 (.539-2.58)	1.82 (.563-5.04)	.27	462 (55.20%)	
Class A	1192	915 (76.76%)		1.101 (.484-2.28)	1.59 (.492-4.39)	.40	652 (54.70%)	
Location								
São Paulo city	1855	1534 (82.70%)	18.8 P < .001***	REF	REF		1112 (72.49%)	.915 P = .633
Countryside of São Paulo state	645	514 (79.69%)		.722 (.581-.900)	.775 (.608-.989)	.039*	298 (57.98%)	
Outside of São Paulo state	1586	1223 (77.11%)		.705 (.596-.834)	.706 (.584-.853)	.0003 ***	792 (64.76%)	
Race								
White	2945	2314 (78.57%)	9.13 P = .058	REF	REF		1568 (53.24%)	3.51 P = .477
Black	197	163 (82.74%)		1.303 (.903-1.93)	1.06 (.710 -1.64)	.77	111 (56.35%)	
Brown/Pardo	890	738 (82.29%)		1.320 (1.09-1.61)	1.35 (1.08 -1.71)	.011*	474 (53.26%)	
Asian	96	75 (78.13%)		.971 (.605-1.63)	.885 (.538 -1.52)	.64	58 (60.42%)	
Education								
Some elementary school	167	141 (84.43%)	15.355 P = .0015**	REF	REF		82 (49.10%)	1.68 P = .64
Complete elementary school/some high school	343	295 (86.00%)		1.133 (.668- 1.89)	1.05 (.590-1.83)	.86	193 (56.27%)	
Complete high school/some college	1082	876 (80.96%)		.784 (.493-1.20)	.725 (.436- 1.16)	.195869	594 (54.90%)	
Complete higher education	2157	1684 (78.07%)		.657 (.418-.993)	.657 (.399 -1.04)	.083	1166 (54.06%)	

(continued)

Table 5. (continued)

		Self-HPV Acceptability					Self-Colposcopy Acceptability	
	Total N	N (%)	X^2 (p)	Or (CI)	Adjusted OR (CI)	Adjusted P-value	N (%)	X^2 (p)
Marital status								
Married	2255	1797 (79.69%)	7.79 P = .0505**	REF	REF		1217 (53.97%)	2.48 P = .4
Never married	1452	1137 (78.30%)		.920 (.783-1.08)	1.00 (.816-1.23)	.97	757 (52.13%)	
Widower	27	23 (85.18%)		1.47 (.560- 5.02)	1.25 (.458-4.39)	.69	13 (48.15%)	
Separated/Divorced	337	286 (84.87%)		1.43 (1.05- 1.98)	1.36 (.965-1.95)	.088	199 (59.05%)	
Reproductive health factors								
History of cervical lesion								
Yes	1556	1233 (79.24%)	.321 P = .57	.953 (.815 - 1.11)	.894 (.749-1.07)	.215	890 (57.29%)	.077 P = .783
No	2603	2083 (80.02%)					1338 (51.40%)	
Family history of cervical cancer								
Yes	611	494 (80.85%)	.478 P = .49	1.086 (.877- 1.35)	1.02 (.803-1.31)	.86	337 (55.16%)	.11 P = .74
No	3548	2822 (79.53%)					1891 (53.30%)	
History of gynecological cancer								
Yes	93	71 (73.34%)	.481 P = .49	.816 (.512-1.35)	.823 (.479-1.47)	.49	51 (54.84%)	.0069 P = .93
No	4063	3243 (79.82%)					2177 (53.58%)	
Children								
0	2136	1661 (77.76%)	11.7 P = .0087**	REF	REF		1134 (53.09%)	2.59 P = .46
1	967	799 (82.62%)		1.360 (1.12-1.65)	1.27 (.993-1.62)	.058	537 (55.53%)	
2	726	590 (81.26%)		1.24 (1.01-1.54)	1.16 (.882-1.54)	.29	387 (53.31%)	
≥3	258	258 (81.40%)		1.25 (.907-1.76)	1.20 (.790-1.87)	.40	138 (53.49%)	
Vaginal births								
Yes	582	564 (96.91%)	7.01 P = .0081**	1.35 (1.09-1.69)	1.23 (.929-1.63)	.15	1879 (63.85%)	2.98 P = .084
No	2943	2752 (93.51%)					349 (59.97%)	
Menopause								
Yes	441	345 (78.23%)	.616 P = .43	.901 (.712-1.15)	.733 (.553-.979)	.033*	249 (56.46%)	.095 P = .76
No	3715	2970 (79.95%)					1978 (53.24%)	

In addition to social class and years of schooling,[28,29,31] our regression models revealed that having a history of precancerous cervical lesions was associated with higher levels of knowledge about cervical cancer screening. Individuals diagnosed with precancerous cervical lesions often experience substantial anxiety[34] and have exposure to several steps in the cervical cancer prevention cascade. Despite being a significant predictor for all our KAP outcomes, this variable is rarely elicited in similar papers.

Living in the countryside of São Paulo state and having one or two children were negatively correlated with knowledge. While São Paulo is the largest city with the highest Gross Domestic Product in Brazil, many of its surrounding municipalities in the countryside are less urban and have lower human development index.[35] Childcare commitments could reduce time available for a woman to focus on her own health.[30]

Attitudes

Studies in Brazil demonstrate consistently that more than 90% of study participants think Pap smears and HPV vaccines are important. Additionally,[29,31] HPV vaccine-related studies reveal that even those who have not been vaccinated are amenable to it and would be willing to vaccinate a child.[29] Findings from this study (93.2%) are consistent with the literature. 61.5% of our participants also preferred a speculum-free exam, demonstrating fear of the speculum and demand for a more comfortable gynecological experience. Our models also showed that high attitude scores were associated with having a history of precancerous cervical lesion, and living in the city of São Paulo. Being post-menopausal was associated with inadequate attitudes, which is consistent with the literature demonstrating that women may not realize they are still at risk for developing CC as they age, affecting low screening compliance.[36]

Practices

In the present study, 96.3% have been screened at least once in the past four years, with 78.7% having been screened within the past year, indicating an over-screened population, which can lead to increased costs. Adequate practice of cervical cancer prevention was associated with social class and personal history of cervical lesion. Participants who lived in the countryside of São Paulo state, are brown-skinned ("pardo"), Asian, were never married, or had vaginal birth were less likely to have adequate practices. Our findings reinforce the literature — a study among mostly brown-skinned individuals earning less than three minimum wages found that only 71% had done a Pap test in the previous three years.[30] Conversely, in a study conducted in a similar, more highly educated population, where participants were employed or teaching at a hospital or university, 93.5% saw a gynecologist at least once a year.[32] Given opportunistic screening,[10] it is likely Pap smears were performed at almost all visits. Further, studies support that marital status is correlated with screening coverage,[12] since married women are more likely to visit the gynecologist for other needs like prenatal care.

Individuals who spent 5+ years without screening had lower knowledge and attitude scores than their adequately screened counterparts, indicating that educational campaigns about cervical cancer screening and its importance can contribute to increasing Pap smear coverage. Reported reasons for non-adherence to cytology are consistent with other studies.[12,30,37] The sociodemographic characteristics of participants with limited adherence to cervical cancer screening intervals reflect the population most likely to develop cervical cancer. Peak incidence occurs at 45-50 years of age, almost 50% are brown-skinned, and 60% did complete secondary education.[38] São Paulo state has the lowest CC mortality in the country; however, disease incidence is lower in São Paulo capital than surrounding municipalities.[12]

Self-Screening for HPV and Colposcopy

About 80% of our sample expressed willingness to try DNA-HPV self-sampling, and this figure increased to about 90% when a one-sentence explanation about the method was provided. This indicates that informing the population about screening methods can increase acceptability and adherence. Only geographic location significantly predicted self-sampling willingness after the explanation, emphasizing not just the regional disparities also observed in KAP outcomes, but also the popularity of self-sampling among women despite sociodemographic differences.

There is limited data on self-colposcopy acceptability in literature, but one study found that 60-70% of participants found self-colposcopy easy to conduct.[17] In this study, due to less familiarity, it is expected that self-colposcopy would have lower acceptance than self-DNA/HPV sampling. Our results indicate greater willingness to try both self-colposcopy and self-sampling among those with higher attitude and lower practice scores. While this indicates that poorly screened groups could benefit from self-screening options, it also underscores how understanding the exams' importance is imperative for the adoption of new methods.

A study conducted in a similar population evaluated HPV self-sampling acceptance and showed that over 75% of the participants prefer self-sampling over provider-based exams. Reasons for preferring self-sampling included being more practical, being able to collect samples at home, and feeling less shame and discomfort.[19] Women who undergo self-sampling are more likely to complete screening and follow-up colposcopy.[39]

Ethical Implications of Increased Cervical Cancer Screening for Populations from Hhigher Social Classes

Over-screening is common among Brazilians of higher social class, as demonstrated by 93.8% of study participants who think cytology should be done at greater frequency than recommended. Wealthier individuals who tend to visit private

clinics also undergo more ultrasounds throughout prenatal care, and have high rates of unnecessary C-sections.[40,41] Recent studies have suggested that increased patient autonomy is necessary to revert C-sections to WHO-recommended levels.[42] However, this can also be applied to cervical cancer.

HPV self-sampling and cervix self-visualization both promote shared and informed decision-making, which contributes to greater female autonomy and empowerment in the gynecologic setting. This can increase participation among under-screened women,[39] and also contribute to reducing excess medical intervention in obstetrics and sexual health.[43]

Study Limitations to be Addressed by Future Studies

Limitations of the study include participants who were mostly highly educated individuals and belonging to social classes A and B, which is not representative of the majority of the population and reflects the country's vast inequalities. This may have been due to self-selection bias among participants, which may also explain the over-representation of participants who have been diagnosed with precancerous lesions of the cervix. Given how social media algorithms function, the call for participants likely reached mostly individuals who seek cervical cancer-related content. Also, self-reported data may be influenced by memory bias. No conclusions could be drawn on indigenous and Asian populations due to their limited representation in our study; this parallels their low representation in São Paulo's population.

Implementation Considerations of HPV-Testing, Self-Sampling and Cervix Self-Visualization in Brazil

A pilot study has proven the feasibility of a HPV-DNA testing program in a Brazilian city, yielding high coverage, age compliance, higher rates of early stage cancer detection and superior cost-effectiveness than the conventional cytology program.[44] Scaling this experience would require training of healthcare personnel of HPV-DNA testing and nationwide distribution of necessary materials and technology, which can be hindered by the country's vast geography and regional disparities. While cost-effectiveness of HPV-DNA testing is reported in the literature, Brazil's current strategy relies heavily on opportunistic screening, which may lead to smaller intervals between tests, and thus, increased cost. Therefore, an organized screening program would not only help Brazil reach the WHO goals for cervical cancer eradication, but also more consistent, reliable and effective screening. Organized screening has been successfully implemented by some municipalities, and demonstrated high volume, increased screening uptake from 54.6% to 71%, early stage diagnosis of cervical cancer with 89.4% at stages 0 or I, and 98% of women attending recall for colposcopy.[45] While organizational barriers have prevented scaling up organized screening, inclusion of patients as key players in screening via self-sampling and self-imaging can help overcome such challenges, especially in remote regions.

Conclusion and Future Directions

The present study revealed not only a high demand for self-screening methods that promote greater accessibility, comfort, and autonomy, but also adequate knowledge, attitude and practices related to cervical cancer screening and diagnosis. Hence, the study population, albeit higher education and social class than Brazil's population, has the basis for an effective self-screening program for cervical cancer, which could benefit women with limited adherence to Pap smears, those who undergo excessive screening, and those who seek greater autonomy, comfort and accessibility. Statistical analyses revealed that KAP and self-screening acceptance are predicted by social class, geographic location and history of premalignant lesions in multiple regressions. This understanding can better equip policymakers and researchers to design effective, women-empowering, and cost-saving strategies to enable Brazil to reach goals proposed by the WHO for cervical cancer elimination.

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Supplemental Material

Supplemental material for this article is available online.

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