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Knowledge and Acceptability of Human Papillomavirus Vaccination and Cervical Cancer Screening among Women in Karnataka, India

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Abstract Cervical cancer is the leading cause of cancer-related mortality among women in India; however, participation in prevention and screening is low and the reasons for this are not well understood. In a cross-sectional survey in August 2008, 202 healthy women in Karnataka, India completed a questionnaire regarding knowledge, attitudes, and practices related to human papillomavirus (HPV) and cervical cancer. Factors associated with vaccination and Papanicolau (Pap) smear screening acceptance were explored. Thirty-six percent of women had heard of HPV while 15 % had heard of cervical cancer. Five percent of women reported ever having a Pap smear, and 4 % of women felt at risk of HPV infection. Forty-six percent of women were accepting of vaccination, but fewer (21 %) were willing to have a Pap smear. Overall, knowledge related to HPV and cervical cancer topics was low. Women with negative attitudes toward HPV infection were 5.3 (95 % confidence interval (CI) 2.8–10) times more likely to accept vaccination but were not significantly more likely to accept Pap smear (odds ratio 1.5, 95 % CI 0.7–3.0). Cost and a low level of perceived risk were the most frequent factors cited as potential barriers. Improving awareness of HPV and cervical cancer through health care providers in addition to increasing access to vaccination and screening through government-sponsored programs may be feasible and effective methods to reduce cervical cancer burden in India.

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Introduction

Cervical cancer is the leading cause of cancer-related mortality among women in India [1]. In 2012, there were an estimated 122,000 cases of and 67,000 deaths from cervical cancer in India, which accounts for almost one-quarter of all cases and deaths worldwide [2, 3]. It is well documented that essentially all cases of cervical cancer are associated with infection with human papillomavirus (HPV). An estimated 7 % of women in India are infected with HPV [4]. Use of Papanicolau (Pap) smear screening and HPV vaccination are believed to significantly reduce the burden of cervical cancer [5, 6]. Unfortunately, in low and middle income countries such as India, these preventive strategies have not yet been universally implemented, and additional information on feasibility of scaling up these prevention efforts is needed.

The HPV vaccines available cover two of the most common oncogenic strains of the virus, HPV 16 and 18, which together are responsible for the majority of all invasive cervical cancer cases worldwide [7]. A study among female adolescents suggests that HPV 16 and 18 are also the most prevalent oncogenic strains in India [8]. Prior to the availability of HPV vaccination, cervical cancer screening using the Pap smear was the principal option for reducing cancer burden, and reductions in cervical cancer incidence and mortality have been attributed to increased uptake of Pap smear screening [6, 9]. More recently in India, visual inspection with acetic acid has started to gain ground as an efficacious method to reduce cervical cancer mortality in India [10]. We specifically focus on Pap smears in this study as this was the primary method of screening offered at the time that the study was conducted. Modeling of the impact of combined vaccination

and screening in India found that these strategies could be effective in reducing cancer burden by as much as 63 % and could prove to be a cost-effective health strategy for the country as a whole [11].

This study focuses on the Indian state of Karnataka which is the ninth most populous state with a population of approximately 61 million, 61 % of whom live in rural areas [12]. The literacy rate in rural populations is estimated at 69 % compared to 85 % in urban areas [12]. The health care system in India is dichotomous due to the increasing economic disparities between rich and poor, rapid urbanization, and the rural-urban divide in health care systems [13]. Cervical cancer mortality rates (age-standardized) in Karnataka (16.5 per 100,000) are very similar compared to India overall (16.0 per 100,000) [1]. There is very limited information on sexual behavior and prevalence of HPV and other sexually transmitted diseases among adolescents and young women in our setting. In one cross-sectional study, the prevalence of sexual activity was found to occur in 5.5 % of adolescents aged 15–19 years [14]. In another study of 890 women aged 20–70 years, the incidence of HPV infection was 11.7 % [15]. The purpose of this study is to assess the knowledge, acceptability, attitudes, and feasibility concerning HPV and cervical cancer among adult women in Dakshina Kannada district of the southern state of Karnataka, India.

Methods

The study was approved by the Wake Forest School of Medicine Institutional Review Board and the ethics committee of the K.S. Hedge Medical Academy (KSHEMA). Participants were selected by convenience sampling from family practice and obstetrics and gynecology clinics as well as from postnatal wards within the hospital at KSHEMA in Deralakatte, Karnataka, India between June and August 2008. All women between the ages of 18 and 44 were eligible for inclusion. Women who had previously had an abnormal pap or cervical cancer were not specifically excluded. Participants who were enrolled gave their informed consent and completed a 92-item questionnaire concerning HPV and cervical cancer-related topics. Women responded with either "agree/yes," "disagree/no," or "I do not know" to all of the questions asked, except where otherwise specified.

The first section of the survey collected demographic information. The second section explored the participant's knowledge regarding HPV-related topics. The third and fourth sections of the questionnaire investigated the attitudes and concerns that participants had toward the idea of HPV and HPV vaccination. The final section examined the feasibility of vaccine or screening implementation. Survey questions were selected based on a literature review of similar studies that included measurements of interest. The initial questions selected were first pilot tested in English. Adjustments were made to the questionnaire and then translated in the local language, Kannada. This version was again pilot tested for appropriateness and understanding among 20 randomly chosen women in Karnataka, and minor changes were made to facilitate better comprehension of the survey prior to implementation.

Statistical analysis was conducted using STATA 9.2 (StataCorp, College Station, TX, USA). Statistical comparisons were calculated using chi-square test for categorical variables. Knowledge and attitude factors were investigated for correlation with two primary outcomes using logistic regression to calculate unadjusted odds ratios (OR). The first outcome was willingness to accept HPV vaccination, which was based on response to the question, "If the HPV vaccine was available in India, would you accept using it on yourself?" The second outcome was willingness to accept Pap smear based on response to the question, "Would you get a Pap smear to screen for cervical cancer?" Women who responded "yes" were compared with those who responded "no" or "I do not know". *P* values of less than 0.05 were considered statistically significant.

Results

Sociodemographic Characteristics of Participants (Table 1)

Of the 225 women approached, 202 (90 %) women completed the survey. The age of participants ranged from 18 to 44 years with the most common age group (42 %) between 25 and 29 years old. A little more than half of the population (56 %) lived in Mangalore city, while the remainder was from rural areas outside of Mangalore. The majority were Hindus (90 %) and married (90 %) with children (68 %). There was a diverse range of educational backgrounds with one-fifth having completed primary school, 47 % completing secondary school, and 31 % with a bachelor's level degree or higher. Most women (73 %) were working as a housewife. None of the demographic variables were significantly associated with willingness to accept HPV vaccination. Women willing to accept Pap smear were significantly more likely to have children (*p* value 0.029); otherwise, no other demographic factors were related to Pap smear acceptance.

Knowledge Regarding HPV and Cervical Cancer (Table 2)

Overall cervical cancer and HPV knowledge was low. Fifteen percent of women reported that they knew what cervical cancer is, and 36 % had heard of HPV, with over

Table 1 Demographics among 202 women participating in HPV and cervical cancer survey in Karnataka, India

	Acceptance of HPV vaccine[a] (*N*=200)							Acceptance of Pap smear[b] (*N*=199)				
			Unwilling (*N*=109)		Willing (*N*=91)			Unwilling (*N*=157)		Willing (*N*=42)		
	Total (*N*)	%	*N*	%	*N*	%	*p* value[c]	*N*	%	*N*	%	*p* value[c]
Age (*N*=200)												
Under 21 years	19	10	12	11	7	8		16	10	3	7	
21 to 24 years	38	19	18	17	19	21		25	16	12	29	
25 to 29 years	83	42	47	43	36	40		71	46	12	29	
30 years and older	60	30	32	29	27	30	0.749	44	28	14	34	0.125
Location (*N*=200)												
Urban (Mangalore)	112	56	63	58	49	54		87	56	24	59	
Rural (other)	88	44	45	42	41	46	0.583	69	44	17	41	0.751
Religion (*N*=201)												
Hindu	180	90	98	90	81	90		143	91	35	83	
Other	21	10	11	10	9	10	0.983	14	9	7	17	0.147
Marital status (*N*=202)												
Yes	182	90	98	90	82	90		140	89	39	93	
No	20	10	11	10	9	10	0.962	17	11	3	7	0.480
Married age (*N*=179 of 182 married women)												
<21	38	21	18	19	19	23		23	17	13	33	
21 to <25 years old	73	41	39	41	34	41		58	42	15	38	
≥25 years old	68	38	38	40	29	35	0.731	56	41	11	28	0.065
Children (*N*=182 of 182 married women)												
Yes	124	68	69	70	53	65		89	64	32	82	
No	58	32	29	30	29	35	0.409	51	36	7	18	0.029
Number of children (*N*=120 of 124 women with children)												
1	70	58	43	64	25	49		51	59	18	60	
2	41	34	19	28	22	43		32	37	8	27	
3	9	8	5	7	4	8	0.225	4	5	4	13	0.206
Education (*N*=202)												
Elementary	45	22	23	21	21	23		32	20	11	26	
High school	95	47	59	54	36	40		77	49	17	40	
Advanced degree	62	31	27	25	34	37	0.087	48	31	14	33	0.573
Occupation (*N*=198)												
Housewife	144	73	77	73	65	72		111	73	30	71	
Other	54	27	29	27	25	28	0.948	42	27	12	29	0.886
Monthly household income[d] (*N*=162)												
<40	16	10	8	10	8	10		11	9	5	14	
40 to <80	49	30	28	34	21	27		36	30	11	30	
80 to <120	38	23	17	20	20	26		28	23	9	24	
>120	59	36	30	36	29	37	0.776	47	39	12	32	0.831

[a] Among women who responded to "If the HPV vaccine was available in India, would you accept using it on yourself?"

[b] Among women who responded to "Would you get a Pap smear to screen for cervical cancer?"

[c] Chi-square test

[d] In US dollars

half (51 %) of those being informed through the media (television, magazine, or radio) and 30 % informed by a doctor. Twenty-eight percent recognized HPV as a cause of cervical cancer.

Table 2 Knowledge of HPV and cervical cancer topics among 202 women participating in HPV Survey

Question	Yes (*N*)	Percent
I have a cervix (*N*=198)	99	50
I know what cervical cancer is (*N*=197)	30	15
I know someone with cervical cancer or genital warts (*N*=200)	17	9
I have heard of what the human papillomavirus (HPV) is (*N*=196)	71	36
If you agreed with the question above, where have you heard of HPV before? (*N*=70 of 71 "yes" responses)		
Doctor	21	30
TV	18	26
Magazine	14	20
Multiple	9	13
Radio	4	6
Parents	3	4
Other	1	1
Cervical cancer is caused by the human papillomavirus (*N*=199)	55	28
HPV is a sexually transmitted infection (*N*=200)	100	50
HPV is a virus (*N*=188)	103	55
HPV transmission can be blocked by condoms (*N*=197)	119	60
People usually have symptoms when they are infected with HPV (*N*=199)	94	47
The chance of getting cervical cancer increases when a person has multiple sexual partners (*N*=201)	67	33
HPV can cause cancer in men (*N*=196)	50	26
I know what the Papanicolaou test (Pap smear) is (*N*=197)	14	7
Abnormal Pap smear results can mean an HPV infection (*N*=187)	41	22
Pap smears look for changes on the cervix that can lead to cervical cancer (*N*=193)	65	34
Most types of HPV infection can clear up on their own (*N*=196)	18	9
Cervical cancer is preventable (*N*=195)	96	49
Cervical cancer is treatable (*N*=197)	113	57
There is a vaccine against the common HPV types that cause genital warts and cervical cancer (*N*=202)	52	26

There was a moderate understanding of cervical cancer risk factors and symptoms. Half of participants identified that HPV can be transmitted sexually; 60 % recognized that HPV can be prevented by condoms; and one-third agreed that cervical cancer risk increases with multiple sexual partners. Approximately, half of the women recognized that cervical cancer is preventable (49 %) and treatable (57 %). The lowest level of knowledge was related to cervical cancer screening with only 7 % reporting that they knew what a Pap smear is, compared with 26 % of the population who were aware of a vaccine for HPV.

Despite gaps in knowledge, 57 % of participants were interested in receiving more information regarding HPV, genital warts, and cervical cancer (data not shown), and 76 % of women found it acceptable to have a government campaign to increase awareness regarding these topics. The most preferred method for receiving information was through a doctor (78 %) with considerably fewer preferring the media (16 %) or internet (4 %).

Attitudes Related to HPV, Cervical Cancer, and Vaccination (Table 3)

Perceived risk of contracting HPV was low (4 %) and was associated with willingness to accept HPV vaccination (OR 8.7, 95 % CI 1.0–72). Sixty-three percent of women reported at least one negative attitude toward HPV infection. A little more than half of participants (52 %) believed that a woman should be evaluated for cervical cancer throughout her life, and 69 % felt that a doctor should evaluate a woman for cervical cancer; however, only 21 % of women were willing to get a Pap smear.

The majority of HPV and cervical cancer-related beliefs were significantly associated with acceptance of HPV vaccination but were not significantly associated with acceptance of Pap smears. The one notable exception to Pap smear acceptance was the belief that a doctor should evaluate a woman for cervical cancer in which women who agreed had over five times the odds of accepting Pap smear screening (OR=5.7, 95 % CI 1.9–17).

Although most women were amenable to vaccinations for their children (62 %) and believed that vaccines are effective (66 %), few were interested in using vaccines (15 %). Roughly, half of surveyed women reported that they would use a vaccine against HPV if it were available in India (46 %); however, the percent of women who were interested in vaccination dropped to 12 % at a proposed cost of $360 USD for the vaccine series. Acceptance of the HPV vaccine among women did not differ according to age of administration, but acceptance of HPV vaccination for men (26 %) was lower than for women. Perceived stigma related to HPV vaccination was also low, specifically with little concern that HPV vaccination would lead to increased premarital sexual activity (12 %).

Among women who accepted HPV vaccination, the greatest concern was the cost (39 %, data not shown), followed by the concern that the vaccine is not applicable (23 %), ineffective (13 %), or would have side effects (8 %). The largest concerns for women refusing the HPV vaccine were that it is not applicable to them (42 %), that it would be ineffective (19 %), that it may have side effects (15 %), or that they do not take vaccines in general (12 %).

Table 3 Attitudes related to HPV, cervical cancer, and vaccination among 202 women participating in HPV survey

HPV-related questions	Agree/yes		Acceptance of HPV vaccine		Acceptance of Pap smear	
	N	%	Unadjusted OR (95 % CI)		Unadjusted OR (95 % CI)	
Do you think you are at risk of contracting the HPV? (*N*=198)	8	4	8.7	(1.0–72)	3.9	(0.9–16)
If you had a daughter would you be worried that she might get an HPV infection? (*N*=198)	14	7	2.3	(0.7–7.1)	1.0	(0.2–3.9)
Do you think people would think badly of you if you had an HPV infection? (*N*=201)	72	36	3.7	(2.0–6.7)	1.6	(0.8–3.1)
Do you think people would think you were unclean if you had an HPV infection? (*N*=202)	56	28	3.2	(1.7–6.2)	1.2	(0.6–2.6)
Do you think people would be uncomfortable with you if you had an HPV infection? (*N*=199)	65	33	4.7	(2.5–8.8)	1.8	(0.9–3.6)
Do you think your husband/partner would want to have sex with you if you had an HPV infection? (*N*=198)	56	28	2.6	(1.4–4.9)	1.2	(0.6–2.5)
Would you feel ashamed, embarrassed, guilty, scared, angry, or anxious if you had an HPV infection? (*N*=202)	127	63	5.3	(2.8–10)	1.5	(0.7–3.0)
Cervical cancer-related questions						
If you had a daughter would you be worried that she might get cervical cancer? (*N*=199)	13	7	1.9	(0.6–6.2)	1.1	(0.3–4.2)
Would you get a Pap smear to screen for cervical cancer? (*N*=199)	42	21	5.2	(2.4–11)	referent question	
Should a woman be evaluated for cervical cancer throughout her life? (*N*=201)	105	52	2.4	(1.3–4.2)	2.1	(1.0–4.3)
Should a doctor evaluate a woman for cervical cancer? (*N*=200)	137	69	3.6	(1.8–6.9)	5.7	(1.9–17)
Vaccine-related questions						
Would you use vaccines in general? (*N*=199)	30	15	3.3	(1.4–7.7)	3.9	(1.7–9.0)
Would you use a vaccine on your children in general? (*N*=192)	119	62	3.5	(1.9–6.5)	5.0	(2.0–13)
In general vaccines are effective against infections. (*N*=194)	129	66	4.9	(2.5–9.8)	4.7	(1.8–13)
I believe that this anti-HPV vaccine would be effective. (*N*=200)	75	38	2.9	(1.6–5.2)	2.4	(1.2–4.8)
Is it acceptable to have a vaccine against a sexually transmitted infection? (*N*=201)	63	31	4.7	(2.4–9.0)	2.8	(1.4–5.7)
If the HPV vaccine was available in India, would you accept using it on yourself? (*N*=200)	91	46	referent question		5.2	(2.4–11)
If the HPV vaccine was available in India would you accept its use in all girls between 9 and 14? (*N*=200)	61	31	7.1	(3.5–14)	4.9	(2.4–10)
If the HPV vaccine was available in India would you accept its use in all girls between 15 and 20? (*N*=197)	63	32	10.4	(5.0–22)	5.3	(2.5–11)
If the HPV vaccine was available in India would you accept its use in all women 20 and above? (*N*=198)	65	33	7.3	(3.7–14)	3.5	(1.7–7.2)
If the HPV vaccine was available in India would you accept its use in men? (*N*=198)	52	26	6.5	(3.1–13)	2.7	(1.3–5.5)
The HPV vaccine is given in three doses which costs a total of $360 US. Would you still take the vaccine? (*N*=200)	24	12	2.6	(1.1–6.5)	2.0	(0.8–5.2)
Would you worry that those women receiving the HPV vaccine would engage in premarital sexual intercourse? (*N*=202)	25	12	2.9	(1.2–7.1)	1.5	(0.6–4.0)
Would you worry that receiving the HPV vaccine would make others think women were sexually active when they are not? (*N*=201)	23	11	1.7	(0.7–4.0)	3.0	(1.2–7.6)

Health Seeking Practices and Perceived Barriers to Vaccination (Table 4)

The final section of the questionnaire evaluated potential barriers to screening and vaccination with respect to general health seeking practices. Approximately one-third (31 %) of the population reported that they have health insurance while nearly two-thirds (60 %) have to pay for medical visits. Only one-quarter of the population (27 %) reported that they can always afford to go to the doctor. Eighty-two percent of women have transportation to the doctor; however, 54 % reported that transportation is expensive or that the doctor's office is far (57 %). The majority reported that they see a doctor regularly (69 %). Most women feel that they can talk to their doctor about anything (61 %), and 44 % reported that they talk to their doctor about sexual health. Nevertheless, only 9 % reported that their doctor performs a yearly Pap smear and an even smaller percentage (5 %) reported ever having a Pap smear.

Discussion

This survey examined knowledge and attitudes toward HPV vaccination and cervical cancer screening, two important public health interventions which have potential to greatly reduce cervical cancer morbidity and mortality in India [3]. Almost half of women surveyed were willing to accept HPV vaccination if it were available. Another half agreed that a woman should be evaluated for cervical cancer throughout her life; however, only one-fifth of women were willing to get a Pap smear and 5 % reported ever having a Pap smear. Low knowledge of HPV and cervical cancer, low perceived risk of infection, and infrequent discussions about HPV with health care providers may be in part responsible for the low uptake of Pap smear screening and present potential barriers to uptake of HPV vaccination.

Table 4 Health seeking practices and potential barriers to cervical cancer screening and HPV vaccination among 202 women completing HPV survey

Question	Yes (*N*)	Percent
Do you have health insurance? (*N*=198)	62	31
Do you have to pay for medical visits, tests, or procedures? (*N*=201)	121	60
Can you always afford to go to the doctor? (*N*=200)	53	27
Can you afford to pay for a Pap smear? (*N*=200)	43	22
Do you see a doctor regularly and/or yearly checkups? (*N*=197)	136	69
Do you see a doctor only when you think you are very sick? (*N*=202)	164	81
Do you have transport to see the doctor? (*N*=202)	165	82
Is the transport expensive? (*N*=197)	106	54
The doctor's office is far. (*N*=200)	113	57
I feel that I can talk to the doctor about everything. (*N*=200)	121	61
Do you talk to your doctor about your sexual health? (*N*=202)	88	44
Does your doctor perform a yearly Pap smear? (*N*=201)	19	9
Do you worry about what your doctor might think of you if you ask for a Pap smear? (*N*=200)	46	23
Have you had a Pap smear before? (*N*=198)	10	5

The first barrier identified was the low level of HPV- and cervical cancer-related knowledge. Other surveys of women across other regions of India have shown similar findings. Awareness about cancer screening in general (not specific to cervical cancer) among women in Mumbai was estimated at 35 %; whereas only 7 % of women in our survey were aware of Pap smears for cervical cancer [16]. This may suggest that knowledge of cervical cancer is low even in comparison with other types of cancer. Another study in Mumbai among married couples found that 38 % of women were aware of cervical cancer, and among those aware of cervical cancer, only 10 % were aware of Pap testing [17]. Other estimates of Pap smear awareness have ranged from 11 % among a population of female college students in Kolkata [18] to 16 % among a group of older women [19]. Knowledge of the term HPV in our population (36 %) was higher than that of the Kolkata college student population (15 %) but lower than that found among college students from Delhi and Mangalore (49 %) [20]. Low levels of cervical cancer-related knowledge were also reported among parents of adolescent girls in Mysore [21] and among a group of healthy patients attending a gynecology clinic in Kolkata [22].

In addition to low knowledge, the level of perceived risk of HPV infection was extraordinarily low, despite estimates that 7.5 % of women in India are currently infected with HPV [4]. Perceived risk of infection was strongly associated with HPV vaccination acceptance. This finding should be interpreted with caution given the wide confidence interval; however, this finding would not be unprecedented. A survey in Eastern India examining women who opted-out of cervical cancer screening found that the most common reason cited for non-participation was that the test was unnecessary in light of a lack of symptoms [23]. Similarly, Shekhar, et al. demonstrated that among 239 nurses surveyed in rural India, 93 % had never been screened for cervical cancer, and 90 % of the reasons cited for not being screened were "no reason," "not feeling at risk," and "lack of symptoms" [24]. Raising awareness of infection risk may consequently be an important step in expanding screening and vaccination programs.

The third potential barrier identified was a lack of discussion about HPV and cervical cancer between patients and health care providers. In this survey fewer than half of women reported that they discuss sexual health with their doctor. This

is consistent with the finding that most women had heard of HPV through the media rather than through her doctor and contrasts with the finding that 78 % of women who wanted to learn more about HPV would prefer to hear it from her doctor. One survey of parents in Kolkata found that 60 % of mothers who agreed to vaccinate her daughter cited that a doctor's recommendation was the most important reason for vaccine acceptance [25]. Another survey in Mysore found that parents were significantly more willing to accept HPV vaccination for their daughter if it were recommended by a doctor [26]. Taken together with the fact that 70 % of women reported seeing her doctor regularly along with the low level of HPV-related knowledge, it suggests that spreading awareness of cervical cancer screening and HPV vaccination by health care providers is currently a missed opportunity in India.

In considering strategies for scaling up HPV vaccination and cervical cancer screening, apart from the potential role for health care providers, our findings suggest that a government-sponsored immunization program would be feasible. While government-led vaccination programs have seen variable success in other countries [27, 28], government-sponsored immunization campaigns in India have enjoyed a relatively higher approval among the public. Findings from focus groups in two separate surveys investigating HPV acceptance in India found a positive attitude toward the government universal immunization program in general [21, 29].

The HPV vaccine acceptance rate of 46 % was relatively high considering that perceived risk of HPV infection was nearly nonexistent and that only 15 % of women reported that they would use vaccines for themselves in general. While there appeared to be no preference for targeting vaccination toward any particular age group (9 to 14 vs 15 to 20 vs over 20), overall acceptance of vaccination for these ages was only in the 31–33 % range. These rates are considerably lower than 71 % acceptance by parents in Mysore reported by Madhivanan et al. [26]. They are also lower than actual vaccine coverage rates reported from vaccine delivery pilot projects in Andhra Pradesh and Gujarat which demonstrated a relatively high uptake (77–88 %) of HPV vaccination among girls ages 10 to 14 [30]. Whether the lower acceptance rates reported in our survey are related to low levels of knowledge and perceived risk as described above merits further investigation. One survey among parents in Kolkata found that HPV vaccination approval for their daughters rose from 26 % initially to 74 % after providing a simple, educational fact sheet regarding cervical cancer and HPV [25].

There are a number of limitations of this survey. Participants were selected based on convenience sampling rather than random sampling, which could introduce selection bias. The participants were selected from a clinic population and so may overestimate accessibility to health care compared with the general population of India. The study population's low knowledge of cervical cancer is a limitation as it calls into question the validity of responses to other sections of the questionnaire. Attitudes may therefore be expected to change accordingly over time as knowledge of the subject matter changes. Another limitation is that the study population only partially included the target ages for the vaccine (11–26 years). This study was conducted prior to formal recommendations in India for the HPV vaccine, and therefore, a broad demographic of adult women was selected. It is relevant to note, however, that women over 26 years of age did not differ significantly from ages 26 and younger in their acceptance of HPV vaccination (data not shown). Additionally, not all potential barriers could be anticipated, and therefore, some barriers may not have been identified through the use of a closed-ended questionnaire. Therefore, addressing the issues outlined above may not be sufficient to guarantee increased vaccination or screening uptake.

Conclusion

Current uptake of cervical cancer screening among this population of South Indian women is low. Our findings suggest that low knowledge of HPV and cervical cancer, low perceived risk of infection, and infrequent discussions about HPV with health care providers may be in part responsible for this low uptake. Despite these findings, there was a moderate level of approval for HPV vaccination. These results will be potentially useful in designing information, education, and communication materials for adolescent girls and women who attend primary care clinics in South India. Given the high burden of cervical cancer among women in India and the current low level of screening or vaccination, there is an urgent need to raise awareness of HPV infection risk and cervical cancer and improve uptake of prevention methods to reduce cervical cancer morbidity and mortality.

Author's Contribution MPM conducted data analysis, literature review, and drafting of the manuscript. TD contributed to the study design, implementation, and data collection, and edited the manuscript draft. PKS contributed to the study design and implementation, and edited the manuscript draft. AKS supervised the research design and implementation, and provided input on the data analysis and drafting of the manuscript. All authors have read and approved the final article.

Conflicts of Interest The authors declare that they have no conflict of interest.

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