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The impact of education intervention on awareness of cervical cancer and barriers to HPV vaccination among Saudi pregnant women

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ABSTRACT

Background: Cervical cancer is one of the leading killers of women worldwide despite the availability of screening programs and preventive HPV vaccination. Education intervention could help ease the burden of cervical cancer and associated morbidity and mortality. We evaluated the impact of an education intervention on awareness of cervical cancer, risk factors and presentation, screening, and perceived barriers to HPV vaccination among Saudi pregnant women. *Methods:* We conducted a comparative study pre- and post-education of 18-45 years old pregnant women. Descriptive analysis was performed, and the Chi-Square test was used to compare post-and pre-education knowledge and awareness levels with $p< 0.05$ for statistical significance. *Results:* We enrolled 400 participants, and most (39.3%) were 41 – 45 years old, 69.5% had a university degree, 52%) were unemployed, and 40.8%were non-health field workers. After the education session, the awareness and knowledge improved significantly as evidenced by a 2-4 and 1.6-3 times increase in awareness about cervical cancer risk factors ($p=0.000$), and symptoms ($p=0.000$), respectively, 1.5-3 times increase in awareness of Pap smear ($p=0.000$), and 2-3 times increased awareness of HPV vaccination and ($p<0.005$). Post-education evaluation also revealed a significant reduction in fear of HPV vaccine side-effects ($p=0.000$) and an increase in a good attitude towards vaccination cost ($p=0.005$) and effectiveness ($p=0.003$), which were among perceived barriers. *Conclusion:* Our study findings showed that educational intervention significantly improved awareness and knowledge of cervical cancer, its screening and reduced barriers to the HPV vaccination. The establishments of broader education programs, as well as screening, are recommended.

Keywords: Education intervention, cervical cancer, HPV vaccination, barriers, awareness

1. INTRODUCTION

Cervical cancer is one of the most common cancers diagnosed in females (Alghamd & Hobani, 2022; Sabr et al., 2021; Martel et al., 2017; Mishra et al., 2011), affecting more than half a million annually worldwide (Mishra et al., 2011). It is the fourth most prevalent cancer in women and the fourth cause of cancer mortality (Arbyn et al., 2020; Martel et al., 2017). In 2009, The World Health Organization (WHO) reported that in North Africa and the Middle East, cervical cancer prevalence was 19,500 women per year, causing almost 10 thousand deaths annually. By 2035, the number of fatalities was expected to double in these regions unless effective public health interventions were introduced (Alsous et al., 2021). In Saudi Arabia, cervical cancer ranked the ninth common canceramong women aged 15-44 years (Anfinan, 2019).

Vaccines remain the most effective preventive measures for long-term infectious diseases. The United States Center for Disease Control (CDC) recommends the HPV vaccine for women aged 11 and 12 years old and up to 26 years old if not adequately vaccinated before (Poirier et al., 2021). Currently, there are several HPV vaccines available in Saudi Arabia, including a bivalent vaccine (Cervarix) and a quadrivalent vaccine (Gardasil) (Poirier et al., 2021; Hussain et al., 2016). Early detection through regular screening helps identify and treat the precancerous lesions, thus preventing cervical carcinoma progression (Mishra et al., 2011). Studies found that women living in countries with cervical cancer screening programs are at lower risks ofcervical cancer or dyingfrom it (Karafillakis et al., 2019). Previous studies have identified a lack of knowledge or awareness, negative perceptions of the cervical screening test as the main barriers to screening and stronger relationships with healthcare providers, social norms, support from family as facilitators (Kirubarajan et al., 2021).

A study involving female nursing students in Saudi Arabia to determine the impact of an educational program on cervical cancer early detection and screening showed a significant improvement in knowledge of cervical cancer causes, risk factors, prevention, and screening post-educational intervention (Fathey A. Eittah et al., 2020). Another study compared high school girls who participated in the health education intervention to girls in a control group and found that knowledge of cervical cancer was higher in the intervention group than in the control group (Poirier et al., 2021), indicating that education intervention increases knowledge of cervical cancer similar to findings other studies (Abd et al., 2018; Curry et al., 2018).

In developed countries, cervical cancer screening programs have reduced the incidence of invasive lesions up to 80%. There is no cervical cancer screening program in Saudi Arabia, and random tests are only available to women attending health services (Alnafisah et al., 2019). Therefore, it is important to raise awareness through educational programs on cervical cancer prevention, preventable risk factors, early diagnosis benefits, and the establishment of screening facilities. Therefore, this study explored the impact of education interventions on awareness of cervical cancer, screening and perceived barriers to HPV vaccination among Saudi pregnant women. The results could help orient future education programs on prevention and the establishment of screening facilities that benefit all Saudi women in general.

2. METHODS

Study design

A comparative study was conducted pre- and post-education by a healthcare professional on pregnant women on cervical cancer, HPV vaccination and screening at 4 antenatal care clinics in Riyadh (Alwazart, AlYasmeen, Alsalam, Alorija), from 23 May 2022 to 23 June 2022. All pregnant women aged 18-45 years visiting antenatal care clinic for Gestational diabetes mellitus (GDM) screening by Oral Glucose Tolerance Test (OGTT) were enrolled. We targeted these pregnant women because they wait for about 2 to 3 hours for OGTT, and this waiting time would allow us to educate them and measure the effect of education before and after the education session

Sampling

Eligible women were assigned random numbers generated using Microsoft Excel random number (RAND) function. The questionnaires were distributed to 438pregnant women, and 400 completed responses were considered for the data analysis.

Data collection tool

A self-administered close-ended questionnaire consisting of 47 questions was used for data collection. It was a pre-designed and validated questionnaire used in another similar study (Al-Shaikh et al., 2014). It included 4 sections: the first section comprised socio-demographic data such as age, level of education, job, and monthly income. The second section included 27 items for to evaluate knowledge about risk factors and symptoms of cervical cancer. Respondents had to choose from“Yes, No and don’t

know". The third section assessed the respondents' awareness of the Pap smear. In the fourth section, participants had to respond to questions assessing perception of safety, efficacy, and acceptance of HPV vaccination in a 5-point Likert scale format from 1= strongly disagree to 5 = strongly agree.

Although the vaccination services at PHCs are free of charge, we asked about the acceptable vaccine cost to have an idea about this factor in the community. The questionnaire was initially prepared in English and translated into Arabic by 2 experts. The questionnaire was pilot-studied on15 pregnant women to check the language clarity and reliability of the questions and understandability. The internal consistency of the study questionnaire was assessed by applying Cronbach's alpha reliability coefficient. The questionnaire was slightly amended to reflect the outcomes of the pilot trial, and collected data within the pilot study were excluded in the main study.

Data collection procedure

Data collection took around one month, targeting 20 to 25 pregnant women daily in a 2-hour session. Each education session was conducted by health care professional and presented as a lecture. We used unified power point slides in the lecture containing the education materials to ensure teaching the same knowledge in each session, and then the session ended by open discussion to answer the attended queries. After obtaining the necessary approvals from concerned authorities, the principal investigators gave the eligible women all the information about the study and its objectives then invited them to participate. The principal investigator distributed the questionnaire and collected answers before the women get educated by healthcare professional about cervical cancer, risk factors, preventive measures, and HPV vaccination for two hours. After the education session ended, the same questionnaire was distributed again to measure the impact post-intervention.

Data analysis

The collected data were cleaned, entered and analyzed using Statistical Package for the Social Sciences (SPSS) software version 23. Descriptive statistics were performed for each item and for all demographic variables. For Yes or No responses, correct answers were given 1, wrong answers, and "don't know" answers were given 0, respectively. The sum of questions with correct responses was divided by the total number of questions, ranging from 0 to 100%. The scores were divided into quartiles, and the lowest quartile (fewer correct answers) was compared to the higher quartile (more correct answers). Means with standard deviations (±SD) for continuous variables and proportions for discrete variables were utilized. The overall knowledge and perceived barriers were compared with the demographic variables, and the pre- and post-education intervention cervical cancer knowledge and awareness of screening were also compared using Pearson's chi-square test. A p-value<0.05 was considered significant.

3. RESULTS

Of 400 participants in this study, themajority (39.3%), were aged 41 – 45 years, more than double the next 31-35 age group (17.8%). More than two-thirds (69.5%), had a University degree. More than a half (52%) was unemployed, followed by non-health field workers (40.8%). The majority of participants earned 1,000-5,000 SAR (Saudi Riyal) per month. More than two-thirds (68%) have heard of cervical cancer and 76.8 have heard of Pap smear (Table 1).

Table 1 Participants socio-demographic characteristic

Socio-demographic		n	%
Age (in Years)	18-20	17	4.3
	21-25	40	10.0
	26-30	54	13.5
	31-35	71	17.8
	36-40	61	15.3
	41-45	157	39.3
Education Level	University	278	69.5
	High School	74	18.5
	Other	48	12.0
Job	Health field	28	7.0
	Non-health field	163	40.8
	Not working	209	52.3

Monthly Income	1-5 thousand SAR	186	46.5
	6-10 thousand SAR	100	25.0
	11-15 thousand SAR	72	18.0
	More than 15 thousand SAR	42	10.5
Cervical cancer history of friend or family members	Yes	69	17.3
	No	275	68.8
	I don't know	56	14.0
Have you ever heard of a Pap smear?	Yes	307	76.8
	No	93	23.3

After education intervention, the awareness of cervical cancer and its risk factors improved significantly (Table 2). The women who believed cervical cancer might be prevented increased from 202 (36.6%) pre-education to 63.4% post-education (p=0.000). Post-education survey compared to pre-education showed that awareness of risk factors, such as perianal warts, contraceptive pills, Human Immuno-deficiency virus (HIV) infection, smoking and elderly increased significantly from 19.6% to 80.4% (p=0.000), from 27% to 73% (p=0.000), from 32.5% to 67.5% (p=0.000), from 34.1% to 65.9% (p=0.000), and from 32.6% to 67.4% (p=0.000), respectively.

Table 2 Impact of education intervention on awareness of cervical cancer and the risk factors

		Intervention		Chi-square (P-value)
		Pre-education	Post-education	
What is most common cancer among women in Saudi Arabia?	Cervical cancer	32$_a$	0$_b$	0.000
		100.0%	0.0%	
	Colon cancer	3$_a$	0$_a$	
		100.0%	0.0%	
	Lung cancer	2$_a$	1$_a$	
		66.7%	33.3%	
	Breast cancer	287$_a$	265$_a$	
		52.0%	48.0%	
	Ovarian cancer	1$_a$	2$_a$	
		33.3%	66.7%	
	Uterine cancer	30$_a$	115$_b$	
		20.7%	79.3%	
	I don't know	45$_a$	17$_b$	
		72.6%	27.4%	
Has any of your family members or friends had cervical cancer?	Yes	69	0	-
		17.3%	0.0%	
	No	275	0	
		68.8%	0.0%	
	I don't know	56	0	
		14.0%	0.0%	
Can cervical cancer be Prevented?	Yes	202$_a$	350$_b$	0.000
		36.6%	63.4%	
	No	4$_a$	6$_a$	
		40.0%	60.0%	
	I don't know	194$_a$	43$_b$	
		81.9%	18.1%	
Perianal warts	Yes	71$_a$	291$_b$	0.000

		19.6%	80.4%	
	No	29a	46b	
		38.7%	61.3%	
	I don't know	300a	63b	
		82.6%	17.4%	
Contraceptive Pills	Yes	120a	324b	0.000
		27.0%	73.0%	
	No	71a	33b	
		68.3%	31.7%	
	I don't know	209a	43b	
		82.9%	17.1%	
The human immunodeficiency virus (HIV)	Yes	151a	314b	0.000
		32.5%	67.5%	
	No	12a	29b	
		29.3%	70.7%	
	I don't know	237a	57b	
		80.6%	19.4%	
Smoking	Yes	175a	338b	0.000
		34.1%	65.9%	
	No	45a	21b	
		68.2%	31.8%	
	I don't know	180a	41b	
		81.4%	18.6%	
Obesity	Yes	96a	294b	0.000
		24.6%	75.4%	
	No	66a	50a	
		56.9%	43.1%	
	I don't know	238a	56b	
		81.0%	19.0%	
Human papillomavirus (HPV)	Yes	172a	345b	0.0000
		33.3%	66.7%	
	No	4a	10a	
		28.6%	71.4%	
	I don't know	224a	45b	
		83.3%	16.7%	
Sexually Transmitted Diseases	Yes	240a	351b	0.000
		40.6%	59.4%	
	No	11a	13a	
		45.8%	54.2%	
	I don't know	149a	36b	
		80.5%	19.5%	
Immunodeficiency diseases	Yes	201a	322b	0.000
		38.4%	61.6%	
	No	14a	23a	
		37.8%	62.2%	
	I don't know	185a	55b	
		77.1%	22.9%	
Elderly	Yes	140a	290b	0.000
		32.6%	67.4%	

	No	60a	49a
		55.0%	45.0%
	I don't know	200a	61b
		76.6%	23.4%

Highly significant if p-value < 0.01, Significant if p-value < 0.05, Non significant if p-value > 0.05. The different subscript letters (a, b) show that the proportion of pre- and post-education is significantly different at 5% level of significant.

After being educated, participants who were aware of cervical cancer symptoms significantly increased (Table 3). Those who knew that irregular bleeding, vaginal secretion, pain after intercourse, pelvic pain and weight loss were the symptoms increased from 39% to 61% (p=0.000), from 26.1% to 73.9% (p=0.000), from 30.5% to 69.5% (p=0.000), from 34% to 66% (p=0.000), and from 25.5% to 74.5% (p=0.000), respectively. In addition, those who knew that cervical cancer could be asymptomatic increased from 22.7% to 77.3% (p=0.000).

Table 3 Impact of education intervention on awareness of cervical cancer symptoms

		Intervention		Chi-square (P-value)
		Pre-education	Post-education	
Irregular vaginal bleeding	Yes	228a	356b	0.000
		39.0%	61.0%	
	No	15a	9a	
		62.5%	37.5%	
	I don't know	157a	35b	
		81.8%	18.2%	
Vaginal secretions	Yes	110a	311b	0.000
		26.1%	73.9%	
	No	79a	40b	
		66.4%	33.6%	
	I don't know	211a	49b	
		81.2%	18.8%	
Pain after intercourse	Yes	138a	315b	0.000
		30.5%	69.5%	
	No	31a	35a	
		47.0%	53.0%	
	I don't know	231a	50b	
		82.2%	17.8%	
Pelvic pain	Yes	169a	328b	0.000
		34.0%	66.0%	
	No	22a	19a	
		53.7%	46.3%	
	I don't know	209a	53b	
		79.8%	20.2%	
Weight loss	Yes	110a	321b	0.000
		25.5%	74.5%	
	No	59a	25b	
		70.2%	29.8%	
	I don't know	231a	54b	
		81.1%	18.9%	
Asymptomatic	Yes	53a	180b	0.000
		22.7%	77.3%	

	No	105a	133b
		44.1%	55.9%
	I don't know	242a	87b
		73.6%	26.4%

Highly significant if p-value < 0.01, Significant if p-value < 0.05, Non significant if p-value > 0.05. The different subscript letters (a, b) show that the proportion of pre- and post-education is significantly different at 5% level of significant.

The education intervention increased our study participants' knowledge and awareness of a Pap smear test compared to pre-education knowledge. Most women answered that a Pap smear is sensitive for early detection of cervical cancer, 333 (61.1%) vs. 212 (38.9%), that it doesn't cause pain when performed 279 (65.6% vs. 146 (34.4%), that it can't lead to serious complications, 317 (60.3%) vs. 209 (39.7%), that women should have pap smear test after 3 years of marriage, 286 (77.1%) vs. 85 (22.9%) and married women should get tested with the Pap smear every 3 years, 307 (67.3% vs. 149 (32.7%) (Table 4).

Table 4 Impact of education intervention on awareness of Pap smear test

		Intervention		Chi-square (P-value)
		Pre-education	Post-education	
Have you ever heard of a Pap smear?	Yes	307	0	-
		76.8%	0.0%	
	No	93	0	
		23.3%	0.0%	
Is the Pap smear accurate (sensitive) for early detection of Cervical cancer?	Yes	212a	333b	0.000
		38.9%	61.1%	
	No	22a	19a	
		53.7%	46.3%	
	I don't know	166a	48b	
		77.6%	22.4%	
Does the Pap smear cause pain for women when it is performed	Yes	79a	65a	0.000
		54.9%	45.1%	
	No	146a	279b	
		34.4%	65.6%	
	I don't know	175a	56b	
		75.8%	24.2%	
Is it enough to have a Pap smear once in a lifetime?	Yes	7a	38b	0.000
		15.6%	84.4%	
	No	241a	313b	
		43.5%	56.5%	
	I don't know	152a	49b	
		75.6%	24.4%	
Is a Pap smear can lead to serious complications?	Yes	12a	24b	0.000
		33.3%	66.7%	
	No	209a	317b	
		39.7%	60.3%	
	I don't know	179a	59b	
		75.2%	24.8%	
When should married women have a Pap smear?	3 years after marriage	85a	286b	0.000
		22.9%	77.1%	
	4-9 years after	23a	19a	

	marriage	54.8%	45.2%	
	10 years or more after marriage	48a	25b	
		65.8%	34.2%	
	I don't know	244a	70b	
		77.7%	22.3%	
What is the appropriate rate for a Pap smear for married women?	Once every 3 years	149a	307b	0.000
		32.7%	67.3%	
	Once every 5 years	38a	16b	
		70.4%	29.6%	
	Once every 10 years	13a	11a	
		54.2%	45.8%	
	Once in a lifetime is enough	6a	12a	
		33.3%	66.7%	
	I don't know	194a	54b	
		78.2%	21.8%	

Highly significant if p-value < 0.01, Significant if p-value < 0.05, Non significant if p-value > 0.05. The different subscript letters (a, b) show that the proportion of pre- and post-education is significantly different at 5% level of significant.

When assessed about cervical vaccination after education intervention, women who could correctly identify HPV vaccine component increased from 100 (28.7%) to 248 (71.3%) (p=0.000), and those who could correctly identify the recommended age for vaccination against HPV doubled in number from 103 (31.9%) to 220 (68.1%) (p=0.000). Women who knew that the HPV vaccine prevents genital warts increased from 61 (24.7%) pre-education to 186 (75.3%) post-education (p=0.000). A Health center was chosen by the most as an appropriate place to take the vaccination against HPV by 116 (56.6%) from 89 (43.4%) pre-education interventions (p=0.003) (Table 5).

Table 5 Impact of education intervention on awareness of HPV vaccination

		Intervention		Chi-square (P-value)
		Pre-education	Post-education	
The HPV vaccine contains any of the following virus components?	Herpes virus	7a	25b	0.000
		21.9%	78.1%	
	Human papilloma virus	100a	248b	
		28.7%	71.3%	
	Human immune deficiency virus (HIV)	14a	15a	
		48.3%	51.7%	
	I don't know	279a	112b	
		71.4%	28.6%	
Which of the following diseases can be prevented with HPV vaccination?	Infectious diseases of the urinary system	15a	31b	0.000
		32.6%	67.4%	
	Colon cancer	1a	5a	
		16.7%	83.3%	
	Ovarian cancer	95a	80a	
		54.3%	45.7%	
	Genital warts	61a	186b	
		24.7%	75.3%	
	I don't know	228a	98b	
		69.9%	30.1%	
What is the appropriate age for	During the first five years of life	10a	23b	0.000
		30.3%	69.7%	

HPV vaccination?	From 5 to 10 years old	12a	18a	
		40.0%	60.0%	
	From 11 to 26 years old	103a	220b	
		31.9%	68.1%	
	From 27 to 50 years old	79a	74a	
		51.6%	48.4%	
	More than 50 years old	14a	9a	
		60.9%	39.1%	
	I don't know	182a	56b	
		76.5%	23.5%	
What place do you think is appropriate to take the vaccination against HPV?	Health Center	89a	116b	0.003
		43.4%	56.6%	
	Hospital	233a	242a	
		49.1%	50.9%	
	At home	6a	5a	
		54.5%	45.5%	
	University clinic	3a	3a	
		50.0%	50.0%	
	I don't know	69a	34b	
		67.0%	33.0%	
What is the appropriate amount in Saudi riyals for you for HPV vaccination	Less than 100 SAR	285a	281a	0.932
		50.4%	49.6%	
	100-300 SAR	87a	89a	
		49.4%	50.6%	
	Up to 500 SAR	17a	16a	
		51.5%	48.5%	
	More than 500 SAR	11a	14a	
		44.0%	56.0%	
From what source will you get advice for HPV vaccination?	Family doctor	288a	317b	0.071
		47.6%	52.4%	
	Friends	1a	2a	
		33.3%	66.7%	
	My Family	12a	5a	
		70.6%	29.4%	
	Internet and Social media	19a	8b	
		70.4%	29.6%	
	TV Programs	6a	6a	
		50.0%	50.0%	
	My Personal Decision	74a	62a	
		54.4%	45.6%	

Highly significant if p-value < 0.01, Significant if p-value < 0.05, Non significant if p-value > 0.05. The different subscript letters (a, b) show that the proportion of pre- and post-education is significantly different at 5% level of significant.

Education intervention had impact on some barriers to HPV vaccination. After education session, those who had fear of HPV vaccine side effects significantly decreased (p=0.000) and those who agreed that the vaccine was effective and could afford its price significantly increased (p=0.003 and p=0.005, respectively) (table 6).

Table 6 Impact of education intervention on barriers for HPV vaccination

		Intervention		Total
		Pre-education	Post-education	
Fear of injections (needles)	Agree	130a	131a	0.160
		32.5%	32.8%	
	Neutral	115a	93a	
		28.8%	23.3%	
	Disagree	155a	176a	
		38.8%	44.0%	
Fear of side effects from vaccination	Agree	265a	206b	0.000
		66.3%	51.5%	
	Neutral	85a	90a	
		21.3%	22.5%	
	Disagree	50a	104b	
		12.5%	26.0%	
Cervical cancer is a rare disease and therefore vaccination is not necessary	Agree	68a	65a	0.292
		17.0%	16.3%	
	Neutral	125a	107a	
		31.3%	26.8%	
	Disagree	207a	228a	
		51.8%	57.0%	
The price of the vaccination may not suit me	Agree	143a	127a	0.002
		35.8%	31.8%	
	Neutral	176a	149a	
		44.0%	37.3%	
	Disagree	81a	124b	
		20.3%	31.0%	
I do not have enough time to go to the health center to get the vaccination	Agree	48a	47a	0.9010
		12.0%	11.8%	
	Neutral	101a	96a	
		25.3%	24.0%	
	Disagree	251a	257a	
		62.8%	64.3%	
My family's refusal to be vaccinated	Agree	56a	53a	0.928
		14.0%	13.3%	
	Neutral	121a	125a	
		30.3%	31.3%	
	Disagree	223a	222a	
		55.8%	55.5%	

The Vaccine Is Ineffective	Agree	34_a	33_a	0.0030
		8.5%	8.3%	
	Neutral	184_a	139_b	
		46.0%	34.8%	
	Disagree	182_a	228_b	
		45.5%	57.0%	

Highly significant if p-value < 0.01, Significant if p-value < 0.05, Non significant if p-value > 0.05. The different subscript letters (a, b) show that the proportion of pre- and post-education is significantly different at 5% level of significant.

4. DISCUSSION

We evaluated the impact of education interventions on pregnant women's knowledge and awareness of cervical cancer and perceived barriers to HPV vaccination among Saudi pregnant women. The results could help establish future screening programs currently unavailable in Saudi Arabia and orient awareness campaigns on cervical cancer treatment and prevention. Our study findings showed that education interventions significantly improved the awareness and knowledge and risk factors of cervical cancer among studied women. Though; more than two-thirds of our study participants have heard of Pap smear before, those who knew that it's preventable doubled in number after the education session. A similar impact of the education intervention was reported among Ghanaian women by a study that found that knowledge of cervical cancer and its screening test was significantly higher among women educated on cervical cancer than women without cervical cancer education (Ebu et al., 2019). The same findings were also reported by studies from Ethiopia and India (Abu et al., 2020; Thahirabanuibrahim & Logaraj, 2021).

Another study conducted in Jamaica also found a significant increase in knowledge ofcervical cancer risk factors post-education, while pre-education, women lacked such knowledge, consistent with our study findings (Coronado Interis et al., 2015). Jamaican women also showed up to a 62% increase in knowledge of cervical cancer symptoms post-education intervention compared to pre-education knowledge levels. These findings also agree with our study that showed a significant increase in participants' knowledge of cervical cancer symptoms. However, our study indicated that post-education knowledge increased 2-3 times compared to pre-education knowledge. This drastic difference between our findings and the Jamaican study might be because we surveyed women right after the education sessions ended.

In contrast, the Jamaican study followed up women for 6 months of education before re-evaluating them, which might have caused forgetfulness of some details and loss of some participants during the follow-up period. Since cervical cancer screening is unavailable in Saudi Arabia, this also might indicate that Saudi women are eager to know more about cervical cancer. Before being educated, less than a quarter (22.7%) of participants were aware that cervical cancer mightbe asymptomatic, which increased significantly to more than 77.3%. This underlines the significant role of education in raising awareness that could help in early cervical cancer detection and prevention of late diagnosis and related complications, including deaths. This could encourage women to go for screening without waiting for symptoms since it was found that one of the reasons for not being screened early is the symptom absence (Abu et al., 2020). Therefore, this should be considered when establishing screening programs in Saudi Arabia, and appropriate measures should be taken to educate the population.

Though more than three-quarters of our study participants have heard of Pap smear before, most lacked adequate knowledge, as evidenced by our pre-education survey results where, generally, less than a third could correctly answer questions about the Pap smear. However, their knowledge levels significantly increased up to 300% in some items after being educated. This result shows that education plays a significant role in increasing knowledge of screening and diagnostic measures despite the absence of screening in Saudi Arabia. This highlights that education should be the focus to mobilize Saudi women in future cervical cancer prevention, screening, and treatment strategies.

A previous study conducted in Qassim, Saudi Arabia, revealed that 84.7 women aged 15-65 years didn't get tested with a Pap smear, and most of those who didn't hear of anyone taking it were the ones who refused it (Alnafisah et al., 2019). This emphasizes the necessity of education as it was shown that health education, in addition to increasing knowledge, leads to higher cervical cancer screening rates with Pap smear and acceptance of other prevention options, as women gain comprehensive and clear information about the screening (Ebu et al., 2019; Thahirabanuibrahim & Logaraj, 2021). However, Alnafisah et al., (2019) found that mothers' knowledge level was negatively correlated with the agreement to get daughters vaccinated at school. In addition to the

maternal protective instinct towards daughters, this might indicate the influence of cultural factors, which should be considered during the preparation of educational materials about vaccination.

Aligning with the above previous studies, we found that education intervention increased participants' knowledge of HPV vaccination by 200-300%. Concerns about side effects, doubt about its effectiveness, and fear of injections have been some of the identified barriers to HPV vaccination in the literature (Al-Shaikh et al., 2014), which are similar to our study findings and findings of another study conducted on female high school teachers in Saudi Arabia (Salem et al., 2017). However, we found that fear of injection, concerns about the vaccine's effectiveness, and fear of side effects significantly reduced after the education session, indicating that those barriers were related to poor knowledge. Education's role in improving HPV vaccine knowledge was also found in another previous study involving young Saudi women (Hussain et al., 2016). A study carried out in Jordan found that, despite a good attitude among medical students, lack of information and religious and cultural factors were the barriers to HPV vaccination (Alsous et al., 2021).

Previous studies have also found that barriers to HPV vaccination, such as inadequate information, safety concerns, and mistrust of new vaccines, were dependent upon multiple factors, indicating the need for targeted raising awareness and education programs (Karafillakis et al., 2019). Elimination of these barriers needs a holistic approach, including the involvement of healthcare providers, family support, governmental and non-governmental organizations, and religious leaders in order to increase acceptance of HPV vaccines.

5. CONCLUSION

Our study findings showed that educational intervention significantly improved awareness and knowledge levels of cervical cancer, its risk factors, its symptoms, its screening, and HPV vaccination up to 3 times pre-education levels. Education also significantly helps eliminate barriers to HPV vaccination. Our findings also show that Saudi women are eager to know more about cervical cancer and prevention, as evidenced by drastic improvement in their post-education answers, which might indicate the likelihood of successful screening programs once available. Therefore, health authorities are recommended to establish nationwide screening programs, education, and raising awareness campaigns to increase early detection and cervical cancer treatment and eliminate barriers to HPV vaccination for the prevention of cervical cancer and other HPV-related health conditions.

Ethical considerations

This study was approved by Prince Sultan Medical Military City Institution Review Board (IRB) (Approval number: 1603).

Authors' contributions

Sultan H. Almutairi designed the study's conceptual framework and drafted the research proposal also did data collection and analysis. Then he wrote the manuscript draft.

Safa A. Alsedrah revised and contributed to the research proposal and manuscript writing and supervised the research conduction.

Khalid S. Almutairi contributed to designing the study's conceptual framework and supervised the research conduction.

Yara R. Albayyahi contributed to coordination of data collection and patient's arrangement.

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Conflicts of interest

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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