Original Article

Human papillomavirus and its vaccination: Knowledge and attitudes among female university students in Saudi Arabia

Tahani Altamimi[1]

[1]*Department of Family Medicine and Community Medicine, College of Medicine, University of Hail, Hail, Saudi Arabia*

Abstract

Context: College students worldwide have low levels of knowledge on human papillomavirus (HPV)-related diseases, highlighting the lack of awareness about HPV infection. To date, no study has examined the level of knowledge of cervical cancer and the HPV vaccine in the northern region of Saudi Arabia. **Aim:** This study aimed to assess the level of knowledge of cervical cancer and its risk factors, as well as HPV vaccine acceptance among female students in Saudi Arabia enrolled in health colleges. **Methods:** A descriptive cross-sectional survey was conducted using a valid and reliable self-administered questionnaire. The questionnaire was completed by 966 female students enrolled at the University of Hail, northern region of Saudi Arabia, with a response rate of 83.5%. The main outcome measure was the identification of the knowledge gap pertaining to HPV infection and its prophylactic vaccine. **Results:** The findings highlighted a lack of knowledge about cervical cancer, Pap smears, and HPV vaccine among most female university students. The knowledge score positively correlated to the duration of education. Students enrolled in applied medical science and medical colleges showed significantly higher knowledge scores, as did students in their senior academic years. Vaccine uptake barriers included concerns about its side effects and a lack of information. **Conclusions:** Our findings can be used to formulate effective future awareness programs in the northern region of Saudi Arabia. A larger number of educational programs are required to enlighten Saudi women about cervical cancer and its prophylactic vaccine, including the benefits of screening programs and prevention strategies.

Keywords: Cervical cancer, human papillomavirus, HPV vaccination, Saudi Arabia

Introduction

Cervical cancer is the fourth most commonly diagnosed cancer in women globally and the fourth leading cause of cancer-related death.[1,2] In Saudi Arabia, cervical cancer disease ranked as the ninth most commonly occurring female cancer in women aged 15–44 years.[3,4] However, most cervical cancer cases in Saudi Arabia are diagnosed in the advanced stages when its management is already difficult.[5-8]

Address for correspondence: Dr. Tahani Altamimi, Assistant Professor, Department of Family Medicine and Community Medicine, College of Medicine, University of Hail, Hail, Saudi Arabia.
E-mail: tahanin.altamimi@gmail.com

Received: 21-12-2019 **Revised:** 28-12-2019
Accepted: 22-03-2020 **Published:** 30-04-2020

Access this article online

Quick Response Code:

Website: www.jfmpc.com

DOI: 10.4103/jfmpc.jfmpc_1205_19

Cervical cancer can be prevented by early recognition through cervical screening tests such as the Pap smear.[5] Countries with established cervical cancer screening programs have a reduced incidence of the disease.[9] In Saudi Arabia, there are no national cervical cancer screening programs, with only opportunistic screening provided to women attending health care services.[3,8]

Human papillomavirus (HPV) is a primary risk factor for cervical cancer.[10] There are many HPV-related viruses or serotypes with the high-risk HPV serotypes strongly correlated to cervical cancer.[11,12] Commonly observed high-risk serotypes with oncogenic properties include HPV16 and 18.[13] Currently, a number of prophylactic HPV vaccines are available in Saudi

How to cite this article: Altamimi T. Human papillomavirus and its vaccination: Knowledge and attitudes among female university students in Saudi Arabia. J Family Med Prim Care 2020;9:1849-55.

Arabia,[12] such as a bivalent vaccine (Cervarix); a quadrivalent vaccine (Gardasil); and a monovalent vaccine (Gardasil9).

Despite the serious complications associated with HPV infection, college students globally have poor knowledge levels of HPV-related diseases and associated complications.[14,15] Many studies, including those conducted in Saudi Arabia, have highlighted the lack of awareness of HPV infection and cervical cancer in the general population, as well as among health professionals.[16-27] However, data on the perception and knowledge of HPV and cervical cancer among people living in the northern region of Saudi Arabia are limited, particularly in terms of the levels of knowledge on cervical cancer and its preventive vaccination.

Therefore, this study aimed to assess the knowledge gap pertaining to HPV infection and its prophylactic vaccine among female university students enrolled at health colleges in University of Hail, northern region of Saudi Arabia and to evaluate their cervical cancer-related knowledge levels and attitudes, along with their knowledge of the associated risk factors and prevention procedures. The acceptance rates of the prophylactic HPV vaccine in this population were also determined.

Material and Methods

Study design and population

The present study utilized a descriptive research design and employed a self-administered cross-sectional questionnaire survey. The population comprised female students enrolled at health colleges in the University of Hail, Saudi Arabia including those studying at the medical, dental, pharmacy, applied medical science, nursing, and public health colleges.

Survey instrument

The interview questionnaire used in this study was an adapted and revised version of the one used in a previous study performed in Riyadh.[17] The interview questions were formulated based on an extensive review of the literature and discussions with colleagues and cervical cancer research experts. This approach facilitated and ensured the validity of the survey.

To ensure that the data gathered from the questionnaire were reliable and accurate, the researcher reviewed the document in two phases. In the first phase, items were examined for ambiguity and redundancy by academic faculty members from the University of Hail. The questionnaire was translated into English and then back to Arabic by an independent professional for validity. In the second phase, all questions were checked to ensure issues related to knowledge, attitude, and acceptance and barriers pertaining to the HPV vaccine were included in the survey. A pilot study of 15 female students was undertaken to check language clarity and question understandability. The survey was slightly amended prior to use to reflect the outcomes of the pilot trial. The survey instrument comprised 45 items with a closed-ended response format. The questionnaire was anonymous, confidential, and self-administered. It encompassed four main themes: *socio-demographic information*; *knowledge of cervical cancer, and HPV infection* ("true," "false," and "do not know"); *knowledge of Pap smear as a screening tool* ("true," "false," and "do not know"); *and acceptance of HPV vaccination* (Likert scale). In this study, Cronbach's alpha was 0.788.

Sampling and data collection

All female students enrolled at health colleges in the University of Hail, Saudi Arabia were invited to participate in the study. Participation was voluntary and the only exclusion criterion was an unwillingness to participate. The total number of female students enrolled at health colleges in the university was 1,156 students. Self-administered questionnaires were distributed to students aged 18 years and older from January to June 2017. A total of 966 students completed the questionnaires, resulting in a response rate of 83.5%. There were no missing responses in the returned questionnaires. The objectives of the study were explained to the students, and informed verbal consent was obtained.

Ethics

The objectives of the study were explained to the students, and informed verbal consent was obtained. All respondent information was kept confidential. The study was conducted in accordance with the Helsinki Declaration of 1975, as revised in 2000, and the ethical approval was obtained from the Research Ethics Committee of the University of Hail, on December 2016.

Data analysis

All data analyses were performed using SPSS version 22. The survey responses were summarized and tabulated. For the 27 questions related to the knowledge of cervical cancer, Pap smear as a screening tool, and HPV vaccine, correct responses were given 1 point, while "do not know" or incorrect responses were not scored. The knowledge scores were subsequently computed by summing all item scores; the total score ranged from 0 to 27, with higher scores indicating a better level of knowledge of cervical cancer, as well as its screening and prevention. With respect to knowledge, scores equal to or greater than 60% of the total score were "acceptable," whereas scores less than 60% were considered "poor."

Statistics

On testing the normality distribution of the knowledge score using the Shapiro-Wilk test, it was found that the data were not normally distributed ($P = 0.000$). Kruskal-Wallis tests were used to compare the knowledge scores across the different subgroups.[28] If the results of the Kruskal-Wallis test showed statistically significant differences in the knowledge scores across the different subgroups, Dunn's procedure for pairwise comparisons was performed to investigate which two groups of participants showed statistically significant differences in perception. P values < 0.05 indicated statistical significance.

Results

Table 1 shows the sociodemographic characteristics of the 966 participants. About one-third of them (34%) were enrolled in the college of applied medical science, and the majority of participants (99%) were aged 18–24 years. Students from across all academic years participated in the study, though most were in their second (36%) and third (38%) years. Almost 40% of the participants had a monthly income ranging between 5,000 and 10,000 Saudi Riyals (SR). Less than 10% of the participants' parents were health professionals.

Over half of the participants (66%) knew that cervical cancer is a preventable disease. Nearly 90% had no family members or friends with cervical cancer. Table 2 summarizes responses to the questions related to knowledge of cervical cancer-related risk factors, symptoms, and screening methods. With respect to risk factors, sexually transmitted disease (69%) was the most commonly cited, whereas obesity (28%) and smoking (30%) were the least cited. HPV infection was recognized by less than half of the students (44%) as being a risk factor for cervical cancer. With regard to the symptoms of cervical cancer, irregular vaginal bleeding (65%) was the most commonly cited symptom perceived by the students, whereas "asymptomatic" (9%) was the least known symptom.

Table 2 summarizes responses to the questions related to knowledge of the Pap smear as a screening tool for cervical cancer diagnosis. Only 40% of the participants had heard about cervical smears. About a quarter of the participants were aware that the test was sensitive in the detection of early-stage cervical cancer (23%), and only 25% believed it to be a painless procedure. Only 21% were aware that it does not cause serious complications and 34% understood that undergoing the test just once is not sufficient. Only one-third of participants were aware of the appropriate time to undergo a Pap smear (33%) and how frequently they should undergo a Pap smear (26%).

Table 3 summarizes responses to the questions on the knowledge, attitude, and acceptance pertaining to the HPV vaccine as a cervical cancer prevention measure. Only 31% of the participants were aware that vaccines against cervical cancer include HPV, whereas 30% recognized the recommended age for undergoing the vaccination. Additionally, only 12% of the participants identified that genital warts can be prevented through cervical cancer vaccination. Most of the participants (65%) considered that it was acceptable to receive the vaccination at a hospital. About half of the participants (45%) were able to afford vaccines priced under 100 SR. The majority (83%) stated that they would take vaccination-related advice from doctors and health professionals.

HPV vaccination barriers were assessed using a five-point Likert scale. Table 4 summarizes responses to the questions on the reasons for refusing to undergo vaccination. The major reasons were having a fear of the vaccine's side effects and concerns about its safety (mean = 3.82) and a fear of injections (mean = 3.49). Other barriers included knowledge gaps pertaining to cervical cancer and HPV (mean = 3.04), financial concerns (mean = 2.83), concerns about vaccine ineffectiveness (mean = 2.78), and being too busy to undergo

Table 1: Sociodemographic characteristics of the student participants (*n*=966)

Characteristics	Number	Percentage
College type		
Medical	153	16
Dental	92	9
Pharmacy	83	9
Applied medical sciences	325	34
Nursing	215	22
Public health and health information	98	10
Age		
18-20 years	442	46
21-24 years	514	53
≥25 years	10	1
Academic year		
Year 1	38	4
Year 2	347	36
Year 3	366	38
Year 4	113	12
Year 5	67	7
Year 5+	35	4

Table 2: Correct responses regarding knowledge on cervical cancer and Pap smear (*n*=966)

Knowledge items	Frequency	Percentage
Cervical cancer-related risk factors		
Sexually transmitted disease	668	69
Contraceptive pills	430	45
Human immunodeficiency virus	480	50
Smoking	292	30
Human papillomavirus	427	44
Obesity	272	28
Reduced immune response	523	54
Older age	321	33
Genital warts	390	40
Cervical cancer-related symptoms		
Irregular vaginal bleeding	631	65
Vaginal discharge	387	40
Postcoital bleeding	360	37
Pelvic pain	414	43
Asymptomatic	91	9
Unexplained weight loss	335	35
Cervical cancer-screening tool (Pap smear)		
Sensitive test for the detection of early-stage cervical cancer	219	23
Appropriate timing to undergo Pap smear	318	33
Appropriate frequency of undergoing Pap smear	254	26
Painless test	239	25
Insufficient to undergo the test once in life	325	34
Does not cause serious complications	200	21

vaccination (mean = 2.78); the least commonly cited reason was a lack of parental consent (mean = 2.57).

With 27 items used for the assessment of knowledge of cervical cancer, the lowest possible knowledge score was 0 (i.e. answering all 27 items incorrectly) and the highest was 27 (i.e. answering all 27 items correctly). In this study, the lowest score was 0 and the highest was 22. The mean total knowledge score was 10.49 (standard deviation [SD], 5.27). The poor knowledge score cutoff was set at less than 60% of the total score. Thus, participants with scores less than 16.2 were regarded as having "poor knowledge," whereas those with scores equal to or greater than 16.2 were regarded as having "acceptable knowledge." Of the 966 participants, 819 (84.8%) had poor knowledge and 147 (15.2%) had acceptable knowledge.

Table 5 presents the descriptive statistics pertaining to the knowledge scores for cervical cancer, Pap smear, and HPV vaccine by college, age, academic year, monthly income, and father's and mother's occupation. The results of the Kruskal-Wallis tests suggested that there was a statistically significant difference in the knowledge scores among the following variables: college, age group, academic year, father's occupation, and mother's occupation. No statistically significant difference in the knowledge scores was observed among participants with different income levels ($P = 0.086$).

Table 3: HPV vaccination-related knowledge, attitudes, and acceptance (*n*=966)

Knowledge of HPV vaccine	Frequency	Percentage
Vaccine against cervical cancer contains HPV	299	31
HPV vaccine prevents genital warts	118	12
Recommended age of vaccination	293	30
Acceptable site for vaccination		
Health care centers	172	18
Hospitals	634	65
University clinics	48	5
Residence	5	1
Do not know	107	11
Affordable vaccine price		
<100 SR	434	45
100-300 SR	277	29
Up to 500 SR	152	16
>500 SR	103	11
Sources of information for advice on vaccination		
Doctor and health professionals	801	83
Family	58	6
Friends	63	7
Internet	12	1
Self-decision	29	3
Television	3	0.3

HPV: human papillomavirus; SR: Saudi Riyals

Discussion

Despite the serious complications associated with HPV infection and the availability of vaccines against it, college students globally still have very limited awareness of HPV-related diseases and their prevention.[14,15] The current study revealed poor knowledge scores pertaining to cervical cancer and its related risk factors, symptoms, and preventive measures among female college students in Hail in Saudi Arabia. According to the study protocol, 84.8% of the participants showed poor total knowledge scores, similar to the findings of several studies in both developed and developing countries.[19-33] Thus, increasing the level of knowledge of cervical cancer in Saudi Arabia is important for the promotion of healthy behaviors and the use of preventive methods.

The study's results demonstrate the presence of large knowledge gaps regarding the students' knowledge of cervical cancer-related risk factors; indeed, correct response rates were lower than 70%, ranging from 28% to 69%. A total of 69%, 50%, and 54% of participants provided correct answers to the items on sexually transmitted diseases, the human immunodeficiency virus, and immunosuppression with only 44% considering HPV infection to be a risk factor for cervical cancer. Additionally, the students' knowledge of the relationship between HPV infection and cervical cancer prevention with HPV vaccine use was poor (31%). In general, awareness of cervical cancer-related risk factors was poor, independent of the participants' sociodemographic characteristics. The abovementioned observations are consistent with those observed in a study conducted on Riyadh health college students.[17] Likewise, a study conducted at King Faisal University showed that most students had low knowledge levels of the signs, symptoms, and risk factors of cervical cancer.[16] Furthermore, the majority of the students (67%) were unaware of the availability of the HPV vaccine, and around 41% knew that HPV infection was a risk factor for cervical cancer. In Poland, students aged 17–26 years

Table 4: Barriers to HPV vaccine uptake (*n*=966)

Barriers	Frequency (%) of responses					Mean (SD)
	1	2	3	4	5	
Fear of injections	328 (34)	207 (21)	159 (16)	153 (16)	119 (12)	3.49 (1.41)
Fear of side effects	290 (30)	383 (40)	167 (17)	85 (9)	41 (4)	3.82 (1.09)
Cervical cancer as a rare disease	145 (15)	204 (21)	286 (30)	208 (21)	123 (13)	3.04 (1.24)
Vaccine cost	102 (11)	187 (19)	277 (29)	247 (26)	153 (16)	2.83 (1.22)
No time	132 (14)	150 (15)	250 (26)	245 (25)	189 (20)	2.78 (1.30)
Family refusal	111 (11)	106 (11)	241 (25)	268 (28)	240 (25)	2.57 (1.29)
Ineffectiveness of vaccine	100 (10)	142 (15)	352 (36)	187 (19)	185 (19)	2.78 (1.21)

HPV: human papillomavirus; SD: standard deviation. Note: 1=strongly agree, 2=agree, 3=neutral, 4=disagree, 5=strongly disagree.

Table 5: Descriptive statistics of knowledge scores (*n*=966)

Variables		Knowledge score		*P*
		Mean (SD)	Median	
College	Medicine	11.61 (5.41)	12	0.000*
	Dental	9.43 (5.11)	9.5	
	Pharmacy	7.55 (4.38)	7	
	Applied medical sciences	12.45 (4.99)	13	
	Nursing	9.55 (4.90)	10	
	Public health and health information	7.82 (4.60)	8	
Age group	18-20 years	9.28 (4.75)	9	0.000*
	21-24 years	11.43 (5.48)	12	
	≥25 years	16.00 (2.67)	17	
Academic year	Year 1	8.61 (3.91)	9.5	0.000*
	Year 2	8.80 (4.87)	9	
	Year 3	11.35 (5.31)	11	
	Year 4	12.01 (5.30)	13	
	Year 5	12.58 (4.94)	12	
	Year 5+	11.49 (5.38)	11	
Monthly income	<5000 SR	9.69 (5.16)	10	0.086
	5000-9999 SR	10.93 (5.23)	11	
	10000-14999 SR	10.36 (5.12)	11	
	≥15000 SR	10.54 (5.62)	10	
Father's occupation	Health professional	11.75 (5.72)	14	0.002*
	Other professions	10.56 (5.20)	11	
	Not working	9.39 (5.24)	8	
Mother's occupation	Health professional	12.60 (5.40)	14	0.000*
	Other professions	10.35 (5.12)	10	
	Not working	9.98 (5.57)	10	

SD: standard deviation; SR: Saudi Riyals. Note: Comparisons conducted with the Kruskal-Wallis test.. *Significant at <0.05 level

also showed poor knowledge levels on cervical cancer and its link to HPV infection.[21]

The present study highlights the presence of large knowledge gaps pertaining to the clinical features of cervical cancer, with the percentages of correct answers ranging from 9% to 65%. Overall, 65% of the students considered irregular vaginal bleeding to be the main presenting symptom, whereas 43% and 37% believed that pelvic pain and postcoital bleeding were important symptoms, respectively. Only 9% of the students believed that cervical cancer could be asymptomatic. These findings are consistent with those of a recent survey conducted in Riyadh.[17] Such misinformation may have serious consequences. In Saudi Arabia, most cervical cancer cases are diagnosed at an advanced stage and require aggressive treatment; this may be due to the absence of a national screening program.[5]

Regarding awareness of the Pap smear as a screening tool for cervical cancer, only 40% of the total study population had heard of the test. Additionally, 75% of the students believed the test to be painful and 79% believed it might cause serious complications. This study's findings mirror those of Al-Shaikh *et al.*,[17] as well as those of a recent study conducted in Riyadh in which more than half of the participants did not have any knowledge of cervical cancer screening tests,[33] and another in which most participants were unaware of the screening tools for cervical cancer or the appropriate age to undergo screening or HPV vaccination.[7] The present results are also supported by a study in which university students in Makkah showed a lack of knowledge of HPV prevention, vaccination, and infection.[30] Likewise, several studies in Saudi Arabia found unsatisfactory levels of knowledge pertaining to cervical cancer and screening.[3,24-27,30-34] All these results indicate the need for improvement in the levels of awareness about screening tools for cervical cancer. However, studies in Western countries showed better levels of knowledge of the Pap smear as a screening tool.[18-21] This difference between Saudi Arabia and other countries may be related to the presence of public awareness campaigns on cervical cancer and the Pap smear as a screening tool and HPV vaccination programs in Western countries.

In the current study, most participants had poor knowledge levels of cervical cancer and its prevention. The mean total knowledge score was 10.49 (SD, 5.27) with 819 participants (84.8%) showing poor scores. However, a significantly higher knowledge score was reported for students enrolled in applied medical science and medical colleges, among whom the mean knowledge scores were 12.45 (SD, 4.99) and 11.61 (SD, 5.41), respectively. The scores were also significantly higher among students aged 25 years and older (16; SD, 2.67) and those in academic year four or higher (12.01; SD, 5.30). The positive association between educational academic year and age with knowledge scores on cervical cancer reflects the students' educational level.[16,17,29,32-34] Students with parents in the health profession also had increased

scores. Nevertheless, monthly income did not significantly affect the knowledge scores. However, having a medical background was positively related to knowledge levels.

Statistics pertaining to HPV vaccine acceptance indicated that 65% of the students preferred to undergo HPV vaccination in hospitals. Approximately 45% of the students felt that the price of vaccines should not exceed 100 SR, similar to previous findings.[31] However, a study conducted in Riyadh showed that approximately 80% of participants thought that vaccine prices should not exceed 300 SR.[17] This difference could be explained by the relatively high monthly income of that study's participants. Several studies have shown that HPV vaccine price is an important factor related to vaccine acceptance.[22] Other barriers to HPV vaccine acceptance in the present study include concerns about side effects and fear of injections.[17,20,22,23,24,32] Additionally, health professionals were considered the most reliable sources of knowledge and awareness about HPV-related disease and vaccination; this finding is in agreement with those of other studies.[16,29,33] However, studies have shown that the internet, mass media, and social media were the most important sources of information on HPV-related problems and cervical cancer.[26,30]

This study has some limitations including the lack of representation of male students and those from non-health-related colleges, as well as the differing proportions of students from other colleges. However, a major strength of this study is that it addressed, for the first time, the level of knowledge and attitude toward prophylactic vaccine among women in the northern region of Saudi Arabia. The large representative sample and high response rate are additional strengths. Future studies may be conducted in different colleges among female and male students for comparison of gender-related differences.

Inadequate levels of knowledge of cervical cancer were observed in this study among an educated cohort of female students in Hail, Saudi Arabia. This translates to a lack of awareness campaigns in the community, and the topic has not been extensively addressed in the curriculum of health colleges. It is recommended that the curriculums of health colleges incorporate comprehensive information about this high-priority issue. This may aid in the promotion of health and knowledge among the future health care workforce.

This study also solidifies the need for the initiation of culturally accepted public education programs and awareness campaigns on cervical cancer and its prevention. Effective usage of mass media and the active participation of medical professionals in awareness programs may help narrow the existing knowledge gaps among Saudi women. Primary health care workers play a key role in cervical cancer prevention through promoting public health campaigns such as cervical screening program. Boosting the knowledge of medical students about HPV infections and its vaccines will be effective in enhancing the general population awareness of screening and preventive modalities against HPV. Finally, the population of Saudi Arabia must be empowered with information through community advocacy programs and the development of strategic planning to increase HPV vaccination rates and thereby reduce the incidence of cervical cancer.

Declaration of participants consent

The author certify that she has obtained all appropriate participants consent forms.

Acknowledgments

The author would like to acknowledge the participants and the data collector for facilitating data collection.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

References

1. Arbyn M, Weiderpass E, Bruni L, de Sanjosé S, de Sanjosé S, Saraiya M, Ferlay J, *et al.* Estimates of incidence and mortality of cervical cancer in 2018: A worldwide analysis. The Lancet Global Health. 2019.
2. de Martel C, Plummer M, Vignat J, Franceschi S. Worldwide burden of cancer attributable to HPV by site, country and HPV type. Int J Cancer 2017;141:664-70.
3. Almazrou S, Saddik B, Jradi H. Knowledge, attitudes, and practices of Saudi physicians regarding cervical cancer and the human papillomavirus vaccine. J Infect Public Health 2019. doi: 10.1016/j.jiph.2019.09.002.
4. Saudi Arabia Cancer Incidence Report 2019. Riyadh: https://gco.iarc.fr/today/data.
5. Manji M. Cervical cancer screening program in Saudi Arabia: action is overdue. Ann Saudi Med 2000;20:355-7.
6. Alsbeih G. HPV infection in cervical and other cancers in Saudi Arabia: Implication for prevention and vaccination. Front Oncol 2014;4:65.
7. Salem MR, Amin TT, Alhulaybi AA, Althafar AS, Abdelhai RA. Perceived risk of cervical cancer and barriers to screening among secondary school female teachers in Al Hassa, Saudi Arabia. Asian Pac J Cancer Prev 2017;18:969-79.
8. Alhamlan F, Al-Qahtani A, Al-Ahdal M. Current studies on human papillomavirus in Saudi Arabia. J Infect Dev Ctries 2015;9:571-6.
9. World Health Organization. Human papillomavirus (HPV) and cervical cancer [report on the Internet]. WHO; 2019. Available from: http://www.who.int/mediacentre/factsheets/. [Cited 2019 Mar].
10. Anfinan NM. Physician's knowledge and opinions on human papillomavirus vaccination: A cross-sectional study, Saudi Arabia. BMC Health Serv Res 2019;19:963.
11. Karafillakis E, Simas C, Jarrett C, Verger P, Verger P, Peretti-Watel P, Dib F, *et al.* HPV vaccination in a context of public mistrust and uncertainty: A systematic literature review of determinants of HPV vaccine hesitancy in Europe. Hum Vaccines Immunother 2019;11:1-3.
12. Lowy DR. HPV vaccination to prevent cervical cancer and other HPV-associated disease: From basic science to

effective interventions. J Clin Invest 2016;126:5-11.

13. Kristina SA, Permitasari NP. Knowledge, attitudes and barriers towards human papillomavirus (HPV) vaccination in developing economies countries of South-East Asia region: A systematic review. Systematic Reviews in Pharmacy 2019;10:81-6.
14. Chang IJ, Huang R, He W, Zhang SK, Wang SM, Zhao FH, *et al.* Effect of an educational intervention on HPV knowledge and vaccine attitudes among urban employed women and female undergraduate students in China: A cross-sectional study. BMC Public Health 2013;13:916.
15. Charakorn C, Rattanasiri S, Lertkhachonsuk AA, Thanapprapasr D, Chittithaworn S, Wilailak S. Knowledge of Pap smear, HPV and the HPV vaccine and the acceptability of the HPV vaccine by Thai women. Asia Pac J Clin Oncol 2011;7:160-7.
16. Al-Darwish AA, Al-Naim AF, Al-Mulhim KS, Al-Otaibi NK, Morsi MS, Aleem AM. Knowledge about cervical cancer early warning signs and symptoms, risk factors and vaccination among students at a medical school in Al-Ahsa, Kingdom of Saudi Arabia. Asian Pac J Cancer Prev 2014;15:2529-32.
17. Al-Shaikh G, Almussaed E, Fayed A, Khan F, Syed S, Al-Tamimi T, *et al.* Knowledge of Saudi female university students regarding cervical cancer and acceptance of the human papillomavirus vaccine. Saudi Med J 2014;35:1223-30.
18. Doescher MP, Jackson JE. Trends in cervical and breast cancer screening practices among women in rural and urban areas of the United States. J Public Health Manag Pract 2009;15:200-9.
19. Hawkins NA, Cooper CP, Saraiya M, Gelb CA, Polonec L. Why the Pap test? Awareness and use of the Pap test among women in the United States. J Womens Health (Larchmt) 2011;20:511-5.
20. Oluwole EO, Idowu OM, Adejimi AA, Balogun MR, Osanyin GE. Knowledge, attitude and uptake of human papillomavirus vaccination among female undergraduates in Lagos State, Nigeria. J Fam Med Prim Care 2019;8:3627-33.
21. Kamzol W, Jaglarz K, Tomaszewski KA, Puskulluoglu M, Krzemieniecki K. Assessment of knowledge about cervical cancer and its prevention among female students aged 17-26 years. Eur J Obstet Gynecol Reprod Biol 2013;166:196-203.
22. Marek E, Dergez T, Rebek-Nagy G, Kricskovics A, Kovacs K, Bozsa S, *et al.* Adolescents' awareness of HPV infections and attitudes towards HPV vaccination 3 years following the introduction of the HPV vaccine in Hungary. Vaccine 2011;29:8591-8.
23. Ozyer S, Uzunlar O, Ozler S, Kaymak O, Baser E, Gungor T, *et al.* Awareness of Turkish female adolescents and young women about HPV and their attitudes towards HPV vaccination. Asian Pac J Cancer Prev 2013;14:4877-81.
24. Jradi H, Bawazir A. Knowledge, attitudes, and practices among Saudi women regarding cervical cancer, human papillomavirus (HPV) and corresponding vaccine. Vaccine 2019;37:530-7.
25. Al Khudairi H, Abu-Zaid A, Alomar O, Salem H. Public awareness and knowledge of Pap smear as a screening test for cervical cancer among Saudi population in Riyadh City. Cureus 2017;9:e984.
26. Malibari SS. Knowledge about cervical cancer among women in Saudi Arabia. Egypt J Hosp Med 2018;70:1823-5.
27. Almehmadi MM, Salih MM, Al-Hazmi AS. Awareness of human papillomavirus infection complications, cervical cancer, and vaccine among the Saudi population. A cross-sectional survey. Saudi Med J 2019;40:555-9.
28. Hollander M, Wolfe DA, Chicken E. Nonparametric Statistical Methods. New York: John Wiley and Sons; 2013.
29. Hussain A, Alkhenizan A, McWalter P, Qazi N, Alshmassi A, Farooqi S, *et al.* Attitudes and perceptions towards HPV vaccination among young women in Saudi Arabia. J Family Community Med 2016;23:145-50.
30. Johargy AK, Jamal A, Garout MA. Knowledge, attitudes and practices towards human papillomavirus among females in Saudi Arabia. Int J Trop Dis Health 2016;20:1-11.
31. Alzahrani A, AlGhanaim N, Abdulmageed S. Perception of the Saudi community towards human papillomavirus vaccination in Jeddah, Saudi Arabia. Glob J Health Sci 2017;9:158-64.
32. Dhaher EA. Knowledge, attitudes and practices of women in the southern region of Saudi Arabia regarding cervical cancer and the Pap smear test. Asian Pac J Cancer Prev 2019;20:1177-84.
33. Aldohaian AI, Alshammari SA, Arafah DM. Using the health belief model to assess beliefs and behaviors regarding cervical cancer screening among Saudi women: A cross-sectional observational study. BMC Womens Health 2019;19:6.
34. Alnafisah RA, Alsuhaibani R, Alharbi MA, Alsohaibani AA, Ismail AA. Saudi Women's knowledge and attitude toward cervical cancer screening, treatment, and prevention: A cross-sectional study in Qassim region. Asian Pac J Cancer Prev 2019;20:2965-9.