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Insufficient knowledge of Human Papillomavirus among reproductive-aged women from Arak, Iran

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Abstract

Background The Human Papillomavirus (HPV) is the most common sexually transmitted infection worldwide. Knowledge about this virus and its vaccine is still limited among women in developing countries. Therefore, this study aimed at evaluation of women's knowledge about HPV and vaccination to identify the related factors conducting on reproductive-aged women referred to health care centers in Arak, Iran.

Methods In this cross-sectional study, a researcher-made questionnaire was applied to assess the participants' knowledge about HPV and its vaccination among Iranian reproductive-aged women. Mann Whitney U test, and Kruskal Wallis test were used to analyze the data. Quantile regression was employed to account for potential confounding factors.

Results Totally, 400 women with a mean age of 32.5 years were investigated. The vast majority of the participants (82%) were married, 32.2% graduated from high school, 64.0% had 1–2 children, 93% lived in the urban area. The associated HPV and vaccine knowledge was evaluated to be "insufficient" in 86.5% and 79% of the participants, respectively. Out of 400, 37.5% and 34.5% of participants were aware of HPV vaccine protection against cervical cancer and genital warts, respectively. Multifactorial quantile regression models revealed that women with higher levels of education demonstrated significantly greater awareness of HPV. Additionally, employed women and those with higher education exhibited notably increased awareness of the HPV vaccine.

Conclusions The level of understanding in terms of the incidence and prevention was evaluated "insufficient" in our study. The findings highlight the importance of further campaigns to improve the awareness of HPV among Iranian women. Vaccination programs should be seriously considered to prevent HPV infection and its complications like cervical cancer.

Keywords Human Papillomavirus, HPV vaccine, Knowledge, Reproductive-aged women, Iran

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Background

Human Papillomavirus (HPV) is a leading cause of cervical cancer, yet awareness and vaccination rates remain alarmingly low among women in many regions [1]. It is among the main sexually transmitted infections (STIs) as a serious public health problem worldwide. Some of STIs have preventive vaccines available, while others are still being searched [2–4]. Cervical cancer is evaluated as the fourth most common cancer in females. According to the WHO estimation in 2022, 660,000 women with cervical cancer were diagnosed worldwide and this cancer led to 350,000 deaths [5].

HPV is a huge family of viruses as the most common STI in the United States. More than 200 types of the virus have been recognized so far [6]. HPV types 6 and 11 are responsible for genital warts whereas types 16 and 18 lead to cervical cancer [7–9]. Most HPV infections cause no symptoms and are self-limited [10, 11]. HPV infection occurs at any age among females; however, it is highly prevalent among those aged 20 to 24 years [12].

In an investigation in America, HPV DNA was detected in 99.7% of cervical cancers, of which more than 70% were HPV types 16 or 18 [13] as the main cause of cervical cancer [14]. The estimated HPV prevalence among women with normal cytological findings worldwide was 11.7% [15]. Most the HPV-related non-malignant diseases are due to HPV6/11 [16]. HPV is responsible for 91% of anal cancers, 75% of vaginal cancers, and 60% of oropharyngeal cancers in the US [17, 18].

Numerous studies have provided evidence that there is a notably high prevalence of HPV infection among individuals of both genders, particularly within the age range of 26 to 46 years [19, 20]. Several investigations have reported a significantly high prevalence of high-risk Human Papillomavirus among Iranian women who are afflicted with cervical cancer. These findings have shed light on the alarming frequency of HPV infection in this specific population [21, 22].

There is no doubt that one of the most effective ways to prevent the disease is vaccination. Nevertheless, the rate of vaccinated individuals against HPV is very low due to the limited information among the societies, especially in developing countries [23–25]. There are three types of HPV vaccine, Quadrivalent vaccine (Gardasil: against HPV types 6, 11, 16, 18), Bivalent vaccine (Cervarix: against HPV types 16, 18), and 9-valent vaccine (Gardasil 9: against HPV types 6, 11, 16, 18, 31, 33, 45, 52, 58), which are all desirable to apply before sexual activity initiation [26, 27].

According to the published data in 2024, the rate of cervical cancer was 1.9 per 100,000 individuals in Iran. Furthermore, HPV was detected in 58%, 69% and 81% of LSIL (low-grade squamous intraepithelial lesions), HSIL (high-grade squamous intraepithelial lesions) and invasive cervical cancer, respectively [28].

There is no doubt that education plays a crucial role in HPV prevention and vaccine acceptance in different populations. A recent study from Nepal showed that although half of the surveyed women had favorable attitude towards the role of HPV in cervical cancer, a majority of them had never been screened for this disease [29]. A systematic review study from 16 European countries showed that nearly half of adolescents and their parents had knowledge towards HPV infection. Nevertheless, it concluded that this knowledge was insufficient which led to vaccine hesitancy along with safety concerns [30].

It is notable that in Iran vaccination against HPV is not a part of national vaccine program.

A recent systematic review study reported the low level of HPV and vaccine knowledge in Iran. Moreover, the knowledge of HPV transmission routs and its important consequences such as cervical cancer was not sufficient [31].

There have been some studies about HPV in Iran where the vaccination rate is very low and a routine vaccination program has not been applied yet [32, 33]. Thus, awareness of cervical cancer and its related factors plays a crucial role in prevention of infection and its probable outcomes. The current research is therefore aimed at determining the level of knowledge about HPV and its vaccination amongst women of childbearing age in Arak, Iran.

Methods

Study design and participants setting

In this cross-sectional study, reproductive-aged women who referred to Arak's urban and rural health service centers were investigated in 2020 in Iran. The subject picking was done randomly from health service centers. Ethics approval was obtained from Ethical Committee of Arak University of Medical Sciences under the code of IR.ARAKMU.REC.1399.097. The study was performed in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants before data collection.

The sample size was calculated according to the population covered by the health service centers in Arak. Totally, 14 health service centers of Arak city which agreed to contribute to the study and had the possibility to provide samples, were involved. To achieve this setting, 10 women were selected from the list of daily clients each day. To prevent any bias, sampling was done randomly using random sample feature of Excel. The participants were informed about the survey and a signed consent form was given from each participant. Each person who did not confirm the consent form was excluded from the study.

The designed questionnaires were then completed by a nurse or a trained healthcare worker in the health care centers under the investigation. The required information and data were collected in the field as well.

The sample size was defined according to the main purpose of the study as determination of HPV associated knowledge. The study population was randomly selected among reproductive females referring to health service centers in Arak city to reduce any bias. According to the lack of relevant data and studies in this field, we applied the prevalence rate equal to 50%, which gives the largest sample size with a type one error of 5% and an acceptable error of 5%. The required sample size was calculated 385 people. Finally, we considered 400 female for the possibility of falling rate.

Data collection and analysis

To collect the data, a researcher-made questionnaire was used composing of two parts; reproductive-aged women's knowledge about HPV (Supplementary Table 1) and vaccination awareness (Supplementary Table 2) in addition to demographic information. The content and structure of the applied questionnaire was tested and approved five different experts related to this research and for review of correlation between the questions (Cronbach's alpha), the questionnaire was completed by 30 people similar to the study population.

In addition to demographic data, the questionnaire included questions about HPV knowledge (including infection characteristics, transmission routs, symptoms and complications, prevention, diagnosis, and treatment) and also some questions were about HPV vaccine.

One question in both main sections was included to identify the knowledge source of the participants which was not scored. Therefore, 40 questions in the infection knowledge section and 10 questions in the vaccine knowledge section were used for scoring.

The questions were arranged based on the Likert scale. Each correct scored for 1 point whereas no point for lack of awareness or the wrong response. Therefore, HPV related knowledge score, ranged from 0 to 40, and vaccine related information score ranged from 0 to 10.

At the next step, the 30–40 correct replies were considered as "sufficient", 20–30 right answers were evaluated as average, and below 20 correct responses were marked as "insufficient" over HPV section.

Moreover, vaccine related knowledge score of 0–4, 4–7, and 8–10 were categorized as "insufficient", "average" and "sufficient", respectively.

The content validity of the questionnaire was assessed by different experts and specialists (including public health, health education and promotion, epidemiologist and infectious disease specialists). To check the reliability or internal consistency of the questionnaire, Cronbach alpha was used and it was estimated to be 92.8% for HPV knowledge questionnaire (average inter-item covariance: 0.041, number of items in the scale: 40) and 82.5% for the whole questionnaire (average inter-item covariance: 0.046, number of items in the scale: 50).

Statistical analysis

The collected data were described using mean (standard deviation) and frequency (percentage), Mann Whitney U test, and Kruskal Wallis test were used to analyze the data. Quantile regression was employed to account for potential confounding factors. Linear regression models the conditional mean of the outcome but requires assumptions (e.g., normality, homoscedasticity) that were violated in our data. In contrast, quantile regression estimates conditional quantiles (e.g., median) and is robust to non-normality and heteroscedasticity (Koenker, 2017; Hao & Naiman, 2007). The HPV knowledge score and HPV vaccine knowledge score (analyzed separately) served as dependent variables, while age, geographic area, marital status, number of children, education level, occupation, and socio-economic status were included as explanatory variables. A p-value less than 0.05 is considered statistically significant. All analyses were carried out by Stata software 13 and 17 (Stata Corp, College Station, TX, USA).

Results

Participants' socio-demographic information

As presented in Tables 1 and 400 women aged from 15 to 49 enrolled from whom 372 were from urban areas (93%) and 28 were from rural areas (7%). Moreover, 82.25% of the participants were married from whom 3.75% were divorced and 1% was widowed.

According to the data, 31.91% of the studied subjects were undergraduate, 34.67% successfully graduated from high school and 33.42% graduated from university. The mean age was 32.5 [15–49] years (with a standard deviation of 7.7).

Out of the 400 participants, 23.2% had no children, 64.0% and 12.75% reported 1–2 and 3–4 children, respectively.

In case of socio-economic levels, 88 women were of well-income level, 202 belonged to the average level, and 110 were of low-paid families. 8.7% of the studied women had a smoking history.

Vaccination uptake and intention

Four people (1%) had received HPV vaccine whereas 396 (99%) did not get vaccinated. 166 (41.60%) of unvaccinated population stated that lack of knowledge was the main reason of not being vaccinated. In addition, 20.05% assumed that vaccination is not necessary. Interestingly,

Table 1 Socio-demographic characteristics, HPV knowledge, and HPV vaccine knowledge of reproductive-aged women

Variables		Total *N* (%)	HPV Knowledge score *N* (%)	*P* value	HPV Vaccine knowledge score *N* (%)	*P* value
Living area	Urban	372 (93%)	10.58 (8.5)	0.983*	2.29 (2.28)	0.525*
	Rural	28 (7%)	10.21 (7.8)		2.07 (2.44)	
Marital status	Single	52 (13%)	10.19 (8.09)	0.658**	2.46 (2.40)	0.681**
	Married	329 (82.25%)	10.70 (8.45)		2.26 (2.27)	
	Divorced/ Widow	19 (4.75%)	9.05 (9.46)		2.00 (2.47)	
Numbers of children; Mean (SD): 1.35 (1.00)	0	93 (23.25%)	10.84 (8.03)	0.128**	2.67 (2.45)	
	1–2	256 (64.00%)	10.89 (8.54)		2.31 (2.24)	
	3–4	51 (12.75%)	8.35 (8.55)		1.39 (2.07)	**0.002****
Education	Under diploma	127 (31.91%)	6.71 (7.57)	**< 0.001****	1.33 (1.91)	**< 0.001****
	Diploma	138 (34.67%)	10.02 (7.68)		2.21 (2.14)	
	Academic	133 (33.42%)	14.72 (8.20)		3.22 (2.41)	
Occupation	Housewife	280 (70.18%)	9.33 (8.1)	**< 0.001****	1.89 (2.08)	**< 0.001****
	Employed	79 (19.80%)	14.7 (8.44)		3.5 (2.58)	
	Others	40 (10.03%)	10.85 (8.5)		2.52 (2.27)	
Socio-economic level	Rich	88 (22.00%)	11.52 (9.52)	0.170**	2.36 (2.34)	0. 866**
	Average	202 (50.50%)	10.82 (8.09)		2.28 (2.28)	
	Poor	110 (27.50%)	9.28 (8.09)		2.19 (2.29)	
History of smoking	Yes	35 (8.75%)	12 (8.6)	0.321*	3.11 (0.44)	0.052*
	No	365 (91.25%)	10.41 (8.4)		2.19 (0.11)	

Bold *P* values indicate the statistically significant values

*Mann Whitney U test

**Kruskal Wallis test

Table 2 The distribution of HPV knowledge, and HPV vaccine knowledge among reproductive-aged women

Knowledge		Number	Percent	CL 95%
HPV knowledge (ranged from 0–40)	Insufficient (0–20)	346	86.5%	82.7–89.5%
	Average (20–30)	54	13.5%	10.4–17.3%
	Sufficient(30–40)	0	0	-
HPV vaccine knowledge (ranged from 0–10)	Insufficient (0–4)	316	79.0%	74.7–82.7%
	Average (4–7)	78	19.5%	15.8–23.6%
	Sufficient (8–10)	6	1.5%	0.67–3.30%

238(59.50%) people did not recommend the vaccine to the others.

HPV awareness

As it is shown in Table 2, the awareness of HPV was estimated "insufficient" in 86.5% of the participants highlighting a critical gap in awareness that hinders preventive measures.

This status was evaluated "average" in 13.5% ($n = 54$). The mean HPV knowledge score was 10.5 (S.D.: 8.4, ranged from 0 to 28).

Moreover, the widest range of knowledge was over the necessity of condom application in reduction of HPV transmission risk (53.75%). Subsequently, 213 (53.25%) knew that HPV infection is preventable.

Unfortunately, only a minority of people (3%) were aware that an HPV test is recommended in a relationship with a sexual partner who has genital warts. Furthermore, nearly half of the respondents were aware of cervical cancer as an HPV possible outcome. In addition, 45.25% of the respondents were generally aware of HPV in which internet sharing data (13.50%) and the healthcare staff (11.25%) contributed to the main source of awareness.

Furthermore, there was no significant association between age and HPV knowledge ($p = 0.063$) while a significant association was observed between the knowledge score and education ($p < 0.001$) and occupation ($p < 0.001$).

HPV vaccine awareness

The associated HPV vaccine knowledge was "insufficient" in 79.0%, "average" in 19.5%, and "sufficient" in 1.5% of

participants. The mean HPV vaccine knowledge score was 2.27 (S.D.: 2.29, ranged from 0 to 8) (Table 2).

In addition, the broadest area of HPV vaccine knowledge was the HPV vaccine's ability to protect against cervical cancer (37.5%). Then, 138 (34.5%) knew that the HPV vaccine protected against genital warts. Moreover, 17.7% of the participants knew that the HPV vaccine protects from sexually transmitted infections. The least range of knowledge about HPV was about testing or Pap smear prior to HPV vaccination limited to 36 women (9%).

According to the obtained results, there was no significant association between age and HPV vaccine awareness ($p = 1.000$). However, a significant association was seen between HPV vaccine knowledge score and women's education ($p < 0.001$) and occupation ($p < 0.001$) which shows that high education and career apparently affect the knowledge as well. Moreover, increasing numbers of children in the family led to reduction of the mean HPV vaccine knowledge score ($p = 0.002$).

Furthermore, the population with a diploma (Coefficient = 6.28, $p < 0.001$) or academic education (Coefficient = 12.00, $p < 0.001$) had significantly higher HPV awareness compared to those with less education. In addition, the women residing in rural areas had significantly higher HPV awareness compared to urban women (Coefficient = 5.24, $p = 0.033$). Age, occupation, marital status, number of children, and socio-economic level had not significantly association with HPV awareness ($p > 0.05$ for all) (Table 3).

From another point of view, the females with a diploma (Coefficient = 1.21, $p = 0.002$) or academic education (Coefficient = 2.28, $p < 0.001$) had significantly higher HPV vaccine awareness compared to those with lower educational level. Employed women had significantly higher HPV vaccine awareness compared to housewives (Coefficient = 1.07, $p = 0.029$). Age, marital status, number of children, socio-economic level, and living area did not significantly association with HPV vaccine awareness ($p > 0.05$ for all) (Table 4).

Discussion

A number of studies have shown low level of knowledge about public awareness of HPV, the perceived risks of HPV infection, and the potential health effects of HPV infection, in particular in Asia. Although there have been some HPV knowledge conducted studies in Iran, this is the first released data from Arak city. Our study presented that the range of HPV and HPV vaccine related-knowledge among is "insufficient" and the majority of participants lacked sufficient knowledge about HPV. In other words, none of the enrolled cases had "sufficient" information about HPV and its vaccination. Notably, there was a significant association between the level of education and the mean score of knowledge. This finding shows that high education apparently affects the

Table 3 Factors associated with HPV awareness among reproductive-aged women: quantile regression results

Variables	Coefficient	Standard Error	*P*-value	95% Confidence interval	
				Lower	Upper
Age	0.11	0.10	0.268	-0.09	0.31
Marital status					
Married (Ref*)	-	-	-	-	-
Single	-1.34	2.81	0.632	-6.87	4.18
Divorced/Widow	-2.68	3.02	0.375	-8.61	3.25
Numbers of children	-0.54	0.86	0.529	-2.24	1.15
Education					
Under diploma (Ref*)	-	-	-	-	-
Diploma	6.28	1.56	**< 0.001**	3.21	9.35
Academic	12.00	1.83	**< 0.001**	8.40	15.60
Occupation					
Housewife (Ref*)	-	-	-	-	-
Employed	3.46	1.99	0.084	-0.46	7.38
Others	2.53	2.94	0.390	-3.25	8.32
Socio-economic level					
Poor (Ref*)	-	-	-	-	-
Average	1.20	1.52	0.430	-1.78	4.18
Rich	-0.47	1.83	0.796	-4.07	3.12
Living area					
Urban (Ref*)	-	-	-	-	-
Rural	5.24	2.46	**0.033**	0.41	10.07

*Reference. Bold *P* values indicate the statistically significant values

Table 4 Factors associated with HPV vaccine awareness among reproductive-aged women: quantile regression results

Variables	Coefficient	Standard Error	*P*-value	95% Confidence interval	
				Lower	Upper
Age	0.01	0.02	0.643	-0.04	0.06
Marital status					
Married (Ref*)	-	-	-	-	-
Single	-1.25	0.69	0.070	-2.61	0.10
Divorced/Widow	-0.17	0.74	0.816	-1.63	1.28
Numbers of children	-0.32	0.21	0.135	-0.73	0.10
Education					
Under diploma (Ref*)	-	-	-	-	-
Diploma	1.21	0.38	**0.002**	0.46	1.97
Academic	2.28	0.45	**< 0.001**	1.40	3.17
Occupation					
Housewife (Ref*)	-	-	-	-	-
Employed	1.07	0.49	**0.029**	0.11	2.04
Others	0.76	0.72	0.291	-0.66	2.18
Socio-economic level					
Poor (Ref*)	-	-	-	-	-
Average	0.13	0.37	0.722	-0.60	0.86
Rich	-0.25	0.45	0.582	-1.13	0.64
Living area					
Urban (Ref*)	-	-	-	-	-
Rural	-0.08	0.60	0.894	-1.27	1.10

*Reference. Bold *P* values indicate the statistically significant values

knowledge as well which is consistent with previous studies. Educational attainment often correlates with better access to health information and resources. A study conducted by McBride et al. revealed that higher educational attainment and increased income are substantial predictors of enhanced knowledge regarding HPV and vaccines among women [34].

Other investigated variables including marital status, number of children, socio-economic status and smoking history did not affect the awareness range over HPV ($P > 0.05$). It is also notable that according to the latest meta-analysis study in Iran, the HPV prevalence in Iranian women has been found at a high level, which requires careful attention from national health system. Furthermore, public awareness regarding HPV must be extended along with clinical screenings [35]. The educational program must also provide students with practical content over HPV prevention. In a survey which was done in south-west Iran, more than half of the students had poor knowledge which is in agreement with our finding [36].

A study conducted in Thailand reported that 46% of the participants had insufficient HPV knowledge as almost half of the studied women had poor level of awareness regarding HPV infection and vaccination.

In agreement with our findings, the study indicates an urgent need of effective educational intervention. Although we did not find any correlation between socio-economic status and the range of awareness, they claimed that it was an effective factor with the knowledge in their studies population [23]. These findings underscore the urgent need for targeted education campaigns. Future research should explore the most effective methods of information dissemination to improve HPV awareness among Iranian population. Overall, knowledge about HPV in developing countries is low and more efforts are required to improve the range of awareness.

Differences in knowledge and awareness about HPV and HPV vaccines have been noticed across different geographic regions. In a series of studies, rural residents had less knowledge about HPV and its vaccine [37, 38]. Nonetheless, there was a significant difference in terms of HPV knowledge between urban and rural populations of our study.

Furthermore, our findings indicated that employed women exhibited significantly greater awareness of the HPV vaccine. Consistent with our results, a prior study found that employed women over 30 with higher incomes possess greater knowledge about the HPV vaccine [39]. Additionally, another study highlighted that occupation is a crucial factor linked to HPV vaccine knowledge among Chinese mothers of teenage daughters [40].

HPV causes the most common STI in the world [41]. We found that less than half of the studied population were not aware of HPV transmission routs, along with a nationwide cross-sectional survey in Poland [42]. It has been shown that, about half of the nurses knew about the route of HPV transmission in Turkey [43]. Based on

low level of knowledge about the routes of HPV transmission, the implementation of preventive measures and educational campaigns about this transmission routes are essential.

From another point of view, cervical cancer is one of the most frequent cancer in developing countries [44]. In the present study, 57.5% did not know that HPV infection could cause cervical cancer. Similarly, low level of HPV knowledge and cervical cancer knowledge in South Asian immigrant women were reported in a recent investigation [45]. Totally, cervical cancer incidence in low-income countries is high and should be provide more HPV education as a high priority.

Vaccination intention for women have clear different consequences according to their age. As of today, the greatest impact of HPV vaccination is expected in early ages and recommended in adolescents. Only 1% of women in this survey was vaccinated against HPV, indicating low intention or opportunity to HPV vaccination. Contrary to our results, a study by Cordoba et al., showed that 77% of school-girls in Colombia were vaccinated with HPV vaccine [46]. In addition to vaccination, 59.5% of respondents in our study did not recommend others to get the HPV vaccine, while 84% of participants in the Hong Kong did [47]. This difference might stem from cultural differences. Considering the findings by this study and low rate of vaccination against HPV in Iran, it seems crucial to highlight the necessity of vaccination in national vaccination program in Iran as other studies have shown its great role in prevention from malignancies in women. Gardasil 4 and Gardasil 9 vaccines are accessible in Iran, though these vaccines are not parts of the national vaccination program and people of the indexed age could receive the vaccine on personal payment. For instance, in a study conducted in England showed that HPV vaccine has led to significantly reduced cervical cancer incidence by 87% in women who got at the age of 12–13 years as part of the UK HPV vaccination program [48].

Recently, social media has significantly become a worldwide source of health information [49, 50]. In agreement with our findings; another US study described the internet as a one of the most frequently mentioned sources of health information about vaccines [51].

Overall, most of the participants have gained their knowledge from the internet. There is not sufficient education about HPV in schools nor in universities in Iran. Thus, proper education and specific informative topics are required to be incorporated in educational system. This can hugely affect public level of information regarding HPV, its outcomes and vaccination importance.

There are some limitations of the study. Further investigations would follow the pointed suggestions discussed below.

The data collection was based on a researcher-made questionnaire completed by a nurse or healthcare workers expert. Self-reported data may be subject to bias and may not accurately reflect participants' actual knowledge levels. Scoring as a continuous variable and estimating associate factors through a linear model would be more accurate. There was also lack of information towards cervical cancer screening knowledge and practices in the population study.

Furthermore, there is a gap in understanding the effectiveness of educational interventions in improving awareness. Future research could focus on evaluating the impact of specific educational programs on knowledge levels and vaccination uptake.

From another point of view, the cultural factors that may affect the awareness and acceptance of HPV vaccination in Iran should be taken to attention in further studies focusing on cultural beliefs, attitudes, and barriers towards HPV vaccination could provide valuable insights for designing culturally sensitive public health campaigns.

Moreover, longitudinal studies are recommended to assess the long-term impact of knowledge improvement on vaccination rates and cervical cancer prevention in the population. These kinds of studies could explore the perspectives of healthcare providers in Iran regarding HPV vaccination, including their knowledge, attitudes, and practices in promoting vaccination among their patients.

The participants' socioeconomic status could be more explored which can significantly influence access to healthcare, and information. Including this data would allow for a more nuanced analysis of the barriers to HPV knowledge and vaccination. Understanding attitudes and beliefs is critical to designing effective educational interventions. For instance, if there are prevalent misconceptions or fear surrounding the vaccine, these need to be addressed to improve vaccination rates. Therefore, further investigations could identify barriers (e.g., cultural beliefs, accessibility issues, and cost) which are essential for tailoring public health interventions.

Conclusion

The Iranian women's HPV-related information was evaluated "insufficient" in this study which highlights further campaigns and educational interventions to provide public knowledge in Iran. Integration HPV education into school/university curriculums seems essential. Our population requires a cooperation of different organizations for upgrading public awareness as well as providing mass vaccination against HPV. Policymakers are also supposed to consider the low-level of vaccination coverage in the country and facilitate the vaccine supply as well. Further studies should be performed to find high-risk

populations and prevention of HPV infection to decrease cervical cancer incidence.

Abbreviations

STI	Sexually transmitted infection
WHO	World health organization
HPV	Human Papillomavirus
CL	Confidence level
S.D.	Standard deviation

Supplementary Information

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Supplementary Material 1

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Author contributions
Study conception and design: M.S., A.A.H., P.S.F. and A.R. Data collection, statistical expertise, analysis and interpretation of data: M.S., A.A.H., P. S.F., M.S.L., F.A. and A.R. Manuscript preparation, supervision, administrative support and critical revision of the paper: M.S.L., F.A. and A.R. All authors read and approved the final manuscript.

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Data availability
The datasets used for current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
Ethics approval was obtained from Ethical Committee of Arak University of Medical Sciences under the code of IR.ARAKMU.REC.1399.097. The Helsinki Declaration was followed in this study. Written informed consent was obtained from all participants before data collection. Moreover, in the case of adolescents, the informed consent was obtained from a parent and/or legal guardian.

Consent for publication
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Competing interests
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