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HEALTH BELIEFS, KNOWLEDGE, AND HPV VACCINE HESITANCY IN MOTHERS OF YOUNG GIRLS IN PAKISTAN: A CROSS-SECTIONAL STUDY

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Abstract

A cross-sectional correlational research design was carried out to investigate the correlation between health beliefs, health knowledge and HPV vaccine hesitancy among mothers of young girls in Pakistan. The sample comprised (n=120) Pakistani mothers having at least one daughter between 9 and 16 years of age recruited through purposive sampling from different community and educational settings. Questionnaires were adapted from previously validated scales such as The Health Belief Model Scale for Human Papillomavirus and Its Vaccination (HBMS-HPVV), The HPV Knowledge Scale (HPV-KS) and The Vaccine Hesitancy Scale (VHS) and used to collect data. Assessment measures were used in both Urdu and English language, the items were modified accordingly to the cultural context of Pakistan and for the ease of understanding of the participants. The response format was also modified for greater convenience in administering. reliability analysis, Descriptive statistics, independent samples t-tests, one-way ANOVA,Pearson product-moment correlation, and multiple linear regression analysis were used for statistical analyses. The results showed that there was moderate HPV knowledge and moderate HPV vaccine hesitancy among mothers. HPV knowledge was significantly negatively correlated with HPV vaccine hesitancy, which means that more HPV knowledge was associated with a decreased level of HPV vaccine hesitancy. Regression analysis also revealed that HPV knowledge had a significant negative association with HPV vaccine hesitancy, while perceived barriers had a positive association with HPV vaccine hesitancy. Furthermore, there was a positive correlation among participant age and vaccine hesitancy and perceived barriers. Significant differences in vaccine hesitancy were found across, residential status, family system, family history of cervical cancer, vaccination history, or history of adverse vaccine reactions, however no significant difference was found across educational level. The study concludes that lack of HPV-related knowledge and increased perceived barriers are some of the most significant factors behind HPV vaccine hesitancy among mothers in Pakistan. The results suggest the necessity of awareness sessions, educational programs and counseling through healthcare services to strengthen the knowledge about HPV and reduce the misconceptions about HPV vaccination which should be culturally sensitive. The importance of making HPV vaccination a part of the national immunization agendas and reinforcing the regulatory systems on HPV vaccine in Pakistan cannot be stressed enough. The

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study adds to the paucity of literature on HPV vaccine hesitancy from the local context and offers significant policy, health education, and research implications for the country of Pakistan.

Introduction

Cancer is a complex group of diseases caused by the uncontrolled growth and spread of abnormal cells. It is one of the most important disease causes of morbidity and mortality globally and is a significant public health burden. While medical science has made strides to improve cancer treatment, cancer prevention clearly is one of the better options for cutting down cancer death tolls. Vaccination has become an important prevention tool against some cancers that are triggered by an infectious agent, especially Human Papillomavirus (HPV) linked to cervical cancer. Gardasil and Cervarix vaccines have been proven to be effective against infection with high risk HPV types and to reduce cervical precancerous lesions (Tanaka et al., 2017). HPV vaccines are a great opportunity to diminish the number of cases of cervical cancer by early vaccination. Yet, vaccine hesitancy remains a significant threat to public health, even as vaccines are available and effective. Vaccine hesitancy is the delay or refusal of vaccination despite the presence of vaccination services and is impacted by factors including lack of knowledge, misconceptions, cultural beliefs and concerns about vaccine safety and efficacy (Cataldi & O'Leary, 2021). Therefore, it is crucial to have an understanding of the factors related to vaccine hesitancy to promote HPV vaccination and prevent HPV-related cancers.

The cancer is called cervical cancer, which occurs in the cervix, the lower part of the uterus where it connects to the vagina. This is one of the most common type of cancer that occurs in women all over the world and consequently heavily influences the health of the public. Smoking, immunodeficiency, early exposure to sex in young people and chronic infection by the high-risk human papillomavirus (HPV) are all risk factors that contribute to the development of cervical cancer. These infections can cause a change in the cells of the cervix that in turn can lead to cancer in the future, if the immune system does not remove them. It will take at least 15–20 years for a woman with an HPV infection to develop cervical cancer. Cervical cancer mostly caused by chronic HPV infection with high ongoing risk types, mainly HPV 16 and HPV 18 (Rosendo et al., 2024).

Cervical cancer being the fourth most common cancer type among women worldwide, is the third most common cancer type among women in Pakistan and the second most common among women aged 15–44 years. The death rate according to a World Health Organization (WHO) report published in 2024 is 350 000 deaths in 2022 worldwide. In Pakistan, each year, nearly 5008 women are diagnosed with cervical cancer and 3197 women are thought to die from cervical cancer. This is a high quantity which needs to be identified and treated early to be controlled. Persistent and untreated human papilloma virus (HPV) infection is the cause of 95% of cervical cancers, and about 88.1% of invasive cancers are caused by HPV subtypes 16 and 18 (Qamar et al., 2025). The American College of Obstetricians and Gynecologists (ACOG) guidelines released in April, 2023, provide several screening options for early detection and, in turn, treatment to reduce the death rate. There are several reasons quoted for the high burden of cervical cancer in LMICs. These include attitude and knowledge barriers, inadequate health care systems as well as a lack of screening and treatment.

Cervical cancer is silent and not usually associated with any obvious signs or symptoms. These signs and symptoms include abnormal bleeding (between periods, after menopause or during sex), heavier than normal discharge, fatigue, needing to urinate more often at night, memory loss, disrupted sleep, dry mouth, pain and shortness of breath – and they can get worse after radiotherapy/chemotherapy (Barsevick, 2016). Complications are pain, peripheral neuropathy, diarrhea, sexual dysfunction, menopausal symptoms, urinary problems (cystitis), and persistent morbidity with a low quality of life (enteritis).

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Conceptual Framework

This present study is based on the Health Belief Model (HBM), which is one of most well-known psychological models used to explain and to predict health related behaviors. Rosenstock's original idea for the HBM was to offer an explanation for why people adhere to or do not adhere to preventive health care practices, and Becker expanded this idea. The constructs of the HBM are perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action and self-efficacy. Together, these components provide a good understanding of the influences on health-protective behaviors, like vaccinations (Glanz & Bishop, 2010). Perceived susceptibility in the context of HPV vaccination is defined as what mothers think of the likelihood that their daughters will get HPV infection or cervical cancer in the future. Mothers who believe that their daughter is at higher risk for contracting HPV are more likely to think vaccination is necessary and helpful. A low perceived susceptibility can thus play a role in the delay of vaccination choices and the rise of vaccine hesitancy (Kolek et al., 2022). Perceived severity is a person's assessment of the disease and its seriousness. Regarding HPV vaccine hesitancy, women who know that cervical cancer is serious, and a potential cause of death, are more likely to agree on the need for prevention measures like vaccination. (Gray & Fisher, 2023). Perceived benefits include beliefs about the efficacy of HPV vaccine in preventing HPV infection and cervical cancer. Mothers who are confident that the HPV vaccine is safe, effective, and can help prevent their daughters from developing future health problems are more inclined to accept the vaccine. (Tung et al., 2016). Perceived barriers are those factors that hinder an individual's preventive health-related actions. Mothers may have concerns about the safety of vaccines, fears of side effects, religious/cultural beliefs, misinformation, cost, social stigma, lack of access, and distrust of healthcare systems. Another concern of mothers is that talking about HPV vaccine might lead to early sexual activity with adolescents. These worries can have a detrimental impact on vaccination choices, and result in vaccine hesitancy even when vaccines are offered. Perceived barriers have been shown to be among the strongest predictors of HPV vaccine hesitancy among parents in various cultural contexts (Beavis et al., 2022).

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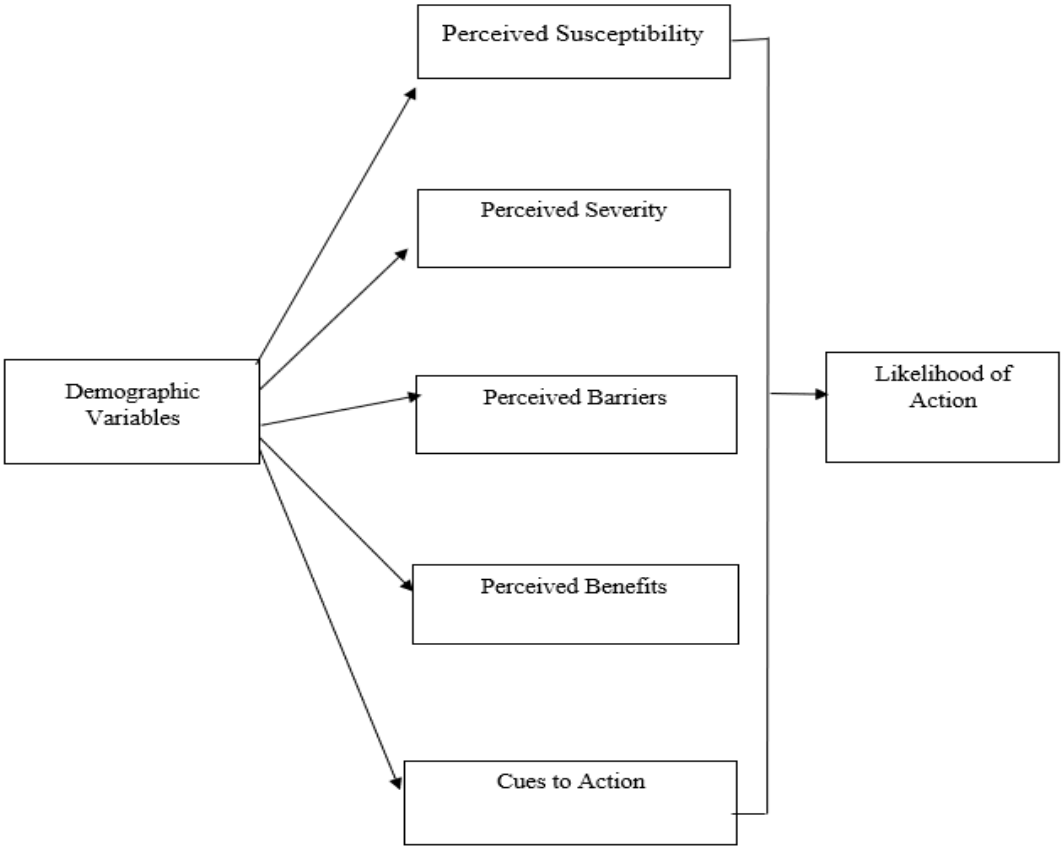
Figure 1
Health Belief Model



The present study is also supported by the Knowledge, Attitude, and Practice (KAP) framework to gain better insight into mothers' hesitancy towards HPV vaccination for young girls in Pakistan. The KAP framework is popularly used in public health research to determine the relationship between the knowledge and beliefs of people with their attitudes and health behaviors. This framework focuses on knowledge as understanding and awareness about a specific health condition; attitudes as feelings, perceptions, and beliefs about the health condition or preventive behavior; and practice as actual practice or actions of people toward health promotion and disease prevention. The KAP framework assumes that there is a positive relationship between knowledge and attitudes, and that this will, in turn, lead to the adoption of health practices and behaviors.

Objective

The aim of the study was to investigate the extent to which HPV-related knowledge and health belief model constructs (perceived susceptibility, perceived severity, perceived barriers, perceived benefits, cues to action, health motivation, and perceived control) tend to predict vaccine hesitancy among mothers of girls in Pakistan. The study also examined how mothers tend to differ in the level of HPV vaccine hesitancy across diverse demographic variables.

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Hypotheses

- Higher levels of knowledge about HPV and the HPV vaccine among mothers predict lower vaccine hesitancy.
- Mothers with higher perceived susceptibility and severity show lower vaccine hesitancy.
- Mothers with higher perceived benefits show lower vaccine hesitancy.
- Mothers with higher perceived barriers show higher vaccine hesitancy.
- Sociodemographic variables (e.g., higher maternal education, higher income) predict lower vaccine hesitancy.

Method

This section introduces the procedure that is used for conducting this research. This included; research design, sampling strategy, sample, demographic information sheet, assessment measure, data collection procedure, ethical consideration and statistics for data analysis.

Sample and Sampling Strategy

The sample comprised (N = 120) Pakistani mothers having at least one daughter between the ages of 9 and 16 years. The participants were selected purposively from various community settings and educational institutions throughout Pakistan, with in-person referrals and direct contact. The mothers who had at least one daughter between 9 and 16 years of age, irrespective of the daughter's HPV vaccination status, mothers with basic formal education and ability to understand, read and write Urdu and English and mothers who willingly agreed to include their daughters in the study by giving informed consent were included. Whereas exclusion criteria involved mothers whose daughters had a history of vaccine allergies, mothers who were healthcare professionals directly working in oncology, gynecology, or immunization services, and individuals who did not consent to participate in the study. A correlational cross-sectional research design was used for the design.

Assessment Measures

To assess the level of health beliefs and knowledge in HPV vaccine hesitancy, following assessment measures are used in the study. A set of questionnaires had been adapted using and modifying previously validated HPV Knowledge Scale, Health Belief Model Scale for HPV vaccination and HPV vaccine hesitancy scale were used in the study. The items were adapted to the cultural context of Pakistan and to ease the participants understanding. Response formats also were modified for ease of administration.

Demographic Information Sheet

A demographic information sheet was created to gather information about the participant's age, level of education, occupation, place of residence, marital status, family system, monthly income, number of children and vaccination status. Other factors measured daughters' age, vaccination history, and decision-making processes regarding HPV vaccination.

The Health Belief Model Scale (HBMS-HPVV)

The Health Belief Model Scale for Human Papillomavirus and Its Vaccination (HBMS-HPVV) was first developed in English by Hae Won Kim (2012) and then translated into Turkish by Gülten Güvenç, Memnun Seven and Aygül Akyüz (2015). The scale was developed to measure the health beliefs of the individuals as related to HPV infection and HPV vaccination in accordance with the constructs of the Health Belief Model. In this study, a shortened version of the scale that included 14 items was used to measure mothers' beliefs about HPV infection and HPV vaccination. The items are scored on a 4-point Likert-type scale from Not at all (1) to Very much (4). The following response category was added I Don't Know.

HPV Knowledge Scale

HPV Knowledge Scale (HPV-KS) was first developed by Hae Won Kim, 2012, to measure human beings' knowledge and awareness of Human Papillomavirus (HPV) infection and HPV vaccination. The original scale is composed of 20 items that assess knowledge about HPV transmission, disease, prevention, screening and

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vaccination. A short form version of the survey was adapted and used to measure the knowledge of mothers about HPV infection, cervical cancer, and HPV vaccination in this study. Each participant answered each statement on a 5-point Likert scale from "Strongly Disagree" (1) to "Strongly Agree" (5). There was also an additional option, "I Don't Know" to give respondents the opportunity to answer when they do not know the response to an item. The scores range from higher to more knowledge and understanding about HPV infection and HPV vaccination.

Vaccine Hesitancy Scale (VHS)

In 2015, the World Health Organization Strategic Advisory Group of Experts on Immunization (SAGE) created the Vaccine Hesitancy Scale (VHS) to measure attitudes and beliefs about vaccine hesitancy among parents and caregivers. An abbreviated version of the scale with nine items was adapted and used to measure mothers' reluctance towards HPV vaccination of their daughter in this study. The scale includes items that reflect confidence in vaccines, perceived benefits of vaccines, trust in health care providers, vaccine safety concerns and perceived risks of newer vaccines. Each item was answered on a 5-point Likert-type scale from "Strongly Agree" (1) to "Strongly Disagree" (5). The option "I Don't Know" was added. The higher mothers' scores on the scale are, the more hesitant they are to vaccinate against HPV. A few items were reverse-scored before analysis to insure consistency in interpreting the scores.

Procedure

All the authors had to be requested for permission to use measurements/instruments prior to the official data collection. The authority letter from the Institute of Applied Psychology, University of The Punjab, and Quaid-e-Azam Campus Lahore was used to contact the authorities for the permission to collect data. All respondents were asked for their informed consent after being made aware of the objectives and rationale behind the study. The participants should be informed about their participation in the present study is voluntary or not. They could withdraw at any time if the study made them feel uncomfortable, and it was ensured that any information they provided will remain confidential, anonymous and for academic research purposes only. The questionaires were given out on an individual basis. Their responses were entered into the SPSS version 27.00 for further analyses.

Result

The results of the statistical analysis performed to explore the relationship between HPV knowledge, health beliefs, and HPV vaccine hesitancy among mothers of young girls are detailed in this chapter. Descriptive statistics and psychometric analysis were used to test the reliability and distributional properties of the study variables, and also served as a basis for the further analysis. Independent samples t-tests and one-way analysis of variance (ANOVA) were used to explore the possible associations between HPV vaccine hesitancy and sociodemographic factors and/or vaccination factors, as appropriate. Pearson product moment correlation analysis was used to explore the relationships between HPV knowledge, perceived severity, perceived barriers, perceived benefits, perceived susceptibility, and vaccine hesitancy. In addition, multiple linear regression was used to assess the contribution of HPV knowledge and the variables of the Health Belief Model for predicting HPV vaccine hesitancy among mothers.

Psychometric Properties of the Scales and Subscales

This table presents the psychometric properties of Health Belief Model, Knowledge and HPV Vaccine Hesitancy scales and subscales used in the study.

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Reliability Analysis

Table 4.1

Psychometric Properties HPV Vaccine Hesitancy, Knowledge and HPV Vaccine Hesitancy (N=120)

Variables	*K*	Range		*α*	Skewness
		Actual	Potential		
HPV Knowledge Scale	10	13-60	10-60	.883	0.90
Perceived Benefits	3	3-15	3-15	.774	-0.15
Perceived Severity	4	4-70	4-20	.421	3.92
Perceived Barriers	5	6-25	5-25	.735	-0.37
Perceived Susceptibility	2	2-10	2-10	.658	-0.31
Vaccine Hesitancy Scale	9	15-49	9-54	.656	0.48

Note. α= reliability coefficient,

Reliability analysis was conducted to explore the internal consistency and psychometric characteristics of the scales and sub scales used in this study to measure HPV knowledge, health beliefs and HPV vaccine hesitancy among mothers of young girls. Cronbach's alpha coefficient, skewness values, and actual and potential score ranges were calculated for each scale. The skewness values for most of the variables were within acceptable limits (within ±1) indicating approximate normality. In general, the results indicated that the majority of scales employed in the present study had good psychometric characteristics and were suitable for further statistical analysis.

Independent Sample t test

Table 4.2

Independent Samples t-Test for HPV Knowledge, Vaccine Hesitancy, and Health Belief Model Constructs by Family System (N = 120)

Variables	Nuclear Family		Joint Family		*t (118)*	*P*	Cohen's d
	M	*SD*	*M*	*SD*			
HPV Knowledge	41.94	11.62	40.74	12.59	0.53	.598	0.10
HPV Vaccine Hesitancy	27.68	7.64	31.36	8.89	-2.34	.021*	-0.44
Perceived Severity	12.62	5.52	13.92	9.08	-0.95	.343	-0.18
Perceived Barriers	16.51	5.58	17.40	5.11	-0.89	.374	-0.17
Perceived Benefits	8.60	4.08	9.82	3.53	-1.72	.089	-0.32
Perceived Susceptibility	6.45	3.07	6.62	2.72	-0.32	.749	-0.06

Note. M = Mean, SD = Standard Deviation. Cohen's d =effect size

An independent samples t-test was conducted to examine differences in HPV knowledge, HPV vaccine hesitancy, and Health Belief Model constructs across family system among mothers of young girls. The results showed that there was a significant difference between the HPV vaccine hesitancy of mothers in nuclear and joint family systems. Mothers belonging to a joint family were found to have high HPV vaccine hesitancy than nuclear family mothers. There was no statistically significant difference between the two groups in terms of HPV knowledge, severity, barriers, benefits, or susceptibility.

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Table 4.3

Independent Samples t-Test for HPV Knowledge, Vaccine Hesitancy, and Health Belief Model Constructs by Decision taken (N = 120)

Variables	Decision taken		Decision not taken		*t (118)*	*P*	*Cohen's d*
	M	*SD*	M	*SD*			
HPV Knowledge	47.41	7.81	39.29	12.41	-4.52	.001	-0.74
HPV Vaccine Hesitancy	31.25	8.48	25.34	5.53	4.48	.001	0.77
Perceived Severity	13.20	7.94	14.74	11.15	-0.74	.462	-0.17
Perceived Barriers	17.05	5.15	16.57	6.04	0.41	.684	0.09
Perceived Benefits	9.13	3.75	9.23	4.29	-0.12	.909	-0.03
Perceived Susceptibility	6.40	2.93	6.91	2.99	-0.86	.392	-0.17

*Note. M = Mean; SD = Standard Deviation; Cohen's d = effect size. **p < .001.*

An independent samples t-test was conducted to examine differences in HPV knowledge, vaccine hesitancy, and Health Belief Model constructs based on mothers' decision status regarding HPV vaccination. Findings showed that mothers who had decided about vaccines knew more about HPV and had mixed feelings about the vaccine compared to those who had not made a decision. With a moderate to large effect size, mothers who did not make a decision had significantly lower scores on HPV knowledge. There were no significant differences between decision groups for perceived severity, perceived barriers, perceived benefits or perceived susceptibility.

Table 4.4

Independent Samples t-Test for HPV Knowledge, Vaccine Hesitancy, and Health Belief Model Constructs by Decision Status (N = 120)

Variables	No	Yes my daughter will get vaccination			*t (118)*	*P*	*Cohen's d*
	M	SD	M	SD			
HPV Knowledge	35.98	14.04	47.15	6.20	-5.69	.001	-1.04
HPV Vaccine Hesitancy	33.91	8.50	25.66	5.63	6.29	.001	1.15
Perceived Severity	14.74	8.83	12.74	8.96	1.22	.224	0.22
Perceived Barriers	18.96	3.82	14.98	5.88	4.34	.001	0.80
Perceived Benefits	10.39	3.27	8.05	4.09	3.42	.001	0.63
Perceived Susceptibility	7.33	2.52	5.85	3.13	2.82	.006	0.52

*Note. M = Mean; SD = Standard Deviation; Cohen's d = effect size. **p < .001.*

An independent samples t-test was conducted to examine differences in HPV knowledge, vaccine hesitancy, and Health Belief Model constructs based on mothers' decision regarding HPV vaccination for their daughters. The results showed a significant difference between the groups regarding total HPV knowledge, total vaccine hesitancy, perceived barriers, perceived benefits, and perceived susceptibility. Vaccine hesitancy scores were significantly higher and perceived barriers and perceived susceptibility were significantly higher for mothers who reported that they would not vaccinate their daughters compared to mothers who decided to vaccinate their daughters vaccination. Mothers who reported that they would not vaccinate their daughters had significantly higher vaccine hesitancy scores, perceived barriers, and perceived susceptibility scores than mothers who decided to vaccinate their daughters. There was no significant difference between the groups on the level of perceived severity.

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Table 4.5

Independent Samples t-Test for HPV Knowledge, Vaccine Hesitancy, and Health Belief Model Constructs by Family History of Cervical or Other Cancer (N = 120)

Variables	Yes		No		*t (118)*	*P*	*Cohen's d*
	M	*SD*	*M*	*SD*			
HPV Knowledge	43.51	13.86	37.39	10.88	-2.54	.012	-0.52
HPV Vaccine Hesitancy	31.12	8.35	29.05	7.84	1.23	.220	0.25
Perceived Severity	13.55	4.56	13.70	10.17	-0.08	.934	-0.02
Perceived Barriers	17.12	4.24	16.78	5.76	0.31	.757	0.06
Perceived Benefits	9.79	3.01	8.93	4.17	1.08	.283	0.22
Perceived Susceptibility	6.55	2.58	6.57	3.08	-0.04	.968	-0.01

*Note. M = Mean; SD = Standard Deviation; Cohen's d = effect size. **p < .001.*

An independent samples t-test was conducted to examine differences in HPV knowledge, vaccine hesitancy, and Health Belief Model constructs based on mothers' family history of cervical or other cancers. The findings showed that there was a significant difference between the total HPV knowledge scores obtained by mothers with and without a family history of cancer. The HPV knowledge scores were significantly higher among mothers with a family history of cervical or other cancer than those mothers lacking a family history. None of the differences were statistically significant, however, between the two groups regarding vaccine hesitancy, perceived severity, perceived barriers, perceived benefits, and perceived susceptibility.

Table 4.6

Independent Samples t-Test for HPV Knowledge, Vaccine Hesitancy, and Health Belief Model Constructs by Participants' HPV Vaccination Status (N = 120)

Variables	Yes		No		t (118)	*P*	*Cohen's d*
	M	*SD*	*M*	*SD*			
HPV Knowledge	48.50	4.95	41.73	12.05	2.34	.021*	0.56
HPV Vaccine Hesitancy	24.50	3.54	29.59	8.24	-2.71	.008**	-0.63
Perceived Severity	12.50	4.95	13.64	8.99	-0.18	.859	-0.13
Perceived Barriers	15.00	1.41	16.90	5.39	-0.50	.621	-0.35
Perceived Benefits	5.50	3.54	9.22	3.86	-1.35	.179	-0.96
Perceived Susceptibility	3.00	1.41	6.60	2.92	-1.74	.085	-1.24

*Note. M = Mean; SD = Standard Deviation; Cohen's d = effect size. **p < .001.*

An independent samples t-test was conducted to examine differences in HPV knowledge, vaccine hesitancy, and Health Belief Model constructs based on participants' personal HPV vaccination status. Results showed that there was a significant difference between the HPV related knowledge of the HPV vaccinated mothers and the HPV unvaccinated mothers. No statistically significant difference was found for HPV vaccine perceived severity, perceived barriers, perceived benefits, or perceived susceptibility between the vaccination status groups.

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Table 4.7

Independent Samples t-Test for HPV Knowledge, Vaccine Hesitancy, and Health Belief Model Constructs by Daughters' HPV Vaccination Status (N = 120)

Variables	Yes		No		*t (118)*	*P*	*Cohen's d*
	M	*SD*	*M*	*SD*			
HPV Knowledge	43.11	4.58	41.74	12.20	2.41	.018*	0.64
HPV Vaccine Hesitancy	24.22	2.12	29.55	8.44	-2.68	.009**	-0.71
Perceived Severity	17.33	1.94	13.32	9.20	3.58	.001**	0.45
Perceived Barriers	19.44	3.52	16.66	5.48	3.35	.003**	0.52
Perceived Benefits	10.11	3.52	9.08	3.90	0.77	.445	0.27
Perceived Susceptibility	8.67	2.60	6.37	2.90	2.53	.031*	0.80

*Note. M = Mean; SD = Standard Deviation; Cohen's d = effect size. **p < .001.*

An independent samples t-test was conducted to examine differences in HPV knowledge, vaccine hesitancy, and Health Belief Model constructs based on daughters' HPV vaccination status. The results showed that there were significant differences between mothers who reported their daughters have been vaccinated with HPV vaccine and those who reported their daughters were not vaccinated on perceived severity, perceived barriers, and perceived susceptibility. Mothers of vaccinated daughters significantly perceived HPV-related diseases to be more serious and perceived barriers and susceptibility higher than mothers of non-vaccinated daughters. Significant differences were found in total HPV knowledge, vaccine hesitancy, however no significant difference was found in perceived benefits between the two groups.

Table 4.8

Independent Samples t-Test for HPV Knowledge, Vaccine Hesitancy, and Health Belief Model Constructs by History of Adverse Reaction After Vaccination (N = 120)

Variables	Yes		No		*t (118)*	*P*	*Cohen's d*
	M	*SD*	*M*	*SD*			
HPV Knowledge	43.44	12.30	41.56	11.98	0.61	.541	0.16
HPV Vaccine Hesitancy	28.00	8.16	29.88	8.22	-0.90	.372	-0.23
Perceived Severity	12.50	5.52	13.81	9.40	-0.57	.567	-0.15
Perceived Barriers	17.17	6.20	16.81	5.22	0.26	.798	0.07
Perceived Benefits	9.83	3.67	9.04	3.91	0.80	.425	0.21
Perceived Susceptibility	6.72	2.89	6.51	2.96	0.28	.779	0.70

*Note. M = Mean; SD = Standard Deviation; Cohen's d = effect size. **p < .001.*

An independent samples t-test was conducted to examine differences in HPV knowledge, vaccine hesitancy, and Health Belief Model constructs based on participants' history of adverse reactions after vaccination. The findings showed no significant differences between the groups (with and without vaccine adverse reactions) in total HPV knowledge, vaccine hesitancy, perceived severity, perceived barriers, perceived benefits, or perceived susceptibility. There was no statistically significant difference in HPV knowledge, perceived barriers, and perceived susceptibility scores between those who had reported adverse reactions and those that did not.

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Table 4.9

One-way ANOVA by Residential Status on HPV Vaccine Hesitancy, HPV Knowledge and Health Belief Constructs (N=120)

Variable	Urban		Semi Urban		Rural		*F*	η^2	*P*
	M	*SD*	*M*	*SD*	*M*	*SD*			
Perceived Severity	14.15	8.11	13.63	4.80	12.00	13.50	0.52	.009	.596
Perceived Barriers	16.92	5.21	16.46	4.89	17.13	6.33	0.10	.002	.905
Perceived Benefits	9.81	3.55	8.83	4.07	7.54	4.22	3.31	.054	.040*
Perceived Susceptibility	6.76	2.78	6.50	2.77	5.92	3.54	0.75	.013	.475
HPV Knowledge	47.35	13.35	44.13	8.01	39.04	8.77	4.50	.071	.013*
HPV Vaccine Hesitancy	30.19	8.25	29.46	8.19	27.96	8.19	0.67	.011	.514

Note. M = *Mean*; *SD* = *Standard Deviation*; η^2 = *Eta squared*. $p \leq .05$; $\boldsymbol{p} \leq .01$; $\boldsymbol{p} \leq .001$

One-way Analysis of Variance (ANOVA) was performed to compare HPV knowledge, vaccine hesitancy and Health Belief Model constructs among the three residential areas: urban, semi-urban and rural. Results showed that perceived benefits and HPV knowledge were significantly related to residential status. Mothers in urban areas also perceived higher benefits of HPV vaccine than those in rural areas, findings also indicated. Likewise, mothers in urban areas had higher knowledge with respect to HPV compared to those in semi-urban and rural areas. There were no statistically significant differences for perceived severity, perceived barriers, perceived susceptibility, or HPV vaccine hesitancy between the residential groups, however.

Table 4.10

One-Way ANOVA for HPV Knowledge, Vaccine Hesitancy, and Health Belief Model Constructs by Education Level (N = 120)

Variable	Matric		Intermediate		Bachelors		Masters		Above Masters		*F*	η^2	*P*
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*			
Perceived Severity	13.51 10.65		12.23	5.22	11.62 4.84		15.74 10.60		13.71	4.82	0.76	.03	.557
Perceived Barriers	16.65 6.17		17.27	5.50	15.15 5.38		17.06	4.40	19.00	2.71	0.67	.02	.615
Perceived Benefits	8.42 4.25		9.27	3.87	8.23	3.59	10.42	3.33	9.43	3.60	1.44	.05	.227
Perceived Susceptibility	6.60 3.32		6.54	2.85	5.38	2.75	6.74	2.57	7.43	2.82	0.70	.02	.595
HPV Knowledge	45.23 8.20		45.23 10.05		36.85 14.19		37.81 14.77		35.57 12.29		3.59	.11	.009
HPV Vaccine Hesitancy	29.07 7.63		28.23	8.32	30.31 8.22		30.87	8.88	31.00	9.36	0.48	.02	.751

Note. M = Mean; *SD* = *Standard Deviation*; η^2 = *Eta squared*. $p \leq .05$; $\boldsymbol{p} \leq .01$; $\boldsymbol{p} \leq .001$.

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A one-way Analysis of Variance (ANOVA) was conducted to examine differences in HPV knowledge, vaccine hesitancy, and Health Belief Model constructs across education levels. The results showed that educational level was significantly related to HPV knowledge, which indicated that there was a disparity in HPV knowledge between mothers with different educational levels. There were no differences in perceived severity, barriers, benefits, susceptibility, or HPV vaccine hesitancy between education groups, however. Based on these results, it can be concluded that educational level might affect knowledge about HPV, however, health beliefs and vaccine hesitancy seemed to be consistent in the mothers regardless of their level of education.

Correlation

A Pearson correlation analysis was conducted to examine the relationships among health belief model constructs, knowledge and HPV vaccine hesitancy in mothers of young girls.

Table 4.11

Inter-Correlation of the Study Variables in Mothers of Young Girls (N=120)

Variables	*1*	*2*	*3*	*4*	*5*	*6*
1.HPV Knowledge	-	-.66**	.06	.08	-.07	-.01
2.Vaccine Hesitancy		-	-.09	.14	-.02	-.05
3.Perceived Severity			-	.39**	.52**	.52**
4.Perceived Barriers				-	-.54**	.52**
5.Perceived Benefits					-	.74**
6.Perceived Susceptibility						-

*Note. *.p < .05; **.p < .01; ***.p < .001*

Pearson product-moment correlation analysis was used to explore the associations between HPV knowledge, health belief model constructs, and HPV vaccine hesitancy among mothers of young girls. The findings showed that there was a significant negative correlation between HPV knowledge and HPV vaccine hesitancy, which means that the higher the HPV knowledge of the mothers, the lower was the level of vaccine hesitancy. Perceived severity, perceived barriers, perceived benefits, and perceived susceptibility, however, were not significantly associated with vaccine hesitancy. Moreover, the constructs of the health belief model were significantly correlated with each other. Overall, the results indicated that HPV-related knowledge seemed to be correlated with decreased HPV vaccine hesitancy, while the health belief model constructs were more strongly correlated with each other than with HPV vaccine hesitancy.

Regression Analysis

Regression analysis was run to find the predictors of HPV vaccine hesitancy in mothers of young girls.

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Table 4.12

Hierarchical Multiple Regression Predicting HPV Vaccine Hesitancy from Demographic Variables, HPV Knowledge, and Health Belief Model Constructs (N = 120)

Variables	*B*	*SE*	*β*	*95%CI*		R^2	ΔR^2
				LL	*UL*		
Model 1						.09*	.09*
Constant	15.73	5.48	_	4.87	26.59		
Age	.37	.12	.28**	.12	.61		
Education	.62	.58	.10	-.52	1.77		
Residence	-1.43	1.00	-.14	-3.40	.55		
Family System	.64	1.08	.05	-1.50	2.78		
Model 2						.57***	.48***
Constant	39.54	4.48	_	30.66	48.43		
Age	.21	.09	.16*	.03	.40		
Education	-.53	.43	-.09	-1.37	.31		
Residence	-.44	.73	-.04	-1.89	1.01		
Family System	1.57	.79	.13*	.00	3.14		
HPV Knowledge	-.50	.05	-.72***	-.59	-.40		
Perceived Severity	-.04	.07	-.05	-.19	.10		
Perceived Barriers	.48	.13	.31***	.23	.72		
Perceived Benefits	-.34	.22	-.16	-.78	.09		
Perceived Susceptibility	-.28	.28	-.10	-.83	.28		

Note. *p < .05; **p < .01; ***p < .001

A hierarchical multiple regression was performed to determine whether the demographic variables and Health Belief Model variables predicted HPV vaccine hesitancy among mothers. Demographic variables explained a small yet statistically significant amount of variance in HPV vaccine hesitancy in Model 1. The addition of the HPV knowledge and Health Belief Model constructs significantly improved the model as shown by the increase in the amount of variance explained by Model 2 (48% variance). Results showed that increased HPV related knowledge was linked with reduced HPV vaccine hesitancy, indicating that mothers with higher levels of HPV knowledge were less hesitant to vaccinate their daughters. Mothers who reported more barriers were also more vaccine hesitant, indicating that perceived barriers was a significant positive predictor. There was also a significant contribution from age and family systems as older mothers and those from joint family systems reported a bit more hesitation. After controlling for the other variables, education level, residence, perceived severity, perceived benefits, and perceived susceptibility were not significant predictors of HPV vaccine hesitancy. This indicates that the most significant factors for vaccine hesitancy among the study population were knowledge of HPV and perceived barriers.

Discussion

The present study aimed to explore the connection between health beliefs, knowledge and HPV vaccine hesitancy in mothers of young girls in Pakistan. Based on the Health Belief Model (HBM), the study aims to examine the relationship between mothers' beliefs about susceptibility to HPV vaccination, the severity of HPV vaccination, the benefits of HPV vaccination, barriers to HPV vaccination, and knowledge about HPV infection and cervical cancer with vaccine hesitancy. The study also explored how sociodemographic factors and HPV vaccine acceptance influenced HPV vaccine hesitancy.

The results of the study showed that the HPV knowledge of mothers was moderate and their HPV vaccine hesitancy was also moderate. Likewise, moderate perceived severity, perceived susceptibility, perceived benefits and perceived

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barriers were noted among the participants. The results indicate the mothers have different awareness and beliefs about HPV infection and HPV vaccination. These moderate knowledge scores suggest that some knowledge about HPV is present, but there is still a lot of information that needs to be filled in for mothers. The results align with previous international and indigenous studies that have documented low levels of awareness about HPV infection, cervical cancer, and HPV vaccination among parents/caregivers (Yu et al., 2016; Mihretie et al., 2022; Awais et al., 2026). HPV vaccination is relatively new in Pakistan, and it has not yet been widely adopted in the national immunization system, potentially leading to low levels of awareness and anxiety about vaccine safety and efficacy. The present study provided one of the key results, which indicated that HPV knowledge was found to have significant negative association with HPV vaccine hesitancy. Mothers with more knowledge about HPV infection, cervical cancer and HPV vaccination had less hesitancy to vaccinate their daughters.

In addition, regression analysis revealed that knowledge of HPV was also a significant negative predictor of vaccine hesitancy. This discovery confirms the first hypothesis of the study and it is very consistent with the first international literature. Park et al. (2020) also reported that increased HPV-related knowledge was correlated with increased vaccine acceptance and decreased hesitancy among parents. A similar study conducted by Awais et al. (2026) found that misinformation and lack of awareness about HPV vaccines are also a great hurdle to HPV vaccine acceptance in Pakistan.

The other noteworthy result of the current study was that perceived barriers was a significant positive predictor of HPV vaccine hesitancy in regression analysis. Mothers who felt that there were more barriers to HPV vaccination had higher vaccine hesitancy. This result confirms the fourth hypothesis of the study and is consistent with other studies that found that perceived barriers are one of the most significant factors associated with vaccine refusal and delay (Park et al., 2020; Gray & Fisher, 2023). These results were also consistent with Pakistani literature, which found that sociocultural beliefs, concerns about vaccine safety, religious misconceptions, fear of side effects, and a lack of reliable information were factors influencing vaccine acceptance (Khawaja et al., 2026; Noreen et al., 2025).

Interestingly, perceived susceptibility, perceived benefits, and perceived severity were not significantly associated with HPV vaccine hesitancy. Likewise, in regression analysis these variables did not significantly predict vaccine hesitancy. This result is in contradiction to the second and third hypotheses of the study. The lack of significant relationships could be due to the lack of awareness or understanding of HPV related risk among Pakistani mothers. While mothers tend to recognize that cervical cancer is a serious disease, they might not think that their daughters are at risk for HPV infection because of cultural attitudes about sexuality and morality. This finding differs slightly from Gray and Fisher (2023) and Park et al. (2020), who found that increased perceived susceptibility and vaccine benefits led to increased vaccine acceptance. But the present results could be attributed to the cultural and contextual context of Pakistan. Parents in conservative societies believe that adolescent girls are not immediately at risk for STIs as sexual activity before marriage is discouraged in their societies. Thus, even when people are aware of the seriousness of cervical cancer, their susceptibility may not be high.

Likewise, perceived benefits do not seem to play a major role when concerns about vaccine safety and mistrust are greater than perceived benefits. The results also indicated very high positive correlations between the perceived severity, perceived barriers, perceived benefits, and perceived susceptibility, indicating that these health beliefs are interrelated among mothers. Mothers who had more negative perceptions of HPV infection had more negative perceptions of susceptibility and more positive perceptions of vaccine benefits and barriers. The results are theoretically consistent with the Health Belief Model that suggests that health beliefs interact with one another and not independently. Previous research on attitudes towards HPV vaccination

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has found similar relationships between HBM constructs (Lee et al., 2026).

Another important finding of the study was that HPV vaccine hesitancy was positively correlated with mothers' age. Perceived barriers and vaccine hesitancy were relatively higher for older mothers. The result indicates that younger mothers are relatively more positive towards HPV vaccination and more inclined towards new health information than older mothers are. Kolek et al. (2022) reported similar results, determining that a maternal younger age was correlated with higher vaccine acceptance. Older mothers might be more likely to believe in traditional wisdom, cultural beliefs or misinformation, and may have more concerns about vaccine safety and/or need. Furthermore, younger mothers might have greater access to digital health information and social media campaigns focusing on HPV awareness.

This study also explored differences in vaccine attitudes among groups for demographic and vaccination-related factors. Significant differences in vaccine hesitancy were found based on family system, residential status, family history of cervical cancer, previous vaccination status, daughters' vaccination status, or history of adverse vaccination reactions. The results indicate that HPV vaccine hesitancy could be relatively high in various demographic groups in Pakistan. The findings of no association with education are somewhat conflicting with previous studies that found higher educational attainment to be related to increased vaccine acceptance (Yu et al., 2016; Mihretie et al., 2022; Khawaja et al., 2026). The findings of the present study however suggest that the awareness of the educated mothers about HPV vaccination is also limited because of inadequate public health communication and the absence of formal programs for raising awareness in Pakistan. There were significant differences in vaccine hesitancy by mothers' vaccination decision status and vaccination intentions for daughters. Mothers who had made vaccination decisions (or expressed intentions) on HPV vaccination had higher hesitancy scores. This discovery could be due to the complexity and ambivalence of vaccine decision making. Mothers who are thinking about vaccinating may be more likely to feel anxious, confused, and be exposed to conflicting information about vaccines. This may temporarily increase hesitancy even among mothers contemplating vaccination. Qualitative studies have also been conducted, revealing that parents who are hesitant to vaccinate were unsure about the vaccine and required information before deciding on vaccination (Beavis et al., 2022). The regression model accounted for 52.5% of the variance in HPV vaccine hesitancy, suggesting that HPV knowledge and health belief constructs have a significant role to predict hesitancy among mothers. HPV knowledge and perceived barriers were the strongest predictors among all predictors. The results highlight the role of informational and perceptual factors in HPV vaccination decision making. The results also provide empirical support for the applicability of the Health Belief Model in understanding HPV vaccine hesitancy in Pakistan.'

Limitations

- Additional psychological factors that could impact vaccine hesitancy were not measured in the study, including trust in health-care systems, religious beliefs, misinformation, and social media influence
- The study was designed as a cross sectional correlational research design, so that there are no causal relationships between variables.
- Self-report questionnaires were used to collect data and may have been subject to social desirability bias and response bias.
- Additionally, the Perceived Severity subscale had a relatively low reliability score and this may have influenced the association with vaccine hesitancy.
- The study did not include fathers or other family decision makers who also may impact vaccination decisions with young girls.
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Implications of the Study and Future Recommendations

The findings of the present study have clinical, public health, educational and research implications related to HPV vaccine hesitancy in mothers in Pakistan. The results highlight the

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importance of delivering accurate and culturally appropriate HPV information to parents to boost their confidence and mitigate misconceptions about HPV and vaccination. Educational institutions can also help by conducting seminars and parent counselling sessions to raise awareness among the parents and adolescents. The study is also a contribution to the scarce Pakistani literature surrounding HPV vaccine hesitancy and will serve as a basis for further research. Longitudinal and intervention studies are needed to gain a deeper understanding of determinants of vaccine hesitancy and to test interventions to enhance vaccine acceptance. Other social factors including trust in health care systems, media exposure and cultural beliefs should also be examined. In addition, culturally relevant awareness building campaigns in Urdu and regional languages, training of health care providers on communication surrounding HPV vaccines, school-based educational programs and policy interventions to increase the affordability and accessibility of HPV vaccines are recommended to increase HPV vaccine uptake in Pakistan.

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