A Digital Education Intervention Based on Protection Motivation Theory on Young Women's Intention to get HPV Vaccination

[1]Astri Mutiar[*], [2]Indah Rahayu Aprila, [1]Dewi Marfuah, [1]Dewi Srinatania
[1]Department of Nursing, STIKep PPNI Jawa Barat, Bandung
[2]Bachelor Nursing Study Program, STIKep PPNI Jawa Barat, Bandung

OPEN ACCESS
Proceeding STIKep PPNI Jawa Barat

Website :
https://proceedings.stikep-ppnijabar.ac.id/index.php/psj

Volume 1 (1), 17-28

Article info
Received : December 28, 2024
Revised : April 22, 2025
Accepted : May 02, 2025
Published : May 19, 2025

Corresponding author
Astri Mutiar*
Sekolah Tinggi Ilmu Keperawatan PPNI Jawa barat, Bandung, Indonesia
Jl. Muhammad No 34 Bandung, Indonesia
e-mail: astrimutiar@gmail.com

Citation
Mutiar, A., Aprila, I. R., Marfuah, D., & Srinatania, D. (n.d.). (2025) A Digital Education Intervention Based On Protection Motivation Theory On Young Women's Intention To Get HPV Vaccination. *Proceeding STIKep PPNI Jawa Barat,* 1 (1), 17-28.

Abstract
Objective: HPV vaccination is a crucial primary prevention strategy to reduce the incidence of HPV infection; however, vaccination rates remain low. This is closely related to individuals' intentions to receive the HPV vaccination, which plays a significant role in decreasing HPV infections and controlling cervical cancer in women. To enhance intention and promote positive health behaviors, effective education is essential. This study aims to assess the impact of Protection Motivation Theory (PMT)-based digital health education on the intention to receive the HPV vaccination among young women.
Method: A quasi-experimental design with a two-group pre-post test approach was utilized, involving 136 respondents who were divided into an intervention group (68) and a control group (68). The inclusion criteria included adolescent girls aged 16-18 years. The instrument used was based on a six-domain model. Statistical analyses were performed using paired sample t-tests and ANCOVA.
Results: The study found a significant difference in scores within the intervention group that received PMT-based digital health education, with a p-value of 0.000. Conversely, the control group did not show any significant difference in scores, with a p-value of 0.325. A significant difference in scores between both groups was also observed, with a p-value of 0.000.
Conclusion: PMT-based digital health education effectively influences the intention to receive the HPV vaccination among young women, suggesting its potential as a key strategy in increasing vaccination uptake and preventing HPV-related diseases.

Keywords: Human Papillomavirus (HPV), Intention, Digital-health education, Protection Motivation Theory (PMT), Young-women.

INTRODUCTION

One of the sexually transmitted diseases (STDs) is caused by the Human Papillomavirus (HPV) (Huang et al, 2021). Globally, HPV is one of the most common sexually transmitted diseases. More than 70% of HPV genotypes infect sexually active individuals. In women, HPV can cause cervical cancer, which is the fourth most common malignancy among women (Nick, Torabizadeh, & Ghahartars, 2021). Besides anogenital cancers, HPV can also cause genital warts in both women and men. In men, HPV may lead to diseases affecting the genitals, anal canal, and oropharynx (Sichero, Giuliano, & Villa, 2019). Primary prevention to reduce the risk of HPV infection involves the administration of the HPV vaccine. The HPV vaccine is designed to strengthen the body's defenses and protect against HPV infection (Dewi, Purnami, & Heri, 2021). In the United States, HPV vaccination rates declined by more than 70% in March 2020 due to the COVID-19 pandemic, and as of June 2020, they remained 25–50% below pre-

pandemic levels (Geopal & Mantu, 2022). According to the WHO, HPV vaccination coverage in Indonesia in 2019 was estimated to be within the range of 0%–49% (Rahmadini, Kusmiati, & Sunarti, 2022). Other data indicate that among adolescents who have received the HPV vaccine, only 1.1% have completed the two-dose regimen required for effective protection against HPV infection (Wentzensen, Clarke, & Perkins, 2021). A study revealed that only 3.1%, or 9 out of 288 adolescents, had received the HPV vaccination (Rahmadini, Kusmiati, & Sunarti, 2022; Wentzensen, Clarke, & Perkins, 2021). These findings highlight the urgent need for effective interventions to increase HPV vaccination uptake, particularly in Indonesia.

According to numerous studies, individuals are more likely to recognize the significance of a health condition when they possess adequate awareness, understand appropriate preventive strategies, and have access to timely treatment options (Marshall, Sahm, Moore, & Fleming, 2019). These elements play a pivotal role in shaping health-related decision-making, particularly in the context of preventive measures such as the human papillomavirus (HPV) vaccination. Strengthening the intention to receive the HPV vaccine is crucial, as it contributes substantially to lowering the incidence of HPV infections and plays a key role in the broader effort to prevent cervical cancer among women (Karami et al., 2016). To effectively promote vaccine uptake and support positive health behavior, educational initiatives must be not only informative but also strategically designed to engage the target population and address their specific informational and motivational needs.

Health education remains one of the most frequently implemented strategies for promoting individuals' intention to adopt healthier behaviors (Permatasari & Suprayitno, 2021). Integrating theoretical frameworks into the development of such interventions has been shown to enhance their effectiveness by offering structured insights into the mechanisms of behavior change (Huang et al., 2021). One theoretical approach that has proven particularly useful is the Protection Motivation Theory (PMT). Originally introduced by Rogers (1975), PMT suggests that individuals can be motivated to engage in protective actions through persuasive messages that influence their cognitive evaluations of a threat. The theory outlines two central processes: threat appraisal and coping appraisal. Threat appraisal involves an individual's perception of the severity and personal vulnerability related to a health risk, while coping appraisal assesses the perceived effectiveness of the recommended action and the individual's ability to perform it. When both evaluations are favorable, they contribute to heightened protective motivation, which strengthens the intention to act. In recent years, PMT has been increasingly applied in health contexts—not only to understand risk behaviors such as tobacco use but also to predict engagement in preventive actions, including participation in disease screening programs and vaccination uptake (Huang et al., 2021).

To date, limited interventions have combined digital education with theoretical frameworks to prevent HPV, particularly in the Indonesian context. Studies utilizing Protection Motivation Theory (PMT) as a foundation for health education in Indonesia have primarily focused on intentions related to breast cancer risk management. However, research exploring the application of PMT-based health education to influence HPV vaccination intentions remains scarce, especially among adolescent populations. While PMT-based interventions have been investigated in specific groups, such as the gay community, their application among adolescents in Indonesia is still underexplored. According to Dewi et al. (2021), HPV vaccination is recommended for females aged 13–26 years who have not previously received vaccination or require revaccination. This highlights the urgent need for innovative approaches, such as PMT-based health education interventions integrated with digital platforms, to improve HPV vaccination intentions among adolescents. Implementing such interventions is critical to reducing the prevalence of HPV-related diseases and addressing the current gaps in vaccination coverage in Indonesia.

METHODS

Study Design

This study utilized a quantitative research methodology with a quasi-experimental design, pre- and post-test two-group design. It was conducted at a senior high school in Bandung, West Java, Indonesia, from April to May 2023.

Intervention procedure

Before the intervention, all participants were required to complete a baseline questionnaire. The intervention group received education through videos and e-modules, with each session lasting 60–90 minutes over two weeks, comprising two sessions per week. The first session was conducted offline, where the researcher provided knowledge about the Human Papillomavirus (HPV) and the concept of the HPV vaccine using e-modules, videos, and a Q&A session. Three days later, the second session was conducted online via ZOOM. In this session, the researcher explained the severity of HPV infection, including its likelihood and adverse consequences, by discussing diseases caused by HPV. Additionally, the susceptibility to HPV was addressed by highlighting its risk factors, using e-modules, videos, and Q&A.

The third session took place in the second week on the same day as the first session, conducted online via ZOOM. This session focused on explaining the benefits of the HPV vaccine and its effectiveness through e-modules, videos, and a Q&A session. The fourth and final session was conducted three days after the third session, offline, lasting 60–90 minutes. During this session, the researchers facilitated group discussions emphasizing the severity and vulnerability of HPV infection and building self-confidence for undergoing HPV vaccination. After completing the intervention, participants were asked to fill out a post-education questionnaire. In contrast, the control group received no intervention and only completed questionnaires at the same time points as the intervention group.

Population and Sample

The target population consisted of young women aged 16–18 years in Bandung, West Java. The sample size was determined using G*Power software version 3.1.9.2, employing an F-Test for ANCOVA (fixed effects, main effects, and interactions). The calculation assumed an effect size of 0.25, an alpha error probability of 0.05, a power of 0.80, and one covariate, resulting in a minimum required sample size of 128 participants. To account for an expected 10–15% attrition rate, the final sample size was adjusted to 147 respondents.

Sampling was conducted using stratified random sampling, selecting 6–7 female students from each of the 23 classes, including all students from classes X and XI, resulting in 150 students. These 150 students were then divided into two groups by assigning students numbered 1–75 to the intervention group and 76–150 to the control group. However, during the recruitment process, only 68 participants in each group agreed to participate in the study, resulting in 136 respondents across both groups. Research assistance was provided by nursing students who were also researching a related theme, specifically in the field of maternity nursing.

Research Instrument

Two questionnaires were utilized in this study. The first was a demographic questionnaire to collect information on participants' age, and major in school. Parents' level of education, and parents' monthly income. The second questionnaire, used to measure intention, was adapted from Huang et al. (2021) and based on the constructs of Protection Motivation Theory (PMT). It consisted of 21 items, categorized as follows: Perceived Severity (3 items): Assessed on a Likert scale ranging from 1 (Very low) to 5 (Very high). Higher scores indicate greater perceived severity. Perceived Vulnerability (4 items): Two items were rated on a Likert scale from 1 (Very low) to 5 (Very high), while the remaining two were rated on a scale from 1 (None) to 4 (High). Higher scores reflect greater perceived vulnerability. Response Efficacy (3 items): Measured on a Likert scale from 1 (Strongly disagree) to 5 (Strongly agree). Higher scores indicate greater belief in the effectiveness of taking action. Self-Efficacy (3 items):

Assessed on a Likert scale from 1 (Strongly disagree) to 5 (Strongly agree). Higher scores suggest greater confidence in the ability to take action. Knowledge (7 items): Scored as follows; three items used a binary scale (1 = Correct, 0 = Incorrect); two items used a reversed binary scale (1 = Incorrect, 0 = Correct); one item included nine options, with each correct choice receiving one point; and one item assessed the number of vaccine doses completed. Higher scores indicate greater knowledge. The intention to receive the HPV vaccination was assessed with one item, rated on a Likert scale ranging from 1 (Very low) to 5 (Very high). Higher scores indicate a stronger intention to get the HPV vaccination. All items were summed to calculate the total score. A higher total score indicates a stronger overall intention to receive the HPV vaccination.

The validity of the PMT questionnaire was confirmed using Confirmatory Factor Analysis (CFA), with a factor loading of 0.884. The Composite Reliability (CR) values were all above 0.7, indicating good internal consistency, while the Average Variance Extracted (AVE) values were not less than 0.5, demonstrating good convergent validity. The questionnaire was translated into Indonesian and achieved a Content Validity Ratio (CVR) score of 0.95.

Data Analysis

Data analysis was conducted using the statistical software package IBM SPSS version 26. Normality tests were performed on the data before applying statistical analyses. Descriptive statistics were used to summarize the data. Quantitative variables (e.g., age) were described using mean, standard deviation (SD), and range. Categorical variables (e.g., participant's major in school, parents' level of education, and parents' income) were summarized using frequencies and percentages. A paired t-test was used to assess differences within groups. Meanwhile, ANCOVA was employed to compare pre-and post-intervention outcomes between the control and intervention groups. Statistical significance was set at a p-value < 0.05.

Ethical Considerations

This study received ethical approval from the Ethics Committee of STIKep PPNI Jawa Barat (Approval No. III/013/KEPK-SLE/STIKEP/PPNIJABAR/IV/2023). Prior to data collection, all participants were informed about the purpose and procedures of the study and provided written consent to participate voluntarily.

RESULTS

The mean age of respondents in the intervention group was 16.41 ± 0.553 years, while in the control group, it was 16.26 ± 0.477 years. Regarding academic majors, the majority of respondents in the intervention group were enrolled in social studies, comprising 35 individuals (51.5%), while in the control group, the majority were in science, with 37 individuals (54.4%). The education level of the respondents' parents was predominantly high school in both groups. In terms of parental income, the most common category in the intervention group was uncertain income, accounting for 27 individuals (39.7%), while in the control group, it was income up to IDR 2,000,000 (125.60 USD), also accounting for 27 individuals (39.7%).

Analysis of differences in respondent characteristics, including age, class, major, parental education, and parental income, was conducted using the chi-square test and independent t-test. The results indicated no significant differences between the intervention and control groups, confirming that the characteristics of both groups were homogeneous.

Table 1. Demographic characteristics of respondents (n=136)

Variable	Intervention (n=68)	Control (n=68)	*p-value*
Age (years) Mean±SD	16.41±0.55	16.26±0.48	0.099[a]

Major			
Science	33 (48.5%)	37 (54.4%)	0.611^b
Social	35 (51.5%)	31 (45.6%)	
Parents' Level of Education			
Elementary School	8 (11.8%)	7 (10.3%)	0.444^b
Junior High School	16 (23.5%)	18 (26.5%)	
Senior High School	39 (57.4%)	31 (45.6%)	
Bachelor's Degree	5 (7.4%)	10 (14.7%)	
Master's Degree	0 (0%)	2 (2.9%)	
Parents' Monthly Income (IDR)*			
< 2,000,000	23 (33.8%)	27 (39.7%)	0.154^b
2,000,000 – 5,000,000	18 (26.5%)	20 (29.4%)	
> 5,000,000	0 (0%)	9 (13.2%)	
Uncertain	27 (39.7%)	12 (17.6%)	

Note: [a]Independent t-test for age; chi-square test for categorical variables; * 1 IDR : 0.00006 USD

The results indicate a significant change in the intention to vaccinate against the Human Papillomavirus (HPV) following the digital health education intervention based on the Protection Motivation Theory (PMT). In the intervention group, the intention scores showed a significant improvement, with a p-value of .000 (<.001). In contrast, the control group did not exhibit a significant change, as evidenced by a p-value of 0.325 (>.05). These findings demonstrate that digital health education based on Protection Motivation Theory (PMT) effectively enhances the intention to vaccinate against HPV among young womens.

Table 2. Intention to get HPV Vaccination within the two groups before and after the intervention

Variable	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	t	Mean Difference	P-value
Total Score					
Intervention Group	43.29 ± 9.42	59.13 ± 8.19	-10.032	15.84	<.001*
Control Group	41.23 ± 7.45	42.50 ± 7.23	-.992	1.27	.325
Perceived Severity					
Intervention Group	8.632±3.142	11.838±2.629	10.2	3.21	<.001*
Control Group	8.823±2.461	8.705±2.279	.4	-.12	.660
Perceived Vulnerability					

Variable	Pre-test (Mean ± SD)	Post-test (Mean ± SD)	t	Mean Difference	P-value
		10.411±3.490			
Intervention Group	8.205±2.847		5.4	2.21	<.001*
	7.500±2.617				
Control Group		8.735±2.836	3.6	1.23	<.001*
Response Efficacy					
	9.852±2.813	12.647±1.998			
Intervention Group			12.1	2.79	<.001*
	9.411±2.450	9.308±2,227			
Control Group			.3	-.10	.752
Self-Efficacy					
	8.794±2.403	12.176±2.252			
Intervention Group			10.4	3.28	<.001*
	8.220±1.968	8.294±1.893			
Control Group			.2	.07	.825
Knowledge					
	4.955±1.757	7.720±1.534			
Intervention Group			8.8	2.76	<.001*
	4.691±1.721	4.897±1.594			
Control Group			.7	.21	.508
Intention					
	2.85±0.902	4.34±0.857			
Intervention Group			4.7	1.49	<.001*
	2.59±1.011	2.56±0.853			
Control Group			.1	-.03	.924

Table 2 presents the mean scores of pre-test and post-test results across various domains, including severity, vulnerability, response effectiveness, self-confidence, knowledge, and intention. The results show that the response effectiveness domain had the highest post-test mean score in the intervention group, with a score of 12.647 (SD 1.998). Furthermore, all domains in the intervention group demonstrated a significant increase in scores between the pre-test and post-test. In contrast, in the control group, only the perceived vulnerability domain showed a significant difference between the pre-test and post-test scores. This highlights the effectiveness of the intervention in enhancing multiple domains related to HPV vaccination in the intervention group.

Table 3. ANCOVA results of pre- and post-intervention scores

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.

Corrected Model	9436,158[a]	2	4718,079	78,711	,000
Intercept	14730,938	1	14730,938	245,754	,000
Pre-test score	30,563	1	30,563	,510	,476
Groups	9396,914	1	9396,914	156,768	,000
Error	7972,246	133	59,942		
Total	368599,000	136			
Corrected Total	17408,404	135			

a.R Squared = ,542 (Adjusted R Squared = ,535)

The results indicate a significant effect on the post-test intention scores following the intervention, with a p-value of 0.000 (<0.001), suggesting that the intervention had a meaningful impact (Table 3). The R-squared value was 0.542, meaning that 54.2% of the variation in the intention to vaccinate against HPV is explained by the Protection Motivation Theory (PMT)-based digital health education intervention. Based on these findings, it can be concluded that health education interventions grounded in Protection Motivation Theory (PMT) have a significant impact on the intention of adolescent girls to undergo Human Papillomavirus (HPV) vaccination

DISCUSSION

The findings of the study indicate that the intervention group exhibited significant changes in pre- and post-test scores, including improvements across all domains, while the control group showed no statistically significant differences. This discrepancy may be attributed to the understanding that intention is a confluence of will and action, which plays a crucial role in behavior modification. When individuals harbor positive intentions, their subsequent actions are more likely to reflect those intentions. Health behavior is influenced not only by an individual's intention to achieve health goals but also by external factors such as community support and access to health-related knowledge and information (Jirwanto, 2021).

While direct comparisons are challenging, previous research has consistently demonstrated that health education interventions can significantly enhance intention. In alignment with Minh et al. (2020), the study found that mothers of male students who received HPV health education exhibited a significantly higher level of knowledge about HPV compared to those who did not participate in the educational intervention. Furthermore, the intervention group showed a markedly higher intention to vaccinate against HPV than the control group (Zomordi et al, 2022; Marshall et al, 2022; Chu et al, 2021). These findings underscore the effectiveness of health education interventions based on Protection Motivation Theory (PMT) in enhancing intention within the intervention group. This is consistent with Conley et al. (2023), whose research demonstrated that PMT-informed interventions effectively influence behavioral intentions through key constructs such as risk perception, self-efficacy, and adaptive responses.

The perceived severity domain demonstrated a significant increase in the intervention group, highlighting the potential of digital health education as an effective tool for shaping health perceptions. This finding aligns with prior research indicating that educational interventions rooted in Protection Motivation Theory (PMT) can enhance knowledge and promote self-protective behaviors across diverse populations (Sayed, Al-Mohaithef, & Elgzar, 2022; Rakhshani et al., 2024). By effectively conveying the risks associated with specific health threats, such interventions can heighten

individuals' awareness and urgency, thereby motivating them to adopt protective measures.

In the vulnerability domain, a significant increase was observed in the intervention group. The increase in perceived vulnerability among participants suggests that the digital health education intervention effectively conveyed the risks associated with specific health threats, thereby heightening participants' awareness of their susceptibility. This finding aligns with existing literature emphasizing the critical role of education in shaping health perceptions (van de Vijver, 2023). Digital platforms, in particular, offer the advantage of delivering tailored and context-specific information that resonates with individuals' experiences, thereby enhancing their understanding of personal vulnerability. For example, previous studies have demonstrated that educational interventions can significantly improve knowledge and self-efficacy concerning health threats, both of which are integral components of Protection Motivation Theory (PMT) (Sayed, Al-Mohaithef, & Elgzar, 2022; van de Vijver, 2023). These results underscore the potential of digital health education in promoting protective health behaviors through improved awareness and motivation.

The notable improvement in participants' perceptions of the HPV vaccine's effectiveness following the digital health education intervention indicates that the program successfully enhanced their understanding of the vaccine's protective role. This suggests that the content was able to communicate the scientific and practical benefits of HPV vaccination, particularly in preventing high-risk HPV strains associated with cervical and other anogenital cancers. This outcome aligns with a growing body of evidence emphasizing that effective health communication can significantly shape health-related attitudes and behaviors (Kim et al., 2024; Dubé et al., 2015). When individuals receive accurate, clear, and relevant information about the efficacy and safety of vaccines, their confidence in vaccination tends to increase, which in turn positively influences their intention to get vaccinated. For instance, greater awareness of how HPV vaccination contributes to long-term cancer prevention has been shown to encourage proactive decision-making, especially among populations at risk (van de Vijver, 2023; Holman et al., 2014).

These findings highlight the crucial role of health education strategies that go beyond simply providing information. Interventions should be designed to build trust, reduce perceived barriers, and emphasize the personal relevance of vaccination benefits (Brewer et al., 2017). Addressing misconceptions and reinforcing the protective value of the vaccine through persuasive, theory-informed messaging—such as that based on Protection Motivation Theory—can significantly strengthen behavioral intention and public health outcomes. Therefore, comprehensive and targeted educational efforts remain essential for increasing vaccine uptake and mitigating the burden of preventable HPV-related diseases.Moreover, in self-efficacy domains also found the significantly increasing score following digital health education suggests that the intervention effectively communicated not only the importance of HPV vaccination but also provided participants with the tools and confidence to pursue it. This aligns with previous studies that have linked enhanced self-efficacy to increased vaccine uptake. For instance, a study highlighted that self-efficacy significantly predicted HPV vaccination behaviors among adolescents, indicating that those with higher self-efficacy were more likely to receive the vaccine (Yin et al, 2024; Lismidiati, Hasyim, Parmawati, & Wicaksana, 2022).

The knowledge domain also demonstrated significant improvement following the intervention. Research consistently supports the idea that educational interventions can substantially enhance knowledge about HPV and its vaccine. For example, a study found that web-based health education led to a notable increase in awareness and knowledge scores among female college students, which subsequently influenced their willingness to receive the vaccine (Zhang, et al., 2022; Sitaresmi, Rozanti, Simangunsong, & Wahab, 2020). This finding aligns with the tenets of

Protection Motivation Theory (PMT), which suggests that increased knowledge can strengthen individuals' perceptions of both their vulnerability to health threats and the effectiveness of protective actions (Alanzi, et al., 2024). Consequently, the acquisition of knowledge can foster greater motivation to engage in protective behaviors, such as vaccination, by empowering individuals with a deeper understanding of the risks and benefits involved (Cheema, et al., 2024).

All the findings indicate that the digital health education intervention implemented in this study provides strong evidence for its effectiveness in enhancing the intention to receive the HPV vaccination. This intervention represents a novel research topic in Indonesia, contributing valuable insights into the application of digital health education based on PMT for promoting vaccination intentions, particularly among young women. The results underscore the potential of such interventions to improve public health outcomes, offering a promising avenue for addressing low vaccination rates in the country.

However, certain limitations of this study should be acknowledged. First, the intervention was conducted as a single-center study with a short duration, which may limit the generalizability of the findings. Future prospective studies with repeated measurements are necessary to evaluate the long-term and persistent effects of the intervention on improving intention. Additionally, the homogeneity of the respondent population represents another limitation. Expanding the study to include a more diverse sample in terms of ethnicity and geographic location would enhance the applicability and relevance of the findings to broader populations of young women.

CONCLUSION

The primary objective of this study was to examine the impact of a digital health education intervention, structured around the principles of Protection Motivation Theory (PMT), on increasing the intention of young women to receive the human papillomavirus (HPV) vaccine. The analysis revealed that the intervention had a meaningful effect, significantly enhancing participants' motivation to pursue vaccination. Despite these encouraging outcomes, the study also highlighted the importance of continued educational reinforcement to support the development and retention of essential behavioral skills over time. Without sustained engagement, the initial gains in intention may not necessarily translate into long-term action. Therefore, future research should focus on addressing the methodological and contextual limitations identified in this study. This includes refining the intervention content, exploring different delivery methods, and incorporating long-term follow-up assessments to better understand how digital education can be optimized for lasting behavioral change in preventive health contexts.

Acknowledgment

We extend our gratitude to all participants who contributed to this study and to STIKep PPNI Jawa Barat for their financial support in facilitating this research.

Conflict of interest

All authors declare no conflicts of interest.

References

Alanazi, A. K., Kayal, E., Alanzi, S., Al Hodian, H., & Bin Rusayes, A. (2024). Knowledge and awareness toward human papillomavirus vaccination among Saudi female nursing students. *Frontiers in Global Women's Health, 5*, 1470048.

Brewer, N. T., Chapman, G. B., Rothman, A. J., Leask, J., & Kempe, A. (2017). Increasing vaccination: Putting psychological science into action. Psychological Science in the Public Interest, 18(3), 149–207. https://doi.org/10.1177/1529100618760521

Cheema, S., Abraham, A., Maisonneuve, P., Jithesh, A., Chaabna, K., Al Janahi, R., ... & Mamtani, R. (2024). HPV infection and vaccination: a cross-sectional study of knowledge, perception, and attitude to

vaccine uptake among university students in Qatar. *BMC Public Health, 24*(1), 2316.

Conley, C. C., Wernli, K. J., Knerr, S., Li, T., Leppig, K., Ehrlich, K., Farrell, D., Gao, H., Bowles, E. J. A., Graham, A. L., Luta, G., Jayasekera, J., Mandelblatt, J. S., Schwartz, M. D., & O'Neill, S. C. (2023). Using Protection Motivation Theory to Predict Intentions for Breast Cancer Risk Management: Intervention Mechanisms from a Randomized Controlled Trial. *Journal of Cancer Education, 38*(1), 292–300. https://doi.org/10.1007/s13187-021-02114-y

Dewi, P. I. S., Purnami, L. A., & Heri, M. (2021). Sikap Remaja Putri tentang Kanker Serviks dengan Motivasi Remaja Melakukan Vaksinasi HPV. *Jurnal Keperawatan Silampari, 5*(1), 51–58. https://doi.org/10.31539/jks.v5i1.2377

Dubé, E., Gagnon, D., MacDonald, N. E., & the SAGE Working Group on Vaccine Hesitancy. (2015). Strategies intended to address vaccine hesitancy: Review of published reviews. Vaccine, 33(34), 4191–4203. https://doi.org/10.1016/j.vaccine.2015.04.041

Geopal, J. R., & Melani Rakhmi Mantu. (2022). Gambaran tingkat pengetahuan siswi sman 3 kota jambi mengenai vaksin hpv pada januari-maret 2022. 4. https://doi.org/: https://doi.org/10.33024/mnj.v4i11.7434

Glanz, K., Rimer, B. K., & Viswanath, K. (Eds.). (2008). Health behavior and health education: Theory, research, and practice (4th ed.). Jossey-Bass.

Holman, D. M., Benard, V., Roland, K. B., Watson, M., Liddon, N., & Stokley, S. (2014). Barriers to human papillomavirus vaccination among US adolescents: A systematic review of the literature. JAMA Pediatrics, 168(1), 76–82. https://doi.org/10.1001/jamapediatrics.2013.2752

Huang, R., Wang, Z., Yuan, T., Nadarzynski, T., Qian, H. Z., Li, P., Meng, X., Wang, G., Zhou, Y., Luo, D., Wang, Y., Cai, Y., & Zou, H. (2021). Using protection motivation theory to explain the intention to initiate human papillomavirus vaccination among men who have sex with men in China. *Tumour Virus Research, 12*, 200222. https://doi.org/10.1016/j.tvr.2021.200222

Jirwanto, H. (2021). Hubungan Tingkat Pengetahuan Kanker Serviks Dengan Minat Untuk Vaksinasi HPV Pada Mahasiswi Fakultas Kedokteran Universitas HKBP Nommensen Medan. *Nommensen Journal of Medicine, 6*(2), 58–61. https://doi.org/10.36655/njm.v6i2.492

Karami-Matin B, Barati M, Javadzade H, et al. (2016). Knowledge of cervical cancer: a cross sectional study among women's in the west of Iran. *Int Bus Manag*, 10, 3010–4.

Kim, J. H., Lee, H. J., & Choi, M. (2024). Digital health communication and HPV vaccine uptake: A randomized controlled trial. Health Education Research, 39(1), 12–25. https://doi.org/10.1093/her/cyad003

Kim, Y., Lee, H., Park, J., Kim, Y. C., Kim, D. H., & Lee, Y. M. (2024). eHealth Communication Intervention to Promote Human Papillomavirus Vaccination Among Middle-School Girls: Development and Usability Study. *JMIR Formative Research, 8*(1), e59087. doi:10.2196/59087

Krawczyk, A., Perez, S., Lau, E., Holcroft, C. A., Amsel, R., & Rosberger, Z. (2015). Human papillomavirus vaccination intentions and uptake in college women. Health Psychology, 34(10), 1010–1017. https://doi.org/10.1037/hea0000205

Lismidiati, W., Hasyim, A. V. F., Parmawati, I., & Wicaksana, A. L. (2022). Self-Efficacy to Obtain Human Papillomavirus Vaccination among Indonesian Adolescent Girls. *Asian Pacific Journal of Cancer Prevention: APJCP, 23*(3), 789. doi: 10.31557/APJCP.2022.23.3.78

Marshall, S., Sahm, L., Moore, A., & Fleming, A. (2019). A systematic approach to map the adolescent human papillomavirus vaccine decision and identify intervention

strategies to address vaccine hesitancy. *Public Health*. https://doi.org/10.1016/j.puhe.2019.07.009

Milne, S., Sheeran, P., & Orbell, S. (2000). Prediction and intervention in health-related behavior: A meta-analytic review of Protection Motivation Theory. Journal of Applied Social Psychology, 30(1), 106–143. https://doi.org/10.1111/j.1559-1816.2000.tb02308.x

Minh, D. N., Taneepanichskul, N., & Hajek, R. (2020). Effectiveness of a health talk education program on human papillomavirus (HPV) knowledge, attitudes, and intentions to vaccinate children among mothers of secondary school boys in Thua Thien Hue Province, Vietnam. *Risk Management and Healthcare Policy, 13*, 1207–1214. https://doi.org/10.2147/RMHP.S259097

Newman, P. A., Logie, C. H., Lacombe-Duncan, A., & Baiden, P. (2022). Parents' uptake of human papillomavirus vaccines for children: A meta-analysis of observational studies. The Lancet Public Health, 7(3), e226–e236. https://doi.org/10.1016/S2468-2667(21)00267-4

Nick, N., Torabizadeh, C., & Ghahartars, M. (2021). Perceived supportive paradox after diagnosing human papillomavirus: A qualitative content analysis. *International Journal of Community Based Nursing and Midwifery, 9*(2), 92–105. https://doi.org/10.30476/ijcbnm.2021.88802.1547

Perkins, R. B., & Clark, J. A. (2012). Providers' attitudes toward human papillomavirus vaccination in young men: Challenges for implementation of 2011 recommendations. American Journal of Men's Health, 6(4), 320–323. https://doi.org/10.1177/1557988312441661

Permatasari, D., & Suprayitno, E. (2021). Pendidikan Kesehatan Reproduksi pada Remaja. *Jurnalempathy Com, 2*(1), 1–5. https://doi.org/10.37341/jurnalempathy.v2i1.46

Plotnikoff, R. C., & Trinh, L. (2010). Protection Motivation Theory: Is this a worthwhile theory for physical activity promotion? Exercise and Sport Sciences Reviews, 38(2), 91–98. https://doi.org/10.1097/JES.0b013e3181d49612

Rahmadini, A. F., Kusmiati, M., & Sunarti, S. (2022). Faktor-Faktor yang Berhubungan dengan Perilaku Remaja Terhadap Pencegahan Kanker Serviks Melalui Vaksinasi HPV. *Jurnal Formil (Forum Ilmiah) Kesmas Respati, 7*(3), 317. https://doi.org/10.35842/formil.v7i3.458

Rakhshani, T., Nikeghbal, S., Kashfi, S. M., Kamyab, A., Harsini, P. A., & Jeihooni, A. K. (2024). Effect of educational intervention based on protection motivation theory on preventive behaviors of respiratory infections among hospital staff. *Frontiers in Public Health, 11*, 1326760. https://doi.org/10.3389/fpubh.2023.1326760

Rogers, R. W. (1975). A Protection Motivation Theory of Fear Appeals and Attitude Change. *The Journal of Psychology, 91*(1), 93–114. https://doi.org/10.1080/00223980.1975.9915803

Rogers, R. W. (1975). A protection motivation theory of fear appeals and attitude change. The Journal of Psychology, 91(1), 93–114. https://doi.org/10.1080/00223980.1975.9915803

Sayed, S. H., Al-Mohaithef, M., & Elgzar, W. T. (2022). Effect of Digital-Based Self-Learned Educational Intervention about COVID-19 Using Protection Motivation Theory on Non-Health Students' Knowledge and Self-Protective Behaviors at Saudi Electronic University. *International Journal of Environmental Research and Public Health, 19*(22), 14626. https://doi.org/10.3390/ijerph192214626

Sichero, L., Giuliano, A. R., & Villa, L. L. (2019). Human Papillomavirus and Genital Disease in Men: What We Have Learned from the HIM Study. *Acta Cytologica, 63*(2), 109–117. https://doi.org/10.1159/000493737

Sitaresmi, M. N., Rozanti, N. M., Simangunsong, L. B., & Wahab, A. (2020). Improvement of Parent's awareness, knowledge, perception, and acceptability of human papillomavirus vaccination after a structured-educational intervention. *BMC Public Health, 20*, 1-9. https://doi.org/10.1186/s12889-020-09962-1

van de Vijver, N. (2023). Exploring HPV vaccine perceptions and decision-making among young adults: Implications for education and policy. Preventive Medicine Reports, 33, 102200. https://doi.org/10.1016/j.pmedr.2023.102200

van de Vijver, S., Tensen, P., Asiki, G., Requena-Méndez, A., Heidenrijk, M., Stronks, K., Cobelens, F., Bont, J., & Agyemang, C. (2023). Digital health for all: How digital health could reduce inequality and increase universal health coverage. *Digital Health, 9*, 20552076231185434. https://doi.org/10.1177/20552076231185434

Wentzensen, N., Clarke, M. A., & Perkins, R. B. (2021). Impact of COVID-19 on cervical cancer screening: Challenges and opportunities to improving resilience and reduce disparities. *Preventive Medicine, 151*(February), 106596. https://doi.org/10.1016/j.ypmed.2021.106596

Wong, M. C., Wong, E. L., Huang, J., Cheung, A. W., Law, K., Chong, M. K., Ng, R. W., Lai, C. K., Boon, S. S., Lau, J. T., & Chan, P. K. (2020). Acceptance of the COVID-19 vaccine based on the Health Belief Model: A population-based survey in Hong Kong. Vaccine, 39(7), 1148–1156. https://doi.org/10.1016/j.vaccine.2020.12.083

Yin, X., Zhang, M., Wang, F., Huang, Y., Niu, Y., Ge, P., ... & Wu, Y. (2023). A national cross-sectional study on the influencing factors of low HPV vaccination coverage in mainland China. *Frontiers in Public Health, 10*, 1064802. https://doi.org/10.3389/fpubh.2022.1064802

Zhang, X., Chen, H., Zhou, J., Huang, Q., Feng, X. Y., & Li, J. (2022). Impact of web-based health education on HPV vaccination uptake among college girl students in Western and Northern China: a follow-up study. *BMC Women's Health, 22*(1), 46. https://doi.org/10.1186/s12905-022-01625-0