

# From Knowing To Deciding: How Attitudes And Perceived Susceptibility Shape HPV Vaccine Intentions

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| <p><b>Keywords:</b><br/>         HPV<br/>         Vaccination,<br/>         Vaccine<br/>         Intention,<br/>         Perceived<br/>         Susceptibility,<br/>         Vaccine<br/>         Attitudes,<br/>         Health Belief<br/>         Model, Adult<br/>         Women.</p> | <p><b>Abstract</b></p> <p><b>Objective</b><br/>         This paper aimed at analyzing the psychological processes that affect HPV vaccination intention among adult women. The researchers particularly examined the mediating risk of vaccine attitudes and beliefs on the relationship involving HPV awareness and vaccination intention, and the moderation impact of perceived vulnerability.</p> <p><b>Methodology</b><br/>         The survey design used was cross-sectional and quantitative. A sample of 163 adult females who used a convenience and snowball sampling technique was used to collect data. The participants took standardized tests of HPV knowledge, attitudes, beliefs (CHIAS scale), perceived susceptibility, and intended to vaccinate. The analysis of the data included the correlation, bootstrapped mediation analysis, and moderated regression.</p> <p><b>Findings</b><br/>         The findings denoted that there was a significant positive correlation between HPV awareness and the attitudes/beliefs about the vaccine. The projected mediation route whereby knowledge is translated into intention via attitudes was not supported. Perceived susceptibility was determined as the biggest and most important direct predictor of intention to vaccination but the suggested moderating effect was not significant. One of the major methodological findings was the low reliability of the composite attitude scale, which means that the multidimensional subscales in the composite should be studied separately.</p> <p><b>Significance</b><br/>         This paper has highlighted the importance of the perceived personal risk in the use of HPV among adult females to influence the HPV vaccination position, challenging the primacy of the general beliefs. It offers an essential methodological framework upon which additional research relating to vaccine reluctance will be conducted and the need to have the public health messages that effectively communicate vulnerability to HPV.</p> <p><b>Research limitations</b><br/>         The cross-sectional nature of the study and reliance on self-reported data limits the study to causation. Given that a non-probability sample has been used, it could have an effect on generalizability. The main limitation is the poor internal consistency of</p> |
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|  | the overall measure of attitude indicating that further research is needed to study its subparts. |
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## **1.Introduction**

### **1.1 Background**

Human Papillomavirus (HPV) is a widespread and high profile health problem in the world, recognized as the most prevalent sexually transmitted disease in the world (Chesson et al., 2014). There are approximately 200 known genotypes, of which approximately 14 are high-risk oncogenic forms, of which HPV 16 and 18 are the most pathogenic, and they cause approximately 70% of all cases of cervical cancer in the world (de Martel et al., 2017; Walboomers et al., 1999). Cervical cancer is a major global health issue, as it is the fourth most common cancer among the female population with about 604, 000 new diagnoses and 342,000 deaths annually, which predominantly affects low- and middle-income countries where screening is limited, and access to treatments is limited (Sung et al., 2021). Besides playing a crucial role in cervical carcinogenesis, HPV is also linked with a substantial pool of other anogenital malignancies, such as vulvar, vaginal, penile, and anal cancer, and is becoming a major cause of oropharyngeal cancer, affecting both genders and constituting a nationwide menace to health (Saraiya et al., 2015; Gillison et al., 2008).

The advent of the 21 st century brought a great development in the cancer prevention through the development of safe and efficient preventive vaccination of HPV. Subsequent versions, the bivalent, quadrivalent, and nonavalent vaccines, have demonstrated impressive levels of efficacy, immunogenicity, and safety in large clinical trials and post-licensure surveillance of the initial vaccine (Garland et al., 2016; Schiller and Markowitz, 2018). The nonavalent vaccine offers comprehensive defense against seven high-risk HPV types associated with approximately 90% of cervical cancers and two types low-risk HPV types that cause approximately 90% of genital warts, which is an important and transformative tool of primary prevention (Joura et al., 2015). The global campaign to eliminate cervical cancer as a social health challenge was launched by the World Health Organization, which is essentially based on the achievement of 90 per cent. of vaccination of girls at the age of 15 (WHO, 2020). It will save millions of lives in the next century and when this plan is effectively implemented, it will be one of the significant improvements in the field of public health.

The process of scientific innovation through to the overall societal influence is burdened with numerous obstacles. Although there is obvious evidence of the vaccine safety and efficacy, the coverage rates worldwide are still unsatisfactory, and the gap between the availability of vaccines and general acceptance is more than sufficient but is disturbing (Damgacioglu et al., 2022; Shapiro et al., 2022). In many countries with high incomes, the rates of vaccination have stabilized at a level lower than the national goals, and in low-resource settings, logistical and financial barriers make the situation worse (Bruni et al., 2022). This timeless gap points to an enormous paradigm shift: the major challenge in dealing with HPV-related cancers has shifted off of biomedical science, which aims at the development of an effective vaccine, to the one that is deeply rooted in health psychology, behavioral science, and socio-ecological systems. The complexity of factors affecting the decision to take a vaccine, particularly the cognitive and emotional mechanisms that connect the knowledge to action, has become a central issue in the global campaign to eliminate cervical cancer and reduce the consequences of the diseases caused by HPV.

### **1.2 Research Gap and Problem definition.**

A significant amount of research showed that there exists a basic relationship between general knowledge of HPV and vaccine between intent (Bennett et al., 2012). This connection is sophisticated and often irregular, indicating that there is a large gap in knowledge-intention (Massey et al., 2016). It is not always

the dissemination of information that will lead to the acceptance of vaccination, which means that the process is not a simple one but is conditioned by a complex network of psychological factors.

There are two major gaps that are found in this analysis. First, it will attempt to clarify the mediation process in which knowledge influences intention. The present work makes use of the multi-dimensional Carolina HPV Immunization Attitudes and Beliefs Scale (CHIAS) to examine this mediation with more specificity, in spite of the broad discussion of the attitudes. We claim that HPV knowledge has no direct effect on intention, but rather has an effect on some, measurable, aspects of attitude; the perceived Harms and Barriers of the vaccine and the perceived Effectiveness of the vaccine. A parent can have a lot of information that HPV causes cancer; however, when the parent is convinced that the vaccination is dangerous, he will not have much to aim.

This paper investigates one of the key boundary conditions of this process, which is the moderating effect of Perceived Susceptibility. According to the model developed by Gerend and Shepherd (2012), we can state that the knowledge impact on attitudes is not universal. An individual with low perceived susceptibility (the person believes that he or she is not at risk of being inflicted by HPV) may ignore the facts, preventing the formation of positive attitudes towards the importance of the vaccine. On the other hand, to a person who is risk-perceiving, the same knowledge could be more salient and have an important impact on his/her attitudes. This paper looks at an integrated model where the indirect influence of knowledge on intention by the CHIAS constructs depends on the degree of perceived susceptibility.

### **1.3 Comprehensive Theory**

This paper is essentially anchored on the integration of the Health Belief Model (HBM) and the Theory of Planned Behavior (TPB) which is automatically aligned to the chosen scales.

The health belief model (Rosenstock, 1974) has a moderating variable and other mediators. One of the key elements of the Health Belief Model (HBM) is the moderator, Perceived Susceptibility. Additionally, CHIAS subscales are similar to other elements of the Health Belief Model: Perceived Barriers (conceptually defined by the CHIAS "Barriers" subscale) and Perceived Benefits (theoretically measured by the CHIAS "Effectiveness" subscale). The CHIAS "Hamps" subscale represents an important kind of perceived barrier.

Mediation pathway is developed on the basis of the comprehensive groundwork of the Theory of Planned Behavior (Ajzen, 1991). The Attitude construct in the TPB is operationalized in this study, but not as an individual item, a multi-dimensional measure developed based on the CHIAS scale, comprising of Harms, Barriers, and Effectiveness. Behavioral Intention is the dependent variable measured using the standard intention scale using the Theory of Planned Behavior (TPB).

The combination of the two models allows us to test a process that is theoretically consistent: The Knowledge about HPV also influences the Theory of Planned Behavior Attitude (measured by CHIAS), which in turn influences the Vaccine Intention, and the Health Belief Model Perceived Susceptibility moderates the former relations in this cause-effect relationship.

### **1.4 Research Questions**

How do the attitudinal domains of Harms, Barriers, and Effectiveness (measured by the CHIAS) mediate the relationship between general HPV awareness and the intention to get the HPV vaccination and to what extent is this mediating relationship moderated by perceived susceptibility?

#### **Sub-queries:**

**1:**Do CHIAS (Harms, Barriers, Effectiveness) subscales mediate between HPV knowledge and vaccination intention (HPV knowledge to vaccination intention) and the combination (HPV knowledge to vaccination intention)?

**2:** Does perceived susceptibility modify the relationship between HPV knowledge and every of the CHIAS subscales?

**3:** Does the indirect influence of HPV knowledge on vaccination intention occur on the CHIAS subscales mediated by the level of perceived susceptibility (i.e., moderated mediation)?

### **1.5 Importance of the Research**

**Theoretical Significance:** The study will can be used to augment the health behavior theory by testing an integrated HBM-TPB model experimentally using validated, multi-dimensional scales. It cuts across the view of the attitude as a unit by assessing its various components thus giving a more in-depth understanding of the attitudinal pathways that play critical roles in transforming knowledge into intention.

**Practical Significance:** The findings will provide practical information to the public health practitioners and physicians. It should be solutions focused on safety communication in case Hamas is the most critical mediator. In case the most potent pathway is the Effectiveness, messages might need the combination of effectiveness data with risk assessment, because of individuals of high vulnerability. This makes it possible to develop carefully targeted and resource-efficient communication interventions to increase HPV vaccine uptake.

### **1.6 Research Aim**

The primary objective is to test a moderated form of mediation, which will explain the connection between HPV knowledge and vaccination intention.

#### **Particular Aims:**

The research hypothesizes to determine HPV knowledge (according to the scale modified by Waller et al., 2003, and Gerend et al., 2009), vaccination intention (according to the TPB scale), attitudes and beliefs (CHIAS), and perceived susceptibility (Gerend and Shepherd, 2012) among the population of the study.

The aim of the study was to examine how the knowledge of HPV directly influenced vaccination intention.

To assess whether the three CHIAS subscales (Harms, Barriers, Effectiveness) intervene to determine the relationship between knowledge and intention.

To investigate the moderating role played by perceived susceptibility on the relationship between knowledge and each of the CHIAS subscales.

To test the comprehensive moderating mediation model to determine whether the indirect effects depend on the perceived susceptibility.

### **1.7 Research Variables Definitions**

#### **Human Papilloma virus Awareness :**

This is the overall knowledge a person has with regards to the information about HPV and the vaccine. Assessed based on a scale previously used by Waller et al. (2003) and Gerend et al. (2009) that includes True/False/Don't Know items (e.g., "HPV can cause cervical cancer").

#### **Vaccination Intention:**

The self-reported likelihood of an individual getting an HPV vaccine. Measured with the help of a 3-item questionnaire (e.g., I intend to receive the HPV vaccine) on the 5-point Likert scale between Strongly Disagree and Strongly Agree.

### **Attitudes and Beliefs:**

**Risks:** Indications about the likelihood of HPV vaccine causing short term, long term or societal harm. As an example, I think that HPV vaccine is dangerous.

**Barriers:** It is believed that there are logistical and financial barriers to getting the vaccine. An example of that is, What is your evaluation of the challenge of finding a provider...?

**Effectiveness:** Belief in the vaccine against HPV diseases. To exemplify, What is your evaluation of the efficacy of HPV vaccine to prevent cervical cancer?

### **Perceived Susceptibility :**

The subjective ratings of one to be at risk of getting HPV. Instrument of assessment: 4-item scale adapted from Gerend and Shepherd (2012) which is founded on the Health Belief Model (e.g., "I believe I am at risk of being infected with HPV virus") on a 5-point Likert scale.

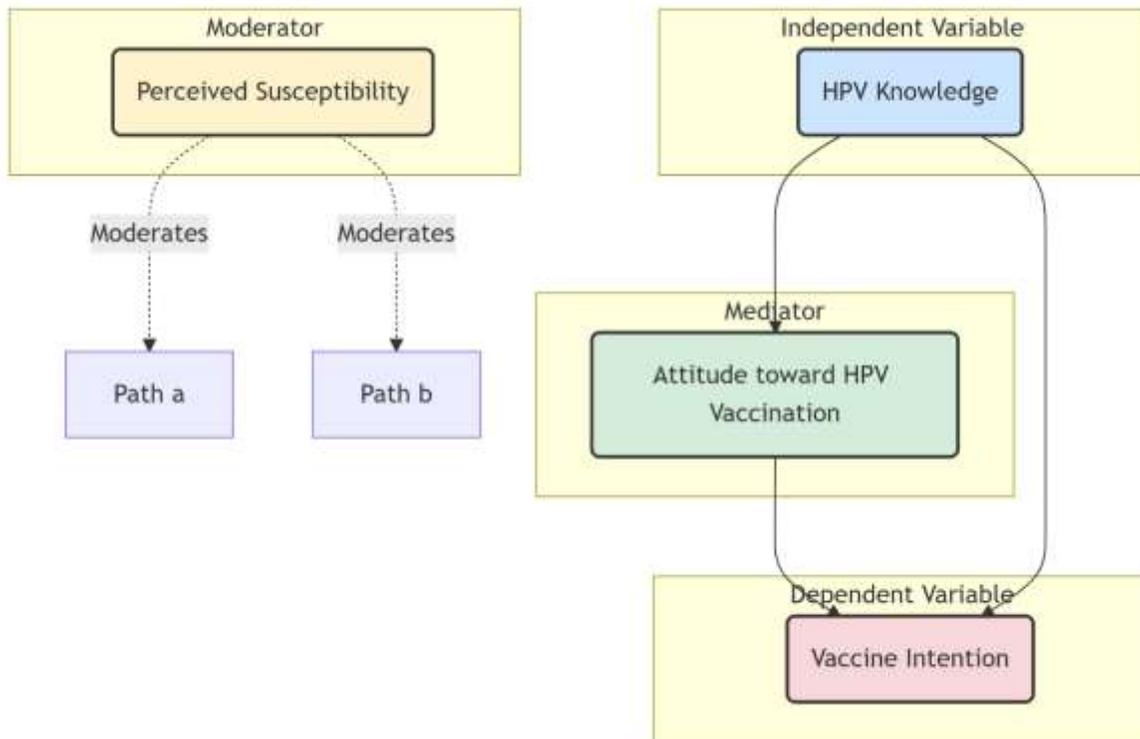
## **Literature Review**

### **2.1. HPV and Intention to Vaccinate.**

The exploration of the determinants of Human Papillomavirus (HPV) vaccination uptake has defined HPV knowledge as essential part of a health study among population. Knowledge is an objective understanding of facts on HPV transmission, health effects, and preventive vaccines by an individual (Waller et al., 2003) which is intuitively considered as a requirement in making informed health choices. There is a large body of evidence suggesting a favorable relationship between general HPV knowledge and vaccine intention. It has been shown through research that the people who recognize the HPV as a causative agent of cervical cancer correctly and understand the preventive role of vaccination are significantly more likely to show the signs of acceptance and a positive willingness to vaccinate (Bennett et al., 2012; Krawczyk et al., 2015). This is logical, awareness of a health threat, and a reasonable preventive action creates a baseline in the cognitive organization of making future decisions, which is in line with the general tenets of health behavior models that require the understanding of a threat before seeking avoidance mechanisms (Rosenstock, 1974).

The assumption that information instantly results in intention is full of mistakes, implying that there is a great gap between knowledge and intention (Massey et al., 2016). This relationship, though important, is often minor, and much of the variation in the behavior towards vaccination cannot be explained by knowledge only. It is noted in the literature that there are numerous instances of knowledgeable hesitancy, whereby individuals with high levels of objective knowledge refuse to take the vaccine, and in some cases, it is because of concerns about safety, need, or because of ethical objections (Nyhan & Reifler, 2015). This paradox brings out the fact that knowledge is not an immediate, but a distant, determinant of behavior. It has an indirect effect, which is mediated by a more complex system of psychological and attitudinal processes. It is not always that the provision of information leads to the vaccination uptake, which implies that the process will be shaped by other important factors (Fishbein and Ajzen, 2010).

**Hypothesis 1 (H1):** There exists a positive relationship between the knowledge of HPV and the intention to vaccination against HPV.



Mediation –moderation model

## 2.2. Knowledge and Attitudes/Beliefs Regarding HPV (CHIAS).

In order to bridge the knowledge-intention gap, it is important to study the psychological processes that transform information to evaluative judgments. Carolina HPV Immunization Attitudes and Beliefs Scale (CHIAS) provides an extensive model to study these mechanisms and put them into particular and quantifiable categories: Perceived Harms, Perceived Barrier, and Perceived Effectiveness. We claim that these concepts act as fundamental go-between in the relationship between knowledge and intention.

There is a complex relationship between the information and the perceived harms of the vaccine. The CHIAS subscale of Hams covers the fear of immediate negative outcomes (e.g., fever), issues with chronic health, and the false assumption that immunization promotes sexual risk-taking. Even though one can assume that with the right knowledge, there would be nothing to fear as the safety myths would be erased, studies show that knowledge sometimes gets misunderstood or corrupted by influential misinformation (Wilson and Wysong, 2020). One of the subjects can have a lot of knowledge that HPV causes cancer and still hold a strong belief that the HPV vaccine is unsafe, and this prevents their desire to vaccinate. Studies have shown that perceived safety issues are often a better predictor of vaccine refusal than lack of knowledge per se and have a moderating effect between knowledge and intention (Gerend et al., 2017).

Similarly, the perceived barriers should be overcome using knowledge. The CHIAS subscale Barriers assesses logistical-practical barriers such as costs, and difficulties in finding a provider who is available, as well as inconvenient clinic timings. The level of understanding of the vaccine can be high; however, when a person feels there are significant barriers between him/her and the vaccine (e.g., the idea about the inability to find a provider or clinic that would be convenient) then the strength of his/her plan to act out of this comprehension will be low (Reiter et al., 2013). These perceived barriers introduce a real boundary that

affects the effectiveness of the information, particularly in low-income and rural areas where the barrier of access is a notable challenge (Bruni et al., 2022).

Finally, the knowledge will not guarantee the belief in the perceived efficacy of the vaccine. The CHIAS Effectiveness subscale measures a person about their faith in the vaccine in the prevention of diseases like genital warts and cervical cancer. A person who is aware and skeptic about the effectiveness of the vaccine or one who has the perception that screening has been properly done will show a low intention to get the vaccine (Brewer and Fazekas, 2007). To influence intention, knowledge should be converted into a strong belief of the individual benefits of the vaccine.

**Hypothesis 2 (H2):** Attitudes and beliefs mediate between the relationship between HPV knowledge and vaccine intention. In particular:

**H2a:** Perceived Harms mediate the relationship.

**H2b:** Perceived Obstacles mediate the relationship.

Perceived Effectiveness is the mediator of the link.

### **2.3. The Mediating role of Attitudes and Beliefs (CHIAS).**

The mediating role played by the CHIAS constructs represents the basic psychological process through which the knowledge is evaluated and transformed into a behavioral predisposition. Not only is this mediation statistically significant but a representation of the cognitive assessment as described by the Theory of Planned Behavior (Ajzen, 1991). When an individual acquires knowledge about HPV, he or she does not keep such knowledge in a vacuum, but it is used to assess the behavior of vaccination. This judgment becomes fixed into specific attitudes and beliefs about the consequences of the action (Harms), the regulation of its performance (Barriers) and its expected outcome (Effectiveness). These analyses consequently act as the main driving forces behind their intention.

The negative consequences of low vaccination intention are amplified where the information of the persons is channeled to high Perceived Harms and Barriers and low Perceived Effectiveness. Such a negative attitudinal personality is a significant barrier to population health purposes. Those employees who believe that the vaccine is unsafe, hard to acquire and ineffective are unwilling to get vaccinated regardless of their understanding of the fact. In turn, it is important to look at the mediating pathway of these attitudes in order to develop interventions that will not only be informative but also confront the underlying concepts that govern behaviour.

**Hypothesis 3 (H3):** The indirect effect of the HPV knowledge on the intention to vaccinate, mediated by Perceived Harms, Barriers, and Effectiveness is dependent on the level of perceived susceptibility (moderated mediation). The indirect influence will be more significant with individuals having a higher sense of sensitivity.

### **2.4. Perceived Susceptibility as a Moderation Factor.**

One of the pillars of the Health Belief Model (HBM) is perceived susceptibility, which is an individual judgment about the personal risk of falling victim to a health condition. Although it is frequently examined as a simple predictor of health behavior, the more important and crucial purpose of it is that of a moderator--a variable which preconditions the intensity and direction of relationship between two other variables (Baron and Kenny, 1986). As a construct that presents a critical boundary condition that dictates the effectiveness with which positive attitudes are translated into behavioral intentions, perceived susceptibility is postulated to have a significant role in the context of HPV vaccination.

This moderation can be explained using the concept of motivational relevance. Positive attitude towards a vaccine is a positive judgment, yet possibly not a concrete idea that leads to an action. This motivational catalyst is perceived susceptibility. The health threat is individually significant to people who consider themselves a high risk of the HPV infection. A positive attitude to the vaccine is highly actionable in this state; the vaccine is perceived to be the direct and relevant solution to the concrete threat to oneself (Carpenter, 2010). The connection between attitude and intention is thus reinforced, in that the intention to vaccinate is a rational, and motivated idea of a perceived risk.

On the other hand, the low perceived susceptibility leads to the individual not perceiving HPV as a threat to them. The intention, in this case, may not be motivated as there might be a generally positive attitude to the vaccine. This vaccine can be perceived as something good to other people, and not as something more necessary and urgent to oneself. It forms an attitude-intention gap, in which positive judgment does not turn into a behavioral plan (Krawczyk et al., 2015). The person has no urgent desire to do it thus weakening the attitudinal normative intention pathway.

There is empirical evidence which underpins this moderating role. As an example, a research by Krawczyk et al. (2015) discovered that the significance of positive relation between vaccine attitudes and vaccination intention was high among young adults who perceived a greater risk of contracting HPV infection. In the same way, the study done on parents has revealed that the relationship that exists between the positive attitude of parents toward the vaccine and the decision of parents to have their children vaccinated is stronger when they believe that their child is susceptible to the virus in future (Marlow et al., 2009). This trend confirms perceived susceptibility is not simply an addition to the prediction of intention but it forms the psychology within which attitudes are constructed and behaved.

Thus, perceived susceptibility is not the other predictor in a linear model but one of the important determinants influencing the contingent efficacy of positive attitudes. It also provides the answer to the urgent question: When is the intention to vaccinate the result of a good attitude? The question is: in case the person feels personal danger.

**Hypothesis 4 (H4):** Perceived susceptibility: Vaccine attitudes / beliefs will not be linearly associated with HPV vaccine intention. In particular, the positive correlation will be greater in instances where perceived susceptibility was high and lesser in instances where perceived susceptibility was low.

### **3. Research Methodology**

In this chapter, the research methodology, participants, measures and analytical framework used to test the proposed model will be outlined in which the relationship between HPV Knowledge and Vaccine Intention is mediated by Attitude Towards HPV Vaccination and controlled by Perceived Susceptibility.

#### **3.1. Sample and Data Acquisition**

##### **3.1.1. Research Methodology**

A cross-sectional survey design was used, which is quantitative. The type of design is suitable to examine the relationships between the most important variables at a particular time and test the hypotheses put forward concerning the mediation and moderation.

##### **3.1.2. Data acquisition methodology.**

An online self-administered questionnaire was used to collect the data through mailing lists of academics, social media and professional networks using snowball sampling technique. The poll was initiated with an informed consent page thus ensuring anonymity and confidentiality of the participants. Those who proceeded to the questionnaire were those who gave an electronic consent.

### **3.2. Measures**

The validated measures were applied to the assessment of variables used in the present study in order to ensure reliability and validity.

#### **3.2.1. HPV Knowledge**

The HPV Knowledge as the independent variable was assessed with the help of the General HPV Knowledge Scale invented by Waller et al. (2003) and Gerend et al. (2009). This scale tests the objective knowledge on HPV and its vaccine through four true/false/don't know questions, such as the statements, such as: HPV can cause cervical cancer (True) and HPV infection is always accompanied by symptoms (False).

#### **3.2.2 Attitudes towards vaccination**

The mediating variable, Attitude Towards HPV Vaccination, was measured using the Carolina HPV Immunization. Attitudes and Beliefs Scale (CHIAS) which is a multidimensional scale that involves various dimensions of HPV vaccine attitudes. The measure is divided into three subscales: Harms (6 items,  $\alpha = .69$ ) which tests concerns related to vaccine safety, Barriers (5 items,  $\alpha = .69$ ) which tests practical obstacles to vaccination and Effectiveness (2 items,  $\alpha = .61$ ) which tests beliefs regarding the efficacy of vaccines. A 5-point Likert scale was used to evaluate all the items. Items in Harms and Barriers subscales were reversed coded in the data analysis and composite attitude score was obtained through the average of all the items where higher scores were given to more favorable attitudes towards HPV vaccination.

#### **3.2.3. Perceived susceptibility**

A moderating variable, perceived susceptibility, was assessed on a four-item scale Comes from the Health Belief Model (HBM), originally developed by Rosenstock (1966) and later operationalized in many studies which is founded on the Health Belief Model. The scale will measure the perceived risk of participants to contract HPV infection, where some questions will include: I believe I am at risk of getting HPV, HPV infection is common in people like me. The responses were given in a 5 valid likert scale on the scale of 1 (Strongly Disagree) and 5 (Strongly Agree). The four items were averaged to obtain an overall score where the higher the score the more perceived risk of being infected by HPV. The alpha on this scale was 0.83.

#### **3.2.4.Vaccine intention**

A Dependent variable in this research, Vaccine intention, was assessed on a three-item scale Comes from Theory of Planned Behavior (TPB), originally developed by Ajzen (1991, 2002) adapted from Gerend and Shepherd (2012). This scale measured how likely participants were to get the HPV vaccine. Some of the statements were "I plan to get the HPV vaccine" and "I will probably get the HPV vaccine." People answered on a 5-point Likert scale, with 1 being "Strongly Disagree" and 5 being "Strongly Agree." The three items were averaged to get a composite score. Higher scores mean a stronger desire to get vaccinated.

### **3.3.Sampling & Sampling techniques**

This research used a non-probability sampling to identify the participants in the investigation. The convenience sampling was used together with snowball sampling. The survey was distributed through the available avenues, such as academic networks and social media platforms (convenience sampling), and the respondents were encouraged to provide the survey link to their eligible peers (snowball sampling).

The study specifically targeted adult females as they are a key demographic for HPV vaccination .The sampling continued until a final sample of  $N = 163$  respondents had been reached. The targeted sample size is considered adequate in the proposed statistical examination.

#### 4.Results:

##### 4.1.Control Variable

One-way ANOVA was applied to examine the possibility that previous knowledge of HPV vaccine had any impact on the research variables. The participants were categorized by the level of their awareness of the vaccine (Yes/No).

The ANOVA showed that there was a great difference in the intention to get vaccinated against HPV in individuals who were informed and those who were not informed and the former had higher scores on intention ( $F(1, 161) = 8.367, p = 0.004$ ). Persons who have heard about the vaccine had an average intention score of 2.95 (SD = 1.07) on HPV vaccination and persons who have not heard of it had an average of 2.42 (SD = 1.09).

On the other hand, no difference between the two groups was significant in Attitudes and Beliefs rating ( $F(1, 161) = 0.043, p = 0.836$ ). The mean Attitudes and Beliefs score was 2.85 (SD = 0.87) among the people who were aware of the immunization and 2.84 (SD = 0.87) among people who were unaware of immunization.

##### 4.2. Descriptive statistics, reliability coefficients, and correlations

The descriptive statistics and coefficients of reliability, as well as correlation of the variables of the study, are presented in Table 1. Average score of Awareness (HPVA) was 1.57 (SD = 0.77) and the Attitudes and Beliefs (HPVAB) was 2.85 (SD = 0.87). The mean of perceived Susceptibility (HPS) was 3.48 (SD = 0.98), and Vaccination Intention (HPVI) had the mean of 2.76 (SD = 1.09).

Significant positive correlations existed between Awareness and Attitudes/Beliefs ( $r = .287, p = .01$ ), Attitudes/Beliefs and Perceived Susceptibility ( $r = .162, p = .05$ ) and Perceived Susceptibility and Vaccination Intention ( $r = .289, p = .01$ ), which indicated that there were significant relationships between these variables. There was no significant correlation among the constructs in terms of Awareness and Perceived Susceptibility; no significant correlation between Attitudes/Beliefs and Intention; and no significant correlation between Intention and Perceived Susceptibility.

The alpha values of Cronbach proved the acceptable levels of internal consistent of Awareness ( $\alpha = .692$ ), Perceived Susceptibility ( $\alpha = .717$ ) and Intention ( $\alpha = .838$ ). However, Attitudes and Beliefs were poor in overall dependability ( $\alpha = .073$ ). Likely, the low alpha is due to the multidimensionality of the scale, which has three distinct subscales. The reliability of this scale as a whole might be a poor measure of the internal consistency of the different subscales, and as a result, this scale might appear to be unreliable but the subscales might provide more meaningful and more consistent results.

**TABLE 1: Correlations, descriptive statistics, and alpha reliabilities**

| Sr. No. | Variables                      | Mean | SD   | 1      | 2      | 3     | 4      |
|---------|--------------------------------|------|------|--------|--------|-------|--------|
| 1       | HPV Awareness (HPVA)           | 1.57 | 0.77 | 1      | .287** | -.075 | .088   |
| 2       | HPV Attitude / Beliefs (HPVAB) | 2.85 | 0.87 | .287** | 1      | .162* | .060   |
| 3       | HPV Susceptibility (HPVS)      | 3.48 | 0.98 | -.075  | .162*  | 1     | .289** |

|   |                      |      |      |      |      |        |   |
|---|----------------------|------|------|------|------|--------|---|
| 4 | HPV Intention (HPVI) | 2.76 | 1.09 | .088 | .060 | .289** | 1 |
|---|----------------------|------|------|------|------|--------|---|

**Note:** N = 103; Cronbach alpha reliabilities are in parenthesis.

\*\* . Correlation is significant at the 0.01 level (2-tailed).

### 4.3. Direct and Indirect Effect

The standardized direct and indirect path coefficients are presented in table 2. The Attitudes and Beliefs had a positive relationship with HPV awareness (HPVA) ( $b = 0.229$ ,  $SE = 0.058$ ,  $p < 0.001$ ). There were positive, but not significant, relationships between attitudes and beliefs on the one hand and vaccination intention (HPVI) and, on the other hand, there was a non-significant relationship between the direct effect of awareness and intention ( $b = -0.005$ ,  $SE = 0.147$ ,  $p = 0.974$ ). The indirect effect of Awareness on Intention via Attitudes and Beliefs was bootstrapped and 0.031 (Boot SE = 0.053, 95% CI [-0.071, 0.139]) which is a possible value of partial mediation. The influence of Awareness on Intention cumulated 0.026 ( $SE = 0.140$ ,  $p = 0.853$ ). These findings imply that the influence of Awareness on Vaccination Intention can be significant as it influences Attitudes and Beliefs.

**TABLE 2: Direct and indirect effects using bootstrapping Sobel test**

| Standardized direct path coefficients of the hypothesized model |                     |        |          |          |          |
|-----------------------------------------------------------------|---------------------|--------|----------|----------|----------|
|                                                                 | Path                |        | Estimate |          | SE       |
| <b>H1</b>                                                       | HPVA → HPVAB        |        | 0.2292   |          | 0.0579   |
| <b>H2</b>                                                       | HPVAB → HPVI        |        | 0.1343   |          | 0.1917   |
| <b>H3</b>                                                       | HPVA → HPVI         |        | -0.0048  |          | 0.1470   |
| Bootstrap results for indirect effects (Mediator)               |                     |        |          |          |          |
| Indirect Effect (Bias Corrected Confidence Interval)            |                     |        |          |          |          |
|                                                                 | Paths               | Effect | Boot SE  | LLCI 95% | ULCI 95% |
| <b>H4</b>                                                       | HPVA → HPVAB → HPVI | 0.0308 | 0.0525   | -0.0707  | 0.1390   |

**Note.** N = 300. \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$

### 4.4. Moderation Analysis

A regression analysis was moderated by exploring whether Perceived Susceptibility (HPVS) was a factor that affected the relationship between Awareness of HPV (HPVA) and Vaccination Intention (HPVI). There was no significant interaction between the term Awareness and Perceived Susceptibility ( $b = -0.236$ ,  $SE = 0.237$ , 95% CI = -0.704, 0.233), which implied that the effect of Awareness on Intention was the same with or without the levels of Perceived Susceptibility. The correlations between Awareness and Intention in the conditional effects of Awareness on Intention at -1 SD, the mean, and +1 SD of Perceived sensitivity were not significant, which means that the correlation between Awareness and Intention was consistent regardless of the perceived sensitivity of individuals.

**TABLE 3: Moderated regression analysis (Moderator)**

| DV         |                |          |    |      |      |
|------------|----------------|----------|----|------|------|
| Predictors | R <sup>2</sup> | Estimate | SE | LLCI | ULCI |
| Step-1     | 0.1012         |          |    |      |      |

|                                                                            |               |           |             |             |       |
|----------------------------------------------------------------------------|---------------|-----------|-------------|-------------|-------|
| Constant                                                                   |               | 2.754     | 0.073       | 2.609       | 2.898 |
| Moderator (HPVS)                                                           |               | 0.373     | 0.105       | 0.167       | 0.580 |
| IV (HPVA)                                                                  |               | 0.158     | 0.133       | -0.105      | 0.420 |
| Step-2                                                                     |               |           |             |             |       |
| <b>IVx Moderator</b>                                                       |               | -0.236    | 0.237       | -0.704      | 0.233 |
| <b>Conditional effect of X on Y at values of the moderator: Slope Test</b> |               |           |             |             |       |
| <b>DV</b>                                                                  |               |           |             |             |       |
| <b>Moderator</b>                                                           | <b>Effect</b> | <b>SE</b> | <b>LLCI</b> | <b>ULCI</b> |       |
| Moderator -1 SD (-1.01)                                                    | 0.177         | 0.142     | -0.103      | 0.457       |       |
| moderator M (0.00)                                                         | 0.157         | 0.133     | -0.105      | 0.420       |       |
| moderator +1 SD (1.01)                                                     | 0.142         | 0.151     | -0.156      | 0.440       |       |

Note. N = 163. IV = HPVA; DV = HPV I; Moderator = HPVS. Interaction term (IV × Moderator) was mean-centered prior to analysis. Bootstrapped 95% confidence intervals are bias-corrected.

## 5. Discussion

The present study attempted to investigate the complex interrelations between the HPV awareness, attitudes and beliefs, perceived vulnerability and the vaccination intention among adult females. The results indicate a complicated situation, in which some of the already known paths were validated, and others were challenged, and in the end, the influence of perceived vulnerability as one of the immediate determinants of behavioral intention is critical.

The original study showed the significant role of the prior awareness of the vaccines on the intention to get vaccinated, but not attitudes. This implies that the simple knowledge about HPV vaccination is a specific mental activity, which has the potential to directly influence the intention of a person to vaccinate regardless of whether they reach a complex of positive or negative evaluation about the vaccine. Such a finding aligns with early stages of health behavior models, in which information is a critical antecedent of action (Brewer et al., 2017). The non-significant relationship between overall attitudes and vaccination intention is surprising since the relationship between attitude and intention has been established to be a major predictor (Gerend and Shepherd, 2012). Such peculiarity is most likely a methodological artefact, which will be corrected in the future.

At the mediation analysis level, it was proposed that awareness would be transformed into intention through attitudes and beliefs. The information provided had little support to this mechanism. Significant as the awareness was as a predictor of attitudes, the attitude to intention relationship was not found to be significant. Consequently, indirect effect was not statistically significant. This indicates that the relationship between the awareness and intention is not always mediated by overall attitude construct as measured in this study. The model shows that the attitudes are affected by the awareness; however, in their accumulated form they did not play the primary role in causing these women to resort to vaccination.

Perceived vulnerability was the most crucial observation to have been made in this research. It was the only variable that had a significant and positive relationship with vaccination intention, other than prior awareness. In addition, during the moderation analysis, perceived vulnerability was found to be a direct predictor of intention. This brings out one of the fundamental concepts of the Health Belief Model: individual risk is a critical stimulus of prevention health behavior (Carpenter, 2010). The vaccine intention in women in this sample was more directly linked to their belief that they were personally vulnerable to HPV as opposed to their general attitudes towards the vaccine. The given finding can be supported by the study carried out by Krawczyk et al. (2015), who discovered the perceived risk to be a decisive factor in the process of making vaccine choices.

Contrary to our hypothesis, the perceived susceptibility had no effects to the relationship between awareness and intention. The effect of vaccine awareness on the intention to take one has been similar regardless of whether a person was considered to be vulnerable or not. This suggests that the intentions of information and the perceived danger have a strong autonomous nature in this setting.

### **The Critical Issue that concerns the Attitude Assessment.**

The major problem with interpreting these results is in the component of Attitudes and Beliefs. The Cronbach alpha ( $\alpha = .073$ ) of the total scale is very low, and it indicates that the internal consistency is severely lacking. The CHIAS scale is a multidimensional type of scale; it has distinct subscales of Harms, Barriers, and Effectiveness. When measured into one score, the statistical analysis of them becomes difficult, as one can simultaneously feel that the vaccine is successful (high Effectiveness score), but feel that it is a costly medication and has some unpleasant side effects (high Harms/Barriers scores). The two competing thoughts cancel each other in a composite score and this could probably explain the non-significant correlation and path coefficient with purpose. Further analyses should take into account these subscales as independent predictors, because some of them (e.g., perceived efficacy) are expected to have a significant correlation with intention, and some of them (e.g., perceived impediments) may have a negative correlation.

### **6. Limitations**

There are several limitations to this research. The cross-sectional structure will automatically make it impossible to make causal inferences. The potential of the convenience and snowball sampling limits the extent to which the findings can be generalized. Third, as discussed above, the poor reliability of the composite attitude measure must have masked the true connection between vaccine beliefs and intention. Test the subscales of CHIAS (Harms, Barriers, Effectiveness) individually to show their different associations with vaccination intention.

Consider other types of mediators (e.g. subjective norms, perceived behavioral control, part of the Theory of Planned Behavior) that could be more effective to explain the relationship between awareness and intention.

Research the factors influencing the development of perceived vulnerability, this concept has become the leading predictor of vaccination intention among this population group.

### **7. Conclusion:**

This research paper was able to conclude that the most common factor prompting the intention to receive the HPV vaccine among adult females is the impression of personal vulnerability to the virus. Awareness influenced the attitudes, but the overall attitude construct was not a significant predictor of intention in our study, which is perhaps because it is statistically challenging to combine its two opposing sub-dimensions. These results suggest that the personalized public health measures that focus on the HPV risk to women and on their specific issues with the vaccine, as opposed to run-of-the-mill awareness campaigns are necessary.

## 8. References

1. Bruni, L., Saura-Lázaro, A., Montoliu, A., Brotons, M., Garcia, L. A., Shi, J. W., Valentino, P., Lopéz, G., Rowley, J., & Kim, J. J. (2022). HPV vaccination introduction worldwide and WHO and UNICEF estimates of national HPV immunization coverage 2010–2019. *Preventive Medicine*, 158, 107010. <https://doi.org/10.1016/j.ypmed.2022.107010>
2. Chesson, H. W., Dunne, E. F., Hariri, S., & Markowitz, L. E. (2014). The estimated lifetime probability of acquiring human papillomavirus in the United States. *Sexually Transmitted Diseases*, 41(11), 660–664. <https://doi.org/10.1097/OLQ.0000000000000193>
3. Damgacioglu, H., Lin, Y., Torrez, M., Li, C., Sonawane, K., & Deshmukh, A. A. (2022). State-level HPV vaccination coverage in the United States in 2019. *Journal of Infectious Diseases*, 226(4), 575–585. <https://doi.org/10.1093/infdis/jiac100>
4. de Martel, C., Plummer, M., Vignat, J., & Franceschi, S. (2017). Worldwide burden of cancer attributable to HPV by site, country and HPV type. *International Journal of Cancer*, 141(4), 664–670. <https://doi.org/10.1002/ijc.30716>
5. Garland, S. M., Kjaer, S. K., Muñoz, N., Block, S. L., Brown, D. R., DiNubile, M. J., Lindsay, B. R., Kuter, B. J., Perez, G., Dominiak-Felden, G., Saah, A. J., & Drury, R. (2016). Impact and effectiveness of the quadrivalent human papillomavirus vaccine: A systematic review of 10 years of real-world experience. *Clinical Infectious Diseases*, 63(4), 519–527. <https://doi.org/10.1093/cid/ciw354>
6. Joura, E. A., Giuliano, A. R., Iversen, O. E., Bouchard, C., Mao, C., Mehlsen, J., Moreira, E. D., Jr., Ngan, Y., Petersen, L. K., Lazcano-Ponce, E., Pitisuttithum, P., Restrepo, J. A., Stuart, G., Woelber, L., Yang, Y. C., Cuzick, J., Garland, S. M., Huh, W., Kjaer, S. K., . . . Luxembourg, A. (2015). A 9-valent HPV vaccine against infection and intraepithelial neoplasia in women. *New England Journal of Medicine*, 372(8), 711–723. <https://doi.org/10.1056/NEJMoa1405044>
7. Schiller, J. T., & Markowitz, L. E. (2018). Current understanding of HPV disease and vaccines. *The Lancet*, 392(10165), 2440–2441. [https://doi.org/10.1016/S0140-6736\(18\)32609-2](https://doi.org/10.1016/S0140-6736(18)32609-2)
8. Shapiro, G. K., Tatar, O., Amsel, R., Prue, G., Zimet, G. D., Knäuper, B., & Rosberger, Z. (2022). Using an integrated conceptual framework to investigate parents' HPV vaccine decision for their daughters and sons. *Preventive Medicine*, 154, 106885. <https://doi.org/10.1016/j.ypmed.2021.106885>
9. Sung, H., Ferlay, J., Siegel, R. L., Laversanne, M., Soerjomataram, I., Jemal, A., & Bray, F. (2021). Global cancer statistics 2020: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA: A Cancer Journal for Clinicians*, 71(3), 209–249. <https://doi.org/10.3322/caac.21660>
10. Walboomers, J. M., Jacobs, M. V., Manos, M. M., Bosch, F. X., Kummer, J. A., Shah, K. V., Snijders, P. J., Peto, J., Meijer, C. J., & Muñoz, N. (1999). Human papillomavirus is a necessary cause of invasive cervical cancer worldwide. *The Journal of Pathology*, 189(1), 12–19. [https://doi.org/10.1002/\(SICI\)1096-9896\(199909\)189:1<12::AID-PATH431>3.0.CO;2-F](https://doi.org/10.1002/(SICI)1096-9896(199909)189:1<12::AID-PATH431>3.0.CO;2-F)
11. World Health Organization. (2020). Global strategy to accelerate the elimination of cervical cancer as a public health problem. <https://www.who.int/publications/i/item/9789240014107>
12. Gerend, M. A., & Shepherd, J. E. (2012). Predicting human papillomavirus vaccine uptake in young adult women: Comparing the Health Belief Model and Theory of Planned Behavior. *Annals of Behavioral Medicine*, 44(2), 171–180. <https://doi.org/10.1007/s12160-012-9366-5>
13. Saraiya, M., Unger, E. R., Thompson, T. D., Lynch, C. F., Hernandez, B. Y., Lyu, C. W., Steinau, M., Watson, M., Wilkinson, E. J., Hopenhayn, C., Copeland, G., Cozen, W., Peters, E. S., & Huang, Y. (2015). US assessment of HPV types in cancers: Implications for current and 9-valent HPV vaccines. *Journal of the National Cancer Institute*, 107(6), djv086. <https://doi.org/10.1093/jnci/djv086>

14. Gillison, M. L., Chaturvedi, A. K., & Lowy, D. R. (2008). HPV prophylactic vaccines and the potential prevention of noncervical cancers in both men and women. *Cancer*, 113(S10), 3036–3046. <https://doi.org/10.1002/cncr.23764>
15. Bennett, K. K., Buchanan, J. A., & Adams, A. D. (2012). The role of patient knowledge on the decision to vaccinate against HPV. *American Journal of Health Education*, 43(2), 90–97. <https://doi.org/10.1080/19325037.2012.10599223>
16. Massey, P. M., Leader, A., Yom-Tov, E., Budenz, A., Fisher, K., & Klassen, A. C. (2016). Applying multiple data collection tools to quantify human papillomavirus vaccine communication on Twitter. *Journal of Medical Internet Research*, 18(12), e318. <https://doi.org/10.2196/jmir.6670>
17. Gerend, M. A., & Shepherd, J. E. (2012). Predicting human papillomavirus vaccine uptake in young adult women: Comparing the Health Belief Model and Theory of Planned Behavior. *Annals of Behavioral Medicine*, 44(2), 171–180. <https://doi.org/10.1007/s12160-012-9366-5>
18. Gerend, M. A., Weibley, E., & Bland, H. (2009). Parental response to human papillomavirus vaccine availability: Uptake and intentions. *Journal of Adolescent Health*, 45(5), 528–531. <https://doi.org/10.1016/j.jadohealth.2009.02.006>
19. Rosenstock, I. M. (1974). The Health Belief Model and preventive health behavior. *Health Education Monographs*, 2(4), 354–386. <https://doi.org/10.1177/109019817400200405>
20. Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
21. Bennett, K. K., Buchanan, J. A., & Adams, A. D. (2012). The role of patient knowledge on the decision to vaccinate against HPV. *American Journal of Health Education*, 43(2), 90–97. <https://doi.org/10.1080/19325037.2012.10599223>
22. Brewer, N. T., & Fazekas, K. I. (2007). Predictors of HPV vaccine acceptability: A theory-informed, systematic review. *Preventive Medicine*, 45(2-3), 107–114. <https://doi.org/10.1016/j.ypmed.2007.05.013>
23. Fishbein, M., & Ajzen, I. (2010). *Predicting and changing behavior: The reasoned action approach*. Psychology Press. <https://doi.org/10.4324/9780203838020>
24. Gerend, M. A., Shepherd, M. A., & Shepherd, J. E. (2017). The multidimensional nature of perceived barriers: Global versus practical barriers to HPV vaccination. *Health Psychology*, 36(2), 163–170. <https://doi.org/10.1037/hea0000431>
25. Krawczyk, A. L., Perez, S., Lau, E., Holcroft, C. A., Amsel, R., Knäuper, B., & Rosberger, Z. (2015). Parents' decision-making about the human papillomavirus vaccine for their daughters: I. Quantitative results. *Human Vaccines & Immunotherapeutics*, 11(2), 322–329. <https://doi.org/10.1080/21645515.2014.1004030>
26. Luthans, F., Youssef, C. M., & Avolio, B. J. (2007). *Psychological capital: Developing the human competitive edge*. Oxford University Press.
27. Massey, P. M., Leader, A., Yom-Tov, E., Budenz, A., Fisher, K., & Klassen, A. C. (2016). Applying multiple data collection tools to quantify human papillomavirus vaccine communication on Twitter. *Journal of Medical Internet Research*, 18(12), e318. <https://doi.org/10.2196/jmir.6670>
28. Nyhan, B., & Reifler, J. (2015). Does correcting myths about the flu vaccine work? An experimental evaluation of the effects of corrective information. *Vaccine*, 33(3), 459–464. <https://doi.org/10.1016/j.vaccine.2014.11.017>
29. Reiter, P. L., McRee, A. L., Kadis, J. A., & Brewer, N. T. (2013). HPV vaccine and adolescent males. *Vaccine*, 31(42), 4721–4726. <https://doi.org/10.1016/j.vaccine.2013.08.002>
30. Rosenstock, I. M. (1974). The Health Belief Model and preventive health behavior. *Health Education Monographs*, 2(4), 354–386. <https://doi.org/10.1177/109019817400200405>
31. Waller, J., McCaffery, K., Forrest, S., Szarewski, A., Cadman, L., & Wardle, J. (2003). Human papillomavirus and cervical cancer: Issues for biobehavioral and psychosocial research. *Annals of Behavioral Medicine*, 25(1), 61–71. [https://doi.org/10.1207/S15324796ABM2501\\_08](https://doi.org/10.1207/S15324796ABM2501_08)

32. Weinstein, N. D. (1989). Optimistic biases about personal risks. *Science*, 246(4935), 1232–1233. <https://doi.org/10.1126/science.2686031>
33. Wilson, S. L., & Wiysonge, C. (2020). Social media and vaccine hesitancy. *BMJ Global Health*, 5(10), e004206. <https://doi.org/10.1136/bmjgh-2020-004206>
34. Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, \*51\*(6), 1173–1182. <https://doi.org/10.1037/0022-3514.51.6.1173>
35. 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>
36. Carpenter, C. J. (2010). A meta-analysis of the effectiveness of health belief model variables in predicting behavior. *Health Communication*, \*25\*(8), 661–669. <https://doi.org/10.1080/10410236.2010.521906>
37. Dempsey, A. F., & Zimet, G. D. (2016). Interventions to improve HPV vaccine uptake: A systematic review. *Vaccine*, \*34\*(15), 1802–1809. <https://doi.org/10.1016/j.vaccine.2016.02.083>
38. Gerend, M. A., & Shepherd, J. E. (2012). Predicting human papillomavirus vaccine uptake in young adult women: Comparing the health belief model and theory of planned behavior. *Annals of Behavioral Medicine*, \*44\*(2), 171–180. <https://doi.org/10.1007/s12160-012-9366-5>
39. Krawczyk, A. L., Perez, S., Lau, E., Holcroft, C. A., Amsel, R., Knäuper, B., & Rosberger, Z. (2015). Human papillomavirus vaccination intentions and uptake in college women. *Health Psychology*, \*34\*(3), 274–285. <https://doi.org/10.1037/hea0000216>
40. Marlow, L. A. V., Waller, J., & Wardle, J. (2009). Parental attitudes to pre-pubertal HPV vaccination. *Vaccine*, \*27\*(9), 1365–1370. <https://doi.org/10.1016/j.vaccine.2008.12.057>
41. Reiter, P. L., Brewer, N. T., Gottlieb, S. L., McRee, A.-L., & Smith, J. S. (2009). Parents' health beliefs and HPV vaccination of their adolescent daughters. *Social Science & Medicine*, \*69\*(3), 475–480. <https://doi.org/10.1016/j.socscimed.2009.05.024>