

Assessing Attitudes and Beliefs Toward HPV Vaccination among Ghanaian Parents with Unvaccinated Adolescents: Application of Multi-Theory Model of Behavior Change

Braden K Popelsky¹, Matt Asare^{1*}, Peter Agyei-Baffour², Adofo Koranteng², Mary E Commeh³

Abstract

Objective: The purpose of the study was to assess the attitudes and beliefs towards HPV vaccination among Ghanaian parents with unvaccinated adolescents using the Multi-Theory Model (MTM) of behavior change. Additionally, we used MTM constructs to predict the likelihood of parents allowing their adolescents to initiate and complete the recommended HPV vaccine series. **Methods:** A 44-item validated survey was administered among parents with unvaccinated adolescents living in the Ashanti Region of Ghana. HPV vaccine initiation predictors were perceived beliefs and MTM constructs: participatory dialogue, behavioral confidence, and change in the physical environment. HPV vaccine completion predictors were emotional transformation, social environment, and practice for change. Results: Multiple linear regression analyses showed that perceived beliefs (95% CI: 0.03 – 0.14), change in the physical environment (95% CI: 0.06 – 0.15), and behavioral confidence (95% CI: 0.00 – 0.07), were strongly associated with parents' likelihood of allowing their adolescents to initiate the HPV vaccine series ($p < 0.001$). Together, perceived beliefs, behavioral confidence, and change in the physical environment accounted for 13.6% of the variance ($R^2 = 0.136$). The emotional transformation (95% CI: 0.04 – 0.10), and social environment (95% CI: 0.25 – 0.35), predictors were both strongly associated with parents' likelihood of allowing their adolescent to complete the vaccine series ($p < 0.001$). Together, emotional transformation and social environment accounted for 45.8% of the variance ($R^2 = .458$). A sample of 380 parents with unvaccinated adolescents, between the ages of 35 – 60 years, participated in this study. Many of the participants were unaware of HPV (98.7%) and its related vaccinations (96.8%). **Conclusion:** Our findings underscore the need for comprehensive multi-level interventions to create HPV vaccination awareness among Ghanaian parents with unvaccinated adolescents.

Keywords: HPV vaccination- parental attitude- multi-theory model

Asian Pac J Cancer Prev, **23** (6), 1901-1911

Introduction

Human Papillomavirus (HPV) is one of the most common viral infections of the reproductive tract with certain strains causing cervical, anal, penile, vulvar, and oropharyngeal cancers as well as genital warts and recurrent respiratory papillomatosis (National Cancer Institute, 2021; National Organization for Rare Disorders, 2019; World Health Organization [WHO], (2020); WHO, 2021). Globally, cervical cancer is the fourth most common cancer among women with over 300,000 deaths occurring in low-and-middle-income countries (LMICs), including Ghana in 2018 (WHO, 2020). In Ghana, cervical cancer was the second most common female cancer among women as well as the second most common cancer among women between

15 and 44 years (HPV Information Center, 2019). As of 2020, cervical cancer comprised 11.6% of all new cancer cases among both sexes and 19.9% of all new cancer cases among only females in the country (International Agency for Research on Cancer, 2021). Interestingly, cervical cancer is one of the most preventable human cancers with primary, secondary, tertiary prevention strategies and even curative possibilities if detected early (Calys-Tagoet al., 2020; WHO, 2020). Primary prevention measures, such as a vaccine, can be introduced to adolescents as early as 9 years of age, and can greatly reduce the risk of obtaining HPV and developing related cancers (WHO, 2020).

There are three prophylactic HPV vaccines: Cervarix, Gardasil, and Gardasil 9 that are effective in preventing HPV-related cancers. All three vaccines are protective against HPV types 16 and 18. Gardasil also prevents HPV

¹Department of Public Health, Baylor University, Waco, Texas, United States. ²School of Public Health, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana. ³Non-Communicable Disease Control, Ghana Health Services, Accra Ghana. *For Correspondence: matt_asare@baylor.edu

types 6 and 11 which cause genital warts and Gardasil 9 prevents HPV types 31, 33, 45, 52, and 58 (Centers for Disease Control and Prevention [CDC], 2020). The World Health Organization recommends two doses of vaccines for youths between 9 and 14 years old. The doses should be administered every 1-2 months. For males and females ages 15-26 who were not previously vaccinated, they recommend three doses administered 6 months apart (WHO, 2017). The Advisory Committee on Immunization Practices (ACIP) extends recommendations up to adults ages 27-45 with clinical decision-making suggesting that some individuals at risk for acquiring new HPV infection could benefit from vaccination (CDC, 2019). The Gardasil 9 vaccine is only available in the United States of America, Europe, and other high-income countries. Cervarix and Gardasil are the current vaccines available in Ghana markets. HPV vaccinations were only first introduced in 2013 (GlaxoSmithKline, [GSK], 2013). In the same year, the Global Alliance for Vaccines and Immunizations (GAVI) and Gardasil Access Program (GAP) successfully pilot-tested HPV vaccination programs (GAVI, The Vaccine Alliance 2012).

Despite compelling evidence of effective protection, the vaccination rates continue to be low. Though the HPV vaccination rate data in Ghana are not currently available, (Laryea et al., 2014; Nartey et al., 2017) it is well documented that LMICs have the lowest vaccination rates (Bruni et al., 2017; Bruni et al., 2016). For instance, in high-income countries, 33.6% of females aged 10 – 20 years received the complete series of vaccines, compared with only 2.7% of females in LIMCs (Bruni et al., 2016). In studies among healthcare providers and adolescents in Ghana, the researchers identified that currently there is no widespread, systematic, publicly available HPV vaccination program in Ghana to help promote vaccination uptake (Asare et al., 2020; Millan, et al. 2020). Additionally, lack of awareness about the vaccine, vaccine cost, stigma, and religious objections, and most importantly, lack of data on HPV vaccination have contributed to the low vaccination in the country. Several studies in sub-Saharan Africa confirmed that the lack of caregivers' knowledge about the HPV vaccination is a barrier to the vaccination uptake (Black and Richmond, 2018; Mukakalisa et al., 2014; Sankaranarayanan et al., 2013). Parents' perceptions about the HPV vaccine directly influence HPV vaccination uptake. However, our understanding of Ghanaian parents' attitudes and behaviors toward HPV vaccination is limited. The Multi-Theory Model of behavior change (MTM) has the potential to help us explain Ghanaian parents' perception of HPV vaccination.

Theoretical Framework

The multi-theory model is a health behavior theory that is used to predict the initiation (short-term) and sustenance (long-term) of health behavior change (Sharma et al., 2017; Sharma and Romas, 2017). Initiation constructs include participatory dialogue (i.e., discussions about advantages and disadvantages of a behavior), behavioral confidence (i.e., perceived ability of an individual to change a behavior in the future), and

changes in the physical environment (i.e., changes in the physical environment that can increase the availability – [e.g., HPV vaccine], and accessibility [e.g., cost of HPV vaccine]). The sustenance constructs include emotional transformation (change in feelings or emotions that can help to maintain a healthy behavior change), practice for change (i.e., determine ways to overcome barriers in order to make the health behavior change possible), and changes in the social environment (building social support and developing helping relationships to facilitate maintenance of the health behavior change). In recent years, several studies have utilized the MTM as a theoretical framework to predict and explain health behavior change (Sharma et al., 2017; Claros et al., 2020; Agyei-Baffour et al., 2020). The aim of this study was to evaluate attitudes and Beliefs Toward HPV Vaccination Among Ghanaian Parents with Unvaccinated Adolescents using Multi-Theory Model of Behavior Change.

Materials and Methods

Study Design

This study used a cross-sectional design with a convenience sample of 380 parents with unvaccinated adolescents recruited from two cities in the Ashanti Region of Ghana. Prior to implementation, the study protocol was approved by Institutional Review Boards from both Kwame Nkrumah University of Science and Technology, Kumasi, and Baylor University.

Recruitment

Parents with unvaccinated adolescents were recruited from various communities including churches, parent-teacher meetings through announcements, and supermarkets through face-to-face contacts and verbal invitations. Inclusion criteria required that parents must have at least one unvaccinated adolescent child between the ages of 12 – 17 years of age and live in the Ashanti Region of Ghana. All eligible parents provided informed consent before participating.

Sample Size

The sample size was calculated using the G*Power software. The criteria specified were alpha of .05, an effect size of 0.10, power of 0.95, and six predictors. A total sample size of 226 recruited participants was determined sufficient. The sample size was increased by 25% to account for missing data, thus the target number of recruited participants was increased to 283 participants.

Measurements

We used a 44-item validated instrument based on Multi-Theory Model constructs consist of predictor and outcome variables. The demographic variables included age, gender, education level, income level, marital status, religion, and knowledge of HPV and the HPV vaccine.

Predictor Variables

This study used a total of seven predictors: a perceived beliefs subscale and Multi-Theory Model (MTM) constructs. The two main components of MTM are

initiation predictors (participatory dialogue, behavioral confidence, and change in physical environment) and sustenance predictors (emotional transformation, change in social environment, and practice for change). The predictor variables were measured on a 5-point response scale.

Initiation Predictor Subscales

The participatory dialogue construct measured parents' perceived advantages and disadvantages to HPV vaccination that their adolescent would experience. Perceived advantages (3 items) included protection against HPV-related cancers and genital warts, improved immune system, and better overall health. Perceived disadvantages (3 items) included vaccine cost, potential side-effects and pain, and possible effects on their adolescent's reproductive system. The participatory dialogue score was calculated by subtracting the disadvantages from the advantages. Participatory dialogue scores ranged from -15 to 15 where negative scores indicated that parents were less inclined to allow their adolescent to participate in HPV vaccination, whereas positive scores indicated that parents were more inclined to allow their adolescent to participate in HPV vaccination.

The behavioral confidence construct (3 items) evaluated parents' confidence in allowing their adolescent to initiate the HPV vaccine series in the future. The items included parents' certainty of allowing HPV vaccination in the future with their current schedule, presence of insurance, vaccination location, and vaccine side effects. Possible scores ranged from 3 – 15 where higher scores indicated higher levels of confidence and likelihood of allowing HPV vaccination.

The change in the physical environment construct (3 items) measured the role or influence of environmental factors in allowing their adolescent to initiate HPV vaccination. The items include parents' certainty to arrange payment for the vaccine, secure a vaccine location, and coordinate transportation for vaccination. Possible scores ranged from 3 – 15 where higher scores indicated greater certainty in arranging environmental factors and increased likelihood of allowing HPV vaccination initiation (see Figure 1).

Completion Predictor Subscales

The practice for change construct (3 items) measured parents' ability to adjust or make mid-course changes to allow their adolescent to sustain or complete the HPV vaccine series. Practice for change items included parents' ability in monitoring their adolescents' doses, confidence in overcoming barriers, and their ability to alter their schedule to allow their adolescent to receive the recommended doses of the vaccine series even when faced with difficulties.

The emotional transformation construct (3 items) evaluated parents' change in feelings toward HPV vaccination completion. Emotional transformation items measured parents' ability to support their adolescent to receive HPV vaccination, motivate, and overcome self-doubt to encourage HPV vaccine series completion. Social environment constructs (3 items) measured

if healthcare provider recommendation influences parents' decision to allow their adolescent to receive HPV vaccination, as well as parents' intention and comfortability in talking with their child's healthcare provider about HPV vaccination. Possible scores for emotional transformation, social environment, and practice for change subscales ranged from 3 – 15, where higher scores indicated that parents were more likely to allow their adolescent to complete the HPV vaccine series (see Figure 2).

Additional Predictor

The construct of perceived beliefs was included as an additional predictor in this study to increase predictive power. Perceived beliefs were measured with 3 – items that assessed parents' beliefs about whether HPV can cause cancer if the HPV vaccine is effective and can prevent most cancers caused by HPV, and whether provider recommendations are important for HPV vaccination. Perceived beliefs scores ranged from 3 – 15 with higher scores indicating higher/stronger beliefs.

Outcome Variables

Because this study was focused on predicting the initiation and completion of the HPV vaccine series, the two outcome variables were the likelihood of parents allowing their adolescent to initiate the HPV vaccine series in the next month and the completion of the recommended doses in the next 12 months. Both outcome variables included responses that were measured on a 5-point Likert scale with possible scores ranging from 1 – 5 where higher scores indicated an increased likelihood that parents would allow their adolescent to initiate and/or complete the HPV vaccine series.

Construct Validity

We conducted construct validity using a confirmatory factor analysis (CFA) in which we analyzed covariance matrices applying maximum-likelihood estimation using Amos. We used three indices to assess how well our models fit the data (Hu and Bentler, 1999; Williams, Vandenberg and Edwards, 2009), chi-square (χ^2), root mean square error of approximation (RMSEA), and comparative fit index (CFI), RMSEA values of 0.06 or less, CFI values of 0.95 or greater were considered indicative of good fit (Hu and Bentler, 1999). Models were considered to have an adequate fit if they met the less stringent, but traditionally accepted, values of 0.90 or greater for CFI, and values less than 0.08 for RMSEA.

Reliability

The internal consistency of the instrument was determined with Cronbach alpha. An alpha coefficient greater than 0.60 was considered acceptable for subscales, as is recommended for measurement scales, especially in the case of new scales (Tabachnick et al., 2007).

Statistical Analyses

The demographic variables were analyzed using descriptive statistics and multiple linear regression analyses were performed to assess the relationships

between Multi-Theory Model constructs and the likelihood of parents allowing their adolescent to initiate and complete the HPV vaccine series. Structural Equation Modeling was performed to evaluate the fitness of the model. The significant result was set a priori at p-value < 0.05. All data were analyzed using the IBM Statistical Package for Social Sciences (SPSS version 25). For the structural equation modeling, we used AMOS.

Results

Sample Population

A sample of 380 parents with unvaccinated adolescents between the ages of 35 – 60 years and living in the Ashanti Region of Ghana participated in this study. Most participants were female (91.1%), married (74.5%), working (92.9%), and had insurance (88.4%). In terms of education, the sample had an even spread with participants reporting various educational backgrounds. Of note, many participants had neither heard of HPV (98.7%) nor HPV vaccinations (96.8%) (Table 1).

The descriptive analysis of the variables indicates high scores for behavioral confidence, change in the physical environment, emotional transformation, practice for change, perceived beliefs, and social environment. Cronbach alpha coefficient of the subscales ranged from 0.61 to 0.84. All the values were over 0.60 and thus acceptable (Tabachnick et al., 2007) (Table 2).

Structural Equation Modeling: Initiation Variables

A total of 380 participants provided complete data to examine the construct validity and reliability of the instrument. This sample size was sufficiently powered to conduct structural equation analysis (Tabachnick et al.,

2007). The structural equation modeling results (e.g., χ^2 [56] = 154.018 [p < 0.001], CFI = 0.94, TLI= 0.92, and RMSEA = 0.06) of the initiation model demonstrated the goodness of fit of the data. The standardized effects of latent variables on the factor loading indicators for advantages, disadvantages, behavioral confidence, and changes in the physical environment were statistically significant. The factor loading for advantages, behavioral confidence, and physical environment had large effects (e.g., β ranging from 0.61 to 0.87) on their respective indicators. The factor loading for disadvantages had moderate to large effects (e.g., β ranging from 0.55 to 0.92) on its three indicators. These effects suggested that our scale scores provided valid measurement of their constructs (Figure 3).

Structural Equation Modeling: Sustenance Variables

For the sustenance model, the model fit the data well (e.g., χ^2 [30] = 69.978 [p < 0.001], CFI = 0.98, TLI = 0.97, and RMSEA = 0.05). The standardized effects of latent variables on their reflective indicators (i.e., factor loadings) showed statistically significant loadings for emotional transformation and practice for change. The emotional transformation, social environment, and practice for change had large effects (e.g., β ranging from 0.72 to 0.89) on their respective indicators, suggesting that our scale scores provided valid measurement of their constructs. We then examined between construct correlations and standardized regression coefficients for the sustenance model (Figure 4).

Predictors for HPV Vaccine Initiation

Multiple linear regression showed that perceived beliefs, participatory dialogue, change in the physical

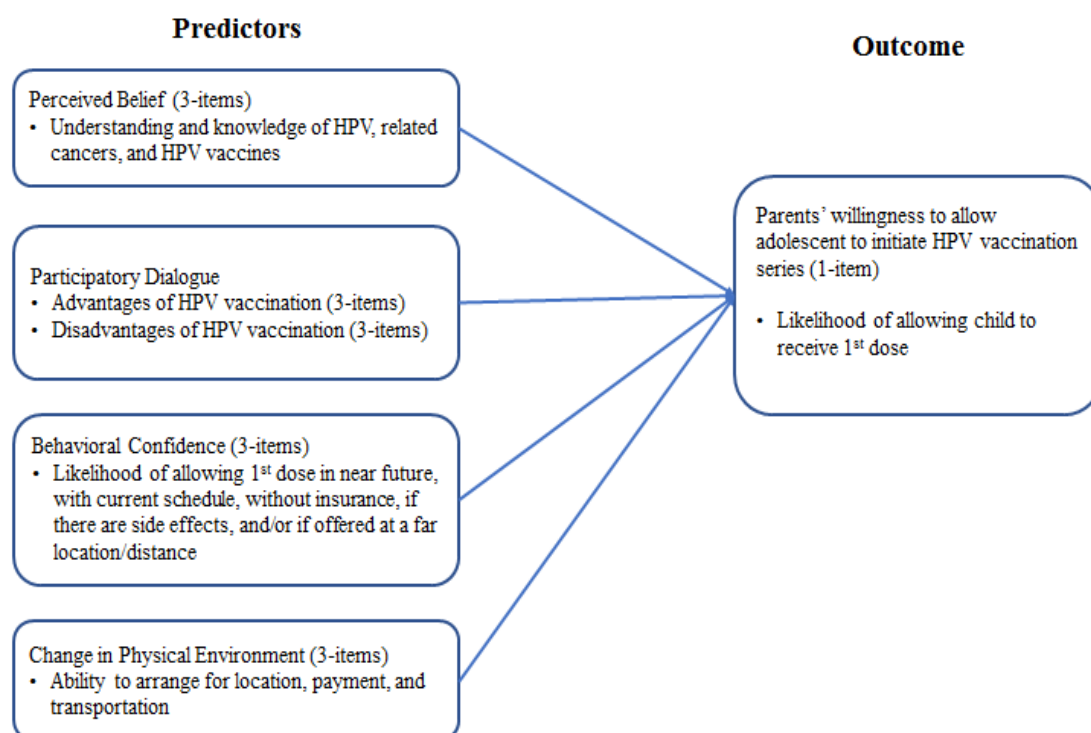


Figure 1. Predictors for HPV Vaccine Series Initiation

Table 1. Demographic Characteristics of Parents with Unvaccinated Adolescents (n = 380)

	Frequency	Percent (%)
Gender		
Female	346	91.1
Male	34	8.9
Age Group		
35 – 40	21	5.5
41 - 45	67	17.6
46 - 50	47	12.4
51 - 55	58	15.3
56 - 60	187	49.2
Marital Status		
Divorced	21	5.5
Married	283	74.5
Never Married	68	17.9
Widowed	8	2.1
Education		
Graduate Degree or Higher	101	26.6
Undergraduate	36	9.5
High School/ Secondary	85	22.4
Basic School/ Up to Middle School	129	33.9
None	29	7.6
Employment Status		
Not Working	27	7.1
Working	353	92.9
Income Level		
< Gh 20,000	275	72.4
< Gh 20,000 – Gh 35,000	98	25.8
< Gh 36,000 – 50,000	6	1.6
> Gh 50, 000	1	0.3
Has Pediatrician		
No	306	80.5
Yes	74	19.5
Insurance Status		
Not Insured	44	11.6
Insured	336	88.4

environment, and behavioral confidence were strongly associated with parents' likelihood of allowing their adolescents to initiate the HPV vaccine series ($p < 0.001$). The participatory dialogue did not appear to be significantly associated ($p = 0.94$) with the likelihood of HPV vaccination initiation. Together, perceived beliefs, change in the physical environment, and behavioral confidence accounted for 13.6% of the variability in the initiation predictors ($R^2 = 0.136$) (Table 3).

Predictors for HPV Vaccine Completion

Multiple linear regression indicated that both emotional transformation and social environment were significant predictors ($p < 0.001$) of parents' likelihood of allowing their adolescent to complete the HPV vaccine series. Practice for change did not appear to be significantly associated with parent's likelihood of allowing their adolescent to complete the HPV vaccine series. Together, emotional transformation and social environment explained 45.8% of the variability in the completion predictors ($R^2 = 0.458$) (Table 4).

Discussion

Multiple factors contribute to the low rates of HPV vaccine uptake in Ghana, however, our understanding of the barriers to vaccination remains limited. Thus, we examined the attitudes and beliefs toward HPV vaccination among Ghanaian parents with unvaccinated adolescents. A secondary purpose was to determine the parents' willingness to allow their adolescent to receive the recommended vaccine series.

A significant finding of our study demonstrated a severe lack of knowledge surrounding HPV and the HPV vaccine. Of the parents surveyed, 98.7% had never heard of HPV and 96.8% had never heard of HPV vaccines. These findings are echoed in previous research studies which found that general knowledge about HPV vaccination in Ghana is extremely low (Agyei-Baffour et al., 2020; Wallace et al., 2019). Parental knowledge and attitudes about HPV vaccination are crucial factors that influence both vaccine acceptance and uptake, but globally those factors are not well understood (Wallace et al., 2019). Increasing HPV vaccination awareness

Table 2. Descriptive Statistics of Study Variables (n = 380)

	Items	Possible range	Observed range	Mean \pm SD	Cronbach Alpha (α)
Initiation	1	1 – 5	1 – 5	3.53 \pm 0.90	-
Advantages	3	3-15	3 – 15	11.58 \pm 2.34	0.81
Disadvantages	3	3 – 15	3 – 15	8.12 \pm 2.65	0.74
Participatory Dialogue (Advantage-Disadvantage)		-24	-9 – 12	3.46 \pm 3.75	-
Behavioral Confidence	3	3 – 15	3 – 15	10.59 \pm 2.39	0.71
Physical Environment	3	3 – 15	3 – 15	10.19 \pm 2.15	0.82
Perceived Beliefs	3	3 – 15	3 – 15	11.11 \pm 2.41	0.83
Sustenance	1	1 – 5	1 – 5	3.56 \pm 0.83	-
Emotional Transformation	3	3 – 15	3 – 15	11.31 \pm 2.24	0.84
Practice for Change	3	3 – 15	3 – 15	11.34 \pm 2.11	0.81
Social Environment	3	3 – 15	3 – 15	7.97 \pm 1.47	0.81

Table 3. Summary of Multiple Linear Regression Analyses for the MTM Constructs Predicting Parents' Likelihood of allowing Their Adolescents to Get the First Dose of HPV Vaccination (n=380)

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% CI		R ²
	B	Std. Error	Beta			Lower Bound	Upper Bound	
Initiation								0.136
Perceived Beliefs	0.08	0.03	0.2	3.3	0	0.03	0.14	
Participatory Dialogue	0	0.01	0	0.08	0.94	-0.02	0.02	
Physical Environment	0.11	0.03	0.22	4.22	0	0.06	0.15	
Confidence	0.03	0.02	0.11	1.96	0.05	0	0.07	

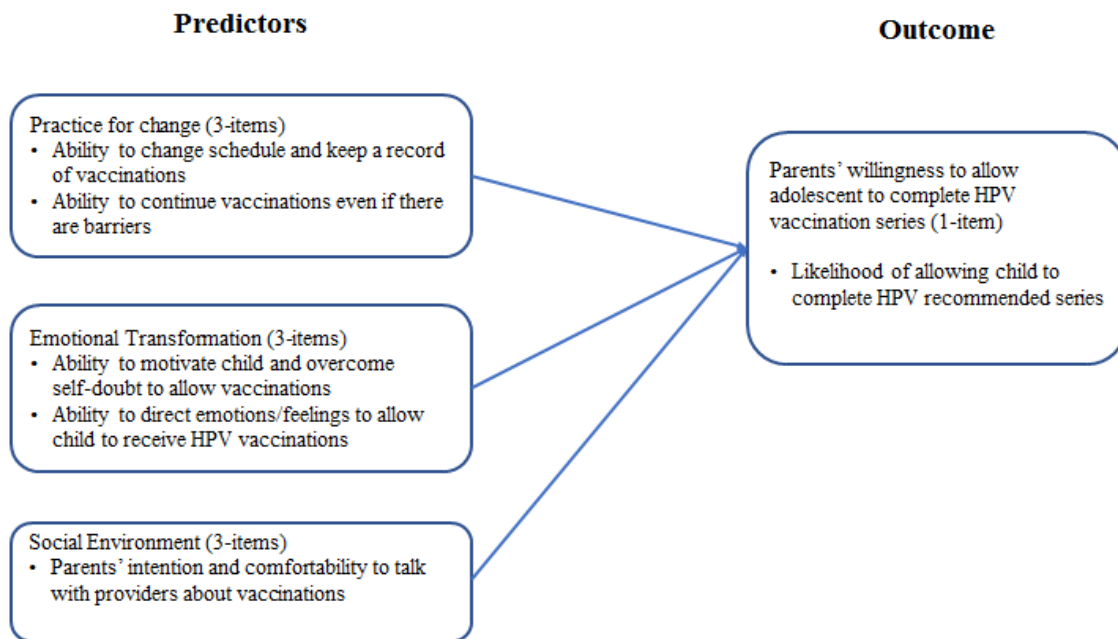


Figure 2. Predictors for HPV Vaccine Series Completion

among parents is very important because the concept of the “medical home”, where medical care is coordinated by a primary care physician, is not well-established in Ghana. In high-income countries like the US, UK, etc., medical homes are well integrated into the health care system, so primary health care providers (e.g., pediatricians) serve as gatekeepers, monitor children’s vaccination records, and remind parents of the due dates of their children’s vaccinations. In Ghana, on the other hand, vaccines are provided through vaccination clinics that are run by the government and there are no concerted efforts to reach out to parents on regular basis to remind them of their children’s vaccination. Additionally, most people rarely receive the HPV vaccination as a preventive

mechanism (Black and Richmond, 2018; Coleman et al., 2011; Nartey et al., 2018). In absence of medical home and routine checkups, parents have to be aware of the available vaccines and their options in order to create demands for those vaccines. Therefore, as confirmed by other researchers, education of parents and the society as a whole is critical to increasing vaccination uptake and those researchers argued for the integration of public health education and cancer prevention into the health care systems in Ghana (Nartey et al., 2018).

We found that perceived beliefs, change in the physical environment, and behavioral confidence were strongly associated with parents’ willingness to allow their adolescent to initiate the HPV vaccine series, accounting

Table 4. Summary of Multiple Linear Regression Analyses for MTM Constructs Predicting Parents' Likelihood of Allowing Their Adolescents to Complete the Doses of HPV Vaccination (n=380)

	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% CI		R ²
	B	Std. Error	Beta			Lower Bound	Upper Bound	
Completion								0.458
Emotional Transformation	0.07	0.02	0.19	4.04	0	0.04	0.1	
Social Environment	0.3	0.02	0.54	12.07	0	0.25	0.35	
Practice for Change	0.01	0.02	0.03	0.7	0.48	-0.02	0.05	

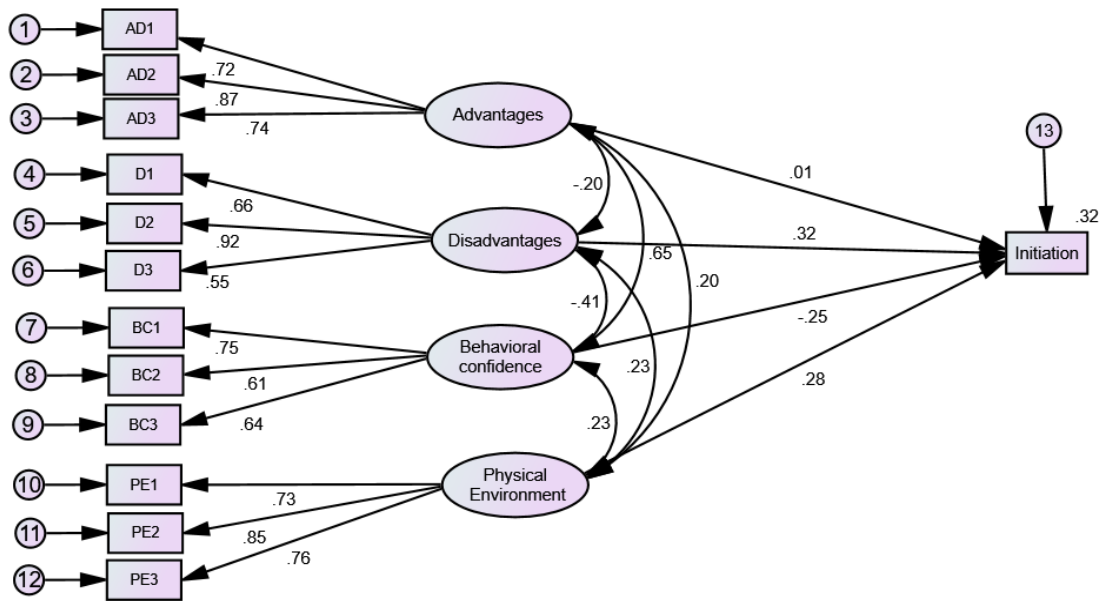


Figure 3. Structural Equation Modeling for the Likelihood of Initiation of HPV Vaccination among Ghanaian Parents

for over 13% percent of the variance. Interestingly, the participatory dialogue was the only construct that did not demonstrate a significant association in predicting vaccine initiation. This finding is noteworthy because the construct of the participatory dialogue focuses on the advantages and disadvantages of the behavior change, which in our survey was measured with questions that concentrated on the potential benefits and risks of HPV vaccination such as improved immunity, protection from various cancers, and possible side effects. This finding also suggests that Ghanaian parents believe their adolescents to have a low perceived risk of HPV which has been identified in previous research as a challenge to vaccine uptake (Wallace et al., 2019).

Perceived Beliefs

We found that perceived beliefs were strongly

associated with parents' willingness to allow their adolescents to initiate the HPV vaccine series. As confirmed by Coleman et al., both the lack of knowledge and women's perceived risk for their daughters were determined to be significant factors for HPV non-acceptance in Ghana (Coleman et al., 2011). For parents, many social, cultural, and psychological factors can influence their beliefs and willingness to allow their adolescent to receive a vaccination. In a study assessing parents' and daughters' beliefs surrounding HPV infection and vaccination, researchers found that a challenge to vaccination among parents was beliefs that their child is not at risk because they are not sexually active (Galbraith-Gyan et al., 2019). This finding was also confirmed in a 2016 study among parents in multicultural Hawai'i which found that the beliefs about the timing of HPV vaccinations are concerning to parents (Cruz et al., 2017).

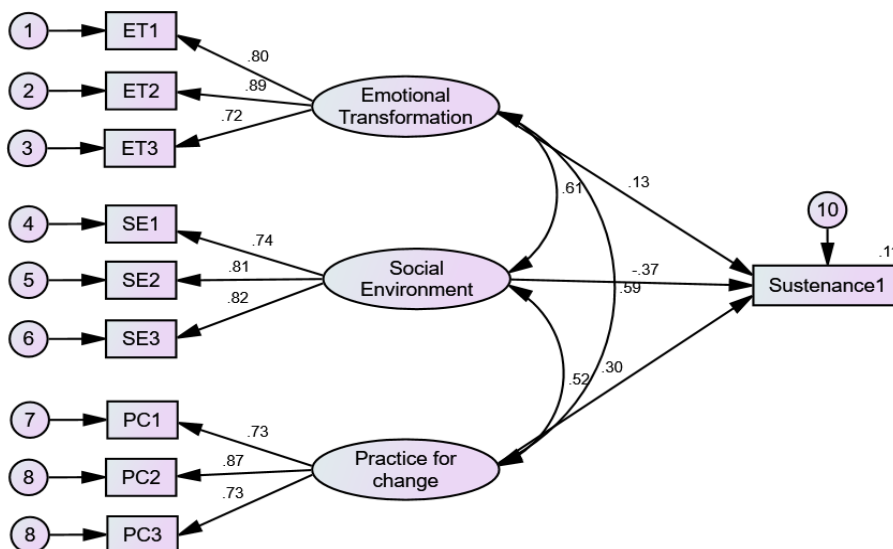


Figure 4. Structural Equation Modeling for the Likelihood of Sustenance of HPV Vaccination among Ghanaian Parents

Galbraith-Gyan et al. also reported the role of cultural norms and expectations surrounding sexuality, and sexual activity and the social consequences of an HPV diagnosis (Galbraith-Gyan et al., 2019). Other potential perceived belief barriers noted by Galbraith-Gyan et al., (2018) were fear of unknown side-effects, mistrust, novelty of the vaccine, and safety concerns (Galbraith-Gyan et al., 2019). These factors are mirrored parents in Ghana's belief system, as observed in other studies (Agyei-Baffour et al., 2020; Asare et al., 2020). Addressing these beliefs along with the lack of knowledge surrounding HPV and HPV vaccines could significantly impact HPV vaccine acceptance and initiation.

Additional negative belief systems and barriers affecting HPV vaccination were identified in a study conducted among Ugandan women, which included: fear of infection from the hospital/clinic settings, disbelief about the cause of HPV and why treatment is needed before symptoms arise, fear of the procedure, past experiences, and rumors (Hasahya et al., 2016). Siu (2014) also found that among mothers with adolescent daughters in Hong Kong, notable belief barriers to HPV vaccination were the idea that HPV vaccination encourages premarital sexual behavior, were unnecessary for young women, were potentially harmful to health, vaccinations were expensive with little protection, and that health care providers did not provide enough reassurance to promote vaccination. Many of the same fears and concerns could be echoed among Ghanaian parents and could contribute to a negative attitude and thus lowered intent to initiate HPV vaccination.

Behavioral Confidence

The behavioral confidence construct of the MTM relates to perceived behavioral control of the Theory of Planned Behavior and self-efficacy but focuses on an individual's confidence to perform a behavior in the future (Sharma and Romas, 2017). A key finding of our study was that behavioral confidence is significant in predicting parents' willingness to allow HPV vaccine initiation. A study conducted among Singaporean women between the ages of 18 – 26 years of age confirmed our findings that perceived behavioral control was moderately associated with HPV vaccination intention (Chirayil et al., 2014). Parental influence is a key factor that influences an adolescents' decision to be vaccinated, therefore intervention efforts can be implemented among Ghanaian parents to help build their confidence in the HPV vaccination efficacy and safety.

Physical Environment

In this study, the construct of the physical environment was assessed with questions relating to the reduction of physical barriers to vaccination that can improve access, availability, and convenience. Our results showed that the physical environment was a key indicator for predicting HPV vaccine initiation among parents. This is consistent with previous research that shows the physical environment plays an influential role in vaccine accessibility. Asare et al.,'s (2020) study demonstrated the physical environment to be a significant predictor of

HPV vaccine initiation among Ghanaian adolescents, and Ebu et al. noted that since its introduction in 2013, HPV vaccines have not been readily available in most facilities throughout Ghana with limited access in urban areas and very little to no access in rural or underserved communities (Asare et al., 2020; Ebu et al., 2021). In a 2020 systematic review of human papillomavirus immunization programs in LMICs, researchers highlighted the success several programs have displayed but also emphasized the health system constraints that still persist with service delivery, vaccine communication, community engagement, financing, and health workforce capacity (Amponsah-Dacosta et al., 2020; Sopian et al., 2019). The findOur findings, in combination with previous research, illustrate how physical barriers to vaccination are exacerbated by the physical environment and that in Ghana there is still a glaring need for increased communication, community support, and policy change.

Emotional Transformation and Social Environment

In terms of HPV vaccination completion, both emotional transformation and social environment proved to be significant predictors. The construct of emotional transformation focuses on the self-motivation of participants, while the social environment construct refers to interactions and communications of the parents with healthcare providers (Sharma and Romas, 2017). Key topics assessed by the social environment construct were healthcare providers' recommendations to parents about HPV vaccinations for their children and parents' comfortability in talking to healthcare providers about HPV vaccination. Our findings are consistent with other studies that found that effective social environments such as parent-provider communications increase HPV vaccination uptake (Gilkey et al., 2016; Shay et al., 2018). The key topics assessed by emotional transformation were the ability to overcome fear or self-doubt. Since emotional transformation and practice for change accounted for almost a quarter of the variability in our data, the findings indicate that HPV vaccination in Ghana is complicated by moral dilemmas and public infrastructure. These results are supported by Coleman et al.'s and Masika et al.'s studies which both noted that significant inhibitors to HPV vaccination among women in Ghana and Kenya were vaccine cost, access, and fear (Coleman et al., 2011; Masika et al., 2015). Similarly in a qualitative study of changing attitudes toward HPV prevention among Irish women, researchers noted important factors to HPV screening such as emotional response, societal influences, knowledge, logistics, and psychological effects (McRae et al., 2014). Given that 91.1% of our sample population were women, the findings of McRae et al.,'s (2014) study are similar to that of the Ghanaian parents surveyed and the various barriers to HPV vaccination that women face. Fear and anticipated regret appear to be major barriers to HPV vaccination for both young women and mothers (Hasahya et al., 2016; Pența et al., 2020; Siu, 2014). Focusing on converting feelings of fear and regret in mothers and parents could increase self-motivation and feelings of self-efficacy, thereby lessening the emotional response and encouraging HPV vaccination.

Limitations and Strengths

Potential limitations of this study may be found in the design and sampling methods used. This study used a cross-sectional design with convenience sampling, which may not provide a representative sample of the parents in the Ashanti region of Ghana. Additionally, a majority of the study population were female, thus study findings may not reflect the beliefs of both male and female parents in the Ashanti region of Ghana.

Although this study has several limitations, there are also many strengths. A major strength of this study was the use of the Multi-Theory Model as a theoretical framework. The Multi-Theory Model utilizes a combination of constructs from various health education theoretical models to predict the initiation and continuation of health behavior. In addition, we added the construct of perceived beliefs which increased the predictive power of our study and allowed for a deeper understanding of the attitudes and beliefs toward HPV vaccination among Ghanaian parents. Another strength of this study was the use of a reliable survey with a Cronbach alpha coefficient ranging from 0.71 to 0.84. In addition, this study recruited a fairly large sample with diverse ages, incomes, and educational levels.

Implications

The findings of our study have significant and far-reaching implications to improve HPV vaccination rates in Ghana. At the individual level, our findings can be utilized to develop targeted health education and intervention programs for Ghanaian parents that promote HPV vaccination. Additionally, at the societal and community level, our findings can aid in the development of community and governmental support and policies that can improve access, availability, and uptake of the HPV vaccine series in Ghana. Such efforts should focus on incorporating the constructs of perceived beliefs, behavioral confidence, change in the physical environment, emotional transformation, and social environment. Future educational and intervention programs concentrating on these modifiable factors will help to increase HPV knowledge and awareness, address accessibility and health concerns, motivate individuals, and improve HPV vaccine acceptance and uptake. Additionally, healthcare providers should be encouraged to communicate more to parents about HPV vaccinations.

In conclusion, the aim of this study was to evaluate attitudes and beliefs toward HPV vaccination among Ghanaian parents with unvaccinated adolescents using the Multi-Theory Model of behavior change. By using MTM constructs this study was able to assess both internal and external barriers to HPV vaccination in Ghana. Additionally, the use of MTM helps to predict the likelihood of initiation and completion of the recommended doses as those two outcome variables are exclusive, but necessary conditions for determining the efficacy of the vaccination in preventing HPV related cancers. Our study contributes to the HPV vaccine literature because it uses Multi-Theory Model constructs to assess predictors of both initiation and completion of adolescent HPV vaccination among Ghanaian parents. We observed that several modifiable factors (perceived beliefs,

physical environment, behavioral confidence, social environment, and emotional transformation) contribute to parents' attitudes, beliefs, and intentions toward HPV vaccination. This study provides important information about Ghanaian cultural and societal perceptions of HPV vaccination, and can be used to develop targeted interventions to increase HPV vaccination rates in Ghana.

Author Contribution Statement

MA and PAB contributed to the conception, design, and conduct of the study with MA acting as senior researchers overseeing the project. PAB, AK, and MEC recruited study participants, collected data, and supported preparation of data. MA, PAB and AK prepared and supervised data collection, prepared data for statistical analyses, and conducted statistical analyses. BKP and MA conducted literature search, drafted the manuscript. All co-authors read, provided comments and critical revisions. The final manuscript was approved by all authors prior to submission.

Acknowledgments

Funding Statement

The authors did not receive any funding to conduct this study.

Ethical Approval

All procedures performed in the study were in accordance with the ethical standards of the institutional research committee and the 1964 Declaration of Helsinki and its later amendments. This article does not contain any studies with animals performed by any of the authors. Permission was obtained from the University's Institutional Review Board (IRB) prior to the beginning of the study.

Conflict of interest

The authors do not have any conflict of interest to declare.

References

- Agyei-Baffour P, Asare M, Lanning B, et al (2020). Human papillomavirus vaccination practices and perceptions among Ghanaian Healthcare Providers: A qualitative study based on multi-theory model. *PLoS One*, **15**, e0240657.
- Amponsah-Dacosta E, Kagina BM, Olivier J (2020). Health systems constraints and facilitators of human papillomavirus immunization programmes in sub-Saharan Africa: A systematic review. *Health Policy Plan*, **35**, 701-7.
- Asare M, Agyei-Baffour P, Lanning B, et al (2020). Multi-theory model and predictors of likelihood of accepting the series of HPV vaccination: a cross-sectional study among Ghanaian adolescents. *Int J Environ Res Public Health*, **17**, 571.
- Black E, Richmond R (2018). Prevention of cervical cancer in Sub-Saharan Africa: The advantages and challenges of HPV vaccination. *Vaccines*, **6**, 61.
- Bruni L, Barrionuevo-Rosas L, Albero G, et al (2017). Human Papillomavirus and related diseases in Ghana. Summary report. ICO/IARC Information Centre on HPV and Cancer (HPV Information Centre). 2017; [Internet]. Available from: *Asian Pacific Journal of Cancer Prevention*, Vol 23 **1909**

- www.hpvcentre.net (Accessed 11 June 2021).
- Bruni L, Diaz M, Barrionuevo-Rosas L, et al (2016). Global estimates of human papillomavirus vaccination coverage by region and income level: A pooled analysis. *Lancet Glob Health*, **4**, 453-63.
- Calys-Tagoe BN, Aheto JM, Mensah G, Biritwum RB, Yawson AE (2020). Cervical cancer screening practices among women in Ghana: evidence from wave 2 of the WHO study on global AGEing and adult health. *BMC Women's Health*, **20**, 1-9.
- Centers for Disease Control and Prevention. Evidence to recommendations for HPV vaccination of Adults, Ages 27 through 45 years [Internet]. Available from: <https://www.cdc.gov/vaccines/acip/recs/grade/HPV-adults-etr.html> (Accessed 25 May 2021).
- Centers for Disease Control and Prevention. HPV Vaccination: What everyone should know. [Internet]. Available from: <https://www.cdc.gov/vaccines/vpd/hpv/public/index.html> (Accessed 25 May 2021).
- Chirayil EI, Thompson CL, Burney S (2014). Predicting human papilloma virus vaccination and pap smear screening intentions among young Singaporean women using the theory of planned behavior. *SAGE Open*, **4**, 2158244014554961.
- Claros E, Nahar VK, Mafi M, et al (2020). Using the multi-theory model of health behavior change to identify correlates of change in substance use behavior in a mental health clinic-based sample. *J Subst Use*, **25**, 555-60.
- Coleman MA, Levison J, Sangi-Haghpeykar H (2011). HPV vaccine acceptability in Ghana, West Africa. *Vaccine*, **29**, 3945-50.
- Cruz MRID, Tsark JAU, Chen JJ, Albright CL, Braun KL (2017). Human papillomavirus (HPV) vaccination motivators, barriers, and brochure preferences among parents in multicultural Hawaii 'i: A qualitative study. *J Cancer Educ*, **32**, 613-21.
- Ebu NI, Abotsi-Foli GE, Gakpo DF (2021). Nurses' and midwives' knowledge, attitudes, and acceptance regarding human papillomavirus vaccination in Ghana: A cross-sectional study. *BMC Nurs*, **20**, 1-10.
- Galbraith-Gyan KV, Lechuga J, Jenerette CM, et al (2019). African-American parents' and daughters' beliefs about HPV infection and the HPV vaccine. *Public Health Nurs*, **36**, 134-43.
- GAVI, The Vaccine Alliance. More than 30 million girls to be immunised with HPV vaccines by 2020 with GAVI support [Internet]. Available from: <https://www.gavi.org/news/media-room/more-30-million-girls-be-immunised-hpv-vaccines-2020-gavi-support> (Accessed 25 May 2021)
- Gilkey MB, Calo WA, Moss JL, et al (2016). Provider communication and HPV vaccination: The impact of recommendation quality. *Vaccine*, **34**, 1187-92.
- GlaxoSmithKline. GSK announces data to support Cervarix® two-dose schedule for the prevention of cervical cancer in 9–14 year old girls [Internet]. Available from: <https://www.gsk.com/en-gb/media/press-releases/gsk-announces-data-to-support-cervarix-two-dose-schedule-for-the-prevention-of-cervical-cancer-in-9-14-year-old-girls/> (Accessed 30 March 2021).
- Hasahya OT, Berggren V, Sematimba D, Nabirye RC, Kumakech E (2016). Beliefs, perceptions and health-seeking behaviours in relation to cervical cancer: A qualitative study among women in Uganda following completion of an HPV vaccination campaign. *Glob. Health Action*, **9**, 29336.
- HPV Information Center. Ghana: Human Papillomavirus and related cancers. 2019 [Fact Sheet]. [Internet]. Available from: https://hpvcentre.net/statistics/reports/GHA_FS.pdf (Accessed 26 May 2021).
- Hu LT, Bentler PM (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Struct Equ Modeling*, **6**, 1-55.
- International Agency for Research on Cancer. Ghana [Fact Sheet] [Internet]. Available from: <https://gco.iarc.fr/today/data/factsheets/populations/288-ghana-fact-sheets.pdf> (Accessed 25 May 2021).
- Nahar VK, Wells JK, Davis RE, et al (2020). Factors associated with initiation and sustenance of stress management behaviors in veterinary students: Testing of multi-theory model (MTM). *Int J Environ Res Public Health*, **17**, 631.
- Laryea DO, Awuah B, Amoako YA, et al (2014). Cancer incidence in Ghana, 2012: Evidence from a population-based cancer registry. *BMC Cancer*, **14**, 1-8.
- Masika MM, Ogembo JG, Chabeda SV, Wamai RG, Mugo N. (2015). Knowledge on HPV vaccine and cervical cancer facilitates vaccine acceptability among school teachers in Kitui County, Kenya. *PLoS One*, **10**, e0135563.
- McRae J, Martin C, O'Leary J, Sharp L (2014). "If you can't treat HPV, why test for it?" women's attitudes to the changing face of cervical cancer prevention: a focus group study. *BMC Womens Health*, **14**, 1-7.
- Millan C, Asare M, Lanning BA, Agyei-Baffour P (2020). Perspectives of Ghanaian health care providers on HPV vaccination: A qualitative study based on multi-theory model. [Internet]. Available from: <https://www.sbm.org/UserFiles/file/AM2020Supplement.pdf>.
- Mukakalisa I, Bindler R, Allen C, Dotson J (2014). Cervical cancer in developing countries: Effective screening and preventive strategies with an application in Rwanda. *Health Care Women Int*, **35**, 1065-80.
- Nartey Y, Hill P, Amo-Antwi K, et al (2018). Recommendations for cervical cancer prevention and control in Ghana: Public education and human papillomavirus vaccination. *Ghana Med J*, **52**, 94-102.
- Nartey Y, Hill PC, Amo-Antwi K, et al (2017). Cervical cancer in the Greater Accra and Ashanti regions of Ghana. *J Glob Oncol*, **3**, 782-90.
- National Cancer Institute. HPV and Cancer [Internet]. Available from: <https://www.cancer.gov/about-cancer/causes-prevention/risk/infectious-agents/hpv-and-cancer#what-is-hpv> (Accessed 25 May 2021).
- National Organization for Rare of Disorders. Recurrent respiratory papillomatosis [Internet]. n.d. Available from: <https://rarediseases.org/rare-diseases/recurrent-respiratory-papillomatosis/#causes> (Accessed 25 May 2021).
- Pența MA, Crăciun IC, Băban A (2020). The power of anticipated regret: Predictors of HPV vaccination and seasonal influenza vaccination acceptability among young Romanians. *Vaccine*, **38**, 1572-1578.
- Rosenstock IM (1974). Historical origins of the health belief model. *Health Educ Monogr*, **2**, 328-35.
- Sankaranarayanan R, Anorlu R, Sangwa-Lugoma G, Denny LA (2013). Infrastructure requirements for human papillomavirus vaccination and cervical cancer screening in sub-Saharan Africa. *Vaccine*, **31**, 47-52.
- Sharma M, Khubchandani J, Nahar VK (2017). Applying a new theory to smoking cessation: case of multi-theory model (MTM) for health behavior change. *Health Promot Perspect*, **7**, 102.
- Sharma M, Romas J (2017). Theoretical foundations of health education and health promotion. Burlington, MA: Jones and Bartlett, pp 250-62.
- Shay LA, Baldwin AS, Betts AC, et al (2018). Parent-provider communication of HPV vaccine hesitancy. *Pediatrics*, **141**.
- Siu JY (2014). Perceptions of and barriers to vaccinating

- daughters against Human Papillomavirus (HPV) among mothers in Hong Kong. *BMC Womens Health*, **14**, 1-10.
- Sopian MM, Din SAT, Hussin H (2019). Obstacles to Implementing the HPV Vaccine: Is it Worth Pursuing or Not?. *Asian Pac J Cancer Care*, **4**, 165-9.
- Tabachnick BG, Fidell LS, Ullman, JB (2007). Using multivariate statistics. Pearson Boston, MA.
- Wallace AS, Wannemuehler K, Bonsu G, et al (2019). Development of a valid and reliable scale to assess parents' beliefs and attitudes about childhood vaccines and their association with vaccination uptake and delay in Ghana. *Vaccine*, **37**, 848-56.
- Williams LJ, Vandenberg RJ, Edwards JR (2009). 12 structural equation modeling in management research: A guide for improved analysis. *Acad Manag Ann*, **3**, 543-604.
- World Health Organization. Cervical Cancer [Internet]. Available from: <https://www.afro.who.int/health-topics/cervical-cancer> (Accessed 25 May 2021).
- World Health Organization. Cervical Cancer (HPV) [Internet]. Available from: [https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases/human-papillomavirus-vaccines-\(HPV\)](https://www.who.int/teams/immunization-vaccines-and-biologicals/diseases/human-papillomavirus-vaccines-(HPV)) (Accessed 25 May 2021).
- World Health Organization. Human Papillomavirus (HPV) and Cervical Cancer [Internet]. Available from: [https://www.who.int/news-room/fact-sheets/detail/human-papillomavirus-\(HPV\)-and-cervical-cancer](https://www.who.int/news-room/fact-sheets/detail/human-papillomavirus-(HPV)-and-cervical-cancer) (Accessed 25 May 2021).



This work is licensed under a Creative Commons Attribution-Non Commercial 4.0 International License.