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Practice-, provider-, and patient-level influences on U.S. Vietnamese parents' decision-making about HPV vaccination for their adolescents

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Doctor of Philosophy

Behavioral, Social, and Health Education Sciences

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Abstract

Practice-, provider-, and patient-level influences on U.S. Vietnamese parents' decision-making about HPV vaccination for their adolescents

By Ha Ngan (Milkie) Vu

U.S. Vietnamese have high cervical cancer incidence rates and low human papillomavirus (HPV) vaccine uptake. Unfortunately, limited research has disaggregated the Asian-American population to examine mechanistic explanations for this disparity. Moreover, no prior work has leveraged a theory-guided health services framework to examine a range of health system-level factors influencing HPV vaccine uptake among U.S. Vietnamese. This dissertation study seeks to fill this gap in the literature and leverage a comprehensive health systems perspective (the P3 model) to identify practice-, provider- and patient-level determinants of U.S. Vietnamese parents' HPV vaccine uptake for their adolescents.

We conducted three research studies. In Study 1, we conducted a systematic review of the literature to identify practice-, provider-, and patient-level determinants of HPV vaccine intention and uptake among Asian-Americans. In Study 2, we analyzed cross-sectional data from our national online survey to examine practice-, provider-, and patient-level factors impacting U.S. Vietnamese parents' HPV vaccine decision-making process. In Study 3, we analyzed qualitative semi-structured interview data to expand upon findings in Study 2, specifically by providing greater context regarding important factors for HPV vaccine acceptance and uptake and by identifying additional P3 influences on mothers' HPV vaccine decision-making.

We found low parental HPV vaccine uptake for U.S. Vietnamese adolescents. Practice-level findings indicated a desire for clinic-based materials about the HPV vaccine to be available in Vietnamese and a need for automated scheduling of HPV vaccine appointments. Provider-level findings show that provider recommendation, particularly a high-quality provider recommendation (e.g., urging same-day vaccination; emphasizing the importance of the vaccine), was critical to HPV vaccine acceptance and uptake. Moreover, we found several patient-level targets for education and programs, including a lack of knowledge about eligible ages and the number of vaccine doses, perceived child's sexual activity, and a lack of understanding about gender-neutral vaccination. The findings advance cancer health equity through exploring multilevel determinants of HPV vaccine uptake among a high-risk minority group and highlight the need for disaggregated data for Asian subgroups in order to understand disparities in health behaviors and outcomes experienced by different communities.

Practice-, provider-, and patient-level influences on U.S. Vietnamese parents' decision-making about HPV vaccination for their adolescents

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Table of Contents

SUMMARY AND SPECIFIC AIMS

U.S. Vietnamese, defined as those living in the U.S. and identifying as Vietnamese, number more than 1.8 million as of 2019, representing the fourth largest Asian group in the U.S (United States Census Bureau, 2019). Critical to this proposal, U.S. Vietnamese women have had historically the highest cervical cancer rates among all racial/ethnic groups in the U.S. Specifically, during the period of 1988 to 1992, the cervical cancer rates among U.S. Vietnamese was 43.0 per 100,000, compared to the nationwide rate of around 10.0 per 100,000 and the specific subgroup rates of 16.2 per 100,000 among Hispanic, 15.2 per 100,000 among Korean-Americans, 13.2 per 100,000 among Blacks, 7.5 per 100,000 among non-Hispanic Whites, 7.3 per 100,000 among Chinese-Americans, and 5.8 per 100,000 among Japanese-Americans (Miller et al., 1996; Parker et al., 1998; Surveillance Epidemiology and End Results Program, n.d.). The cervical cancer rates of U.S. Vietnamese have since decreased but still remain high. From 2009 to 2011, the cervical cancer incidence rate (per 100,000) was 9.0 for U.S. Vietnamese, higher than for all Asian-Americans (6.5) and non-Hispanic Whites (7.5), respectively (Jin et al., 2016). Unfortunately, limited research has disaggregated the Asian-American population to examine mechanistic explanations for this disparity. Indeed, the term "Asian-American" is used to define a very heterogeneous population from around 30 countries with different languages, cultures, and norms. Subpopulation differences are critical in understanding causes for such disparities (Mui et al., 2017). What is known is that, compared to other Asians in the U.S., Vietnamese have lower English proficiency, median household income, and educational attainment (Pew Research Center, 2012, 2017), reflecting potential barriers to health services utilization. Additionally, data from the California Health Interview Survey also show that Vietnamese have lower rates of Pap

test and colorectal cancer screening compared to other Asian groups and compared to non-Hispanic Whites (Maxwell et al., 2010; Ponce et al., 2003; Wong et al., 2005).

Human papillomavirus (HPV) vaccine is a safe and effective method to protect against HPV-related cancers such as cervical cancer. However, HPV vaccine continues to be underutilized in the U.S. (Reagan-Steiner et al., 2016; Walker et al., 2017). The 2019 NIS-Teen, which surveyed vaccination coverage of U.S. adolescents aged 13 to 17, estimated that 72% and 54% of all adolescents had initiated and completed the HPV vaccine series, respectively (Elam-Evans et al., 2020). These rates fall below the Healthy People 2020 goals of 80% HPV vaccination coverage (Office of Disease Prevention and Health, 2014).

Furthermore, HPV vaccine utilization is particularly low among Asian-Americans. The National Health and Nutrition Examination Surveys (from 2013 to 2016) show that female and male Asians aged 9-26 have the lowest levels of HPV vaccine initiation among all racial/ethnic groups in the U.S. (Patel et al., 2018). The National Health Interview Surveys (from 2013 to 2015) show that Asian adult women have lower HPV vaccine initiation and completion rates compared to non-Hispanic Whites (Agénor et al., 2018; Cofie et al., 2018). Moreover, studies of college students in the U.S. also consistently show that Asian college students have lower rates of HPV vaccination compared to White students (Cohen et al., 2015; LaJoie et al., 2018; H. Y. Lee et al., 2015; Licht et al., 2010b).

To date, only 6 studies have looked at HPV vaccine uptake specifically among U.S. Vietnamese; all revealed low knowledge and uptake (Duong & Hopfer, 2020; Gor et al., 2011; Hopfer et al., 2017; Nguyen-Truong et al., 2017; Yi, Anderson, et al., 2013; Yi, Lackey, et al., 2013). Our preliminary work with 101 Vietnamese adults in Atlanta indicated only 60% had ever heard of HPV vaccine; only 1 out of 16 parents with children aged 9 to 26 reported that their

child had initiated HPV vaccine. Collectively, these findings highlight the need to explore HPV vaccine awareness and uptake in this population. However, no prior work has leveraged a theory-guided health services framework to examine a range of health system-level factors influencing HPV vaccine uptake among either Asian-Americans or U.S. Vietnamese. Indeed, previous studies have focused almost exclusively on patient-level factors (e.g., English proficiency or acculturation), leaving critical gaps in research on determinants within the broader healthcare environment that contribute to disparities in HPV vaccine and ultimately cancer risk. Given that multilevel interventions are more effective compared to individual-level interventions (Smedley et al., 2000), research assessing a broader array of potential determinants (from the patient to healthcare practice level) is needed to develop effective interventions for HPV vaccine uptake among U.S. Vietnamese.

The ***long-term goal*** of this program of research is to increase HPV vaccine uptake among a high-risk minority population to reduce HPV-related cancers and promote health equity. The ***overall objective*** of this dissertation project is to leverage a comprehensive health systems perspective to identify determinants of U.S. Vietnamese parents' HPV vaccine uptake for their adolescents. The ***scientific premise*** is based on the literature establishing high cervical cancer rates, low HPV vaccine uptake, and potential mechanisms influencing HPV vaccine uptake among U.S. Vietnamese (e.g., linguistically and culturally appropriate promotion materials, HPV vaccine recommendation quality, and predisposing, enabling, and reinforcing factors) (Allen et al., 2010; Apaydin et al., 2018; Bhat-Schelbert et al., 2012; Brewer & Fazekas, 2007; Dela Cruz et al., 2016; DiClemente et al., 2015; Fernández et al., 2010; Gaston-Johansson et al., 2007; Gerend et al., 2009, 2013; Gilkey et al., 2016, 2017; Guimond & Salman, 201; Holman et al., 2014; Hopfer et al., 2017; Jackson et al., 2002; Javanbakht et al., 2012; Kepka et al., 2015;

Kessels et al., 2012; Kim et al., 2015; Krawczyk et al., 2015; Lam et al., 2003; H. Lee et al., 2016; Licht et al., 2010a; Lorini et al., 2018; Luque et al., 2017; Newman et al., 2018; Nonzee et al., 2018a; Reiter et al., 2009, 2011; Truong et al., 2014; Yi, Anderson, et al., 2013; Yi, Lackey, et al., 2013; Ylitalo et al., 2013).

Guided by the P3 (practice-, provider-, and patient-level) model (Bednarczyk et al., 2018), this study will address the ***central hypothesis*** that ***p***ractice, ***p***rovider, and ***p***atient-level factors are independently predictive of U.S. Vietnamese parents' HPV vaccine uptake for their children. This study will address a critical gap in the literature, as it will be the first to leverage a health services research framework and an explanatory sequential mixed-method design (Creswell & Poth, 2018; Ivankova et al., 2006) to examine multilevel determinants of HPV vaccine uptake among U.S. Vietnamese parents.

This dissertation will address three ***specific aims***:

Aim 1 (Study 1): Identify practice-, provider-, and patient-level factors influencing HPV vaccine intention and uptake among Asians in the U.S. A systematic review of the existing literature will be conducted using the P3 model as the guiding framework. This study will identify and inform measurements included in Aim 2 and 3.

Aim 2 (Study 2): Quantitatively examine practice-, provider-, and patient-level factors influencing U.S. Vietnamese parents' HPV vaccine uptake for their adolescents. A national, cross-sectional, online survey will be conducted among 410 U.S. Vietnamese parents with children aged 9 to 18.

Hypothesis: Factors at the practice level (linguistically and culturally appropriate HPV vaccine materials, use of patient navigation and interpreter services), provider level

(quality of HPV vaccine recommendation), and patient level (predisposing, enabling, and reinforcing) influence HPV vaccine uptake.

Aim 3 (Study 3): Qualitatively examine why and how factors identified in Aim 2 shape U.S. Vietnamese parents' HPV vaccine decision-making and assess practice-, provider-, and patient-level strategies to promote adolescent HPV vaccine uptake. Phone-based semi-structured interviews will be conducted among 32 survey respondents purposively recruited to represent subgroups by HPV vaccine status and sex of child.

Expected outcomes of the study include the identification of multilevel determinants and strategies to improve HPV vaccine uptake among U.S. Vietnamese, an understudied and high-risk minority group. The project will have a ***positive impact*** by advancing cancer health equity (National Cancer Institute, 2018a) through exploring multilevel barriers to HPV vaccine and cancer prevention for a high-risk minority group. The knowledge gained from this study can eventually inform the development of HPV vaccine and cancer prevention interventions for minority groups.

Chapter 1: Introduction

INTRODUCTION AND LITERATURE REVIEW

Cervical Cancer Disparities Impacting U.S. Vietnamese

For the purposes of this dissertation, U.S. Vietnamese are identified as those identifying as Vietnamese and living in the U.S. Between 2000 and 2015, the U.S. Vietnamese population grew by 61% (Pew Research Center, 2017). U.S. Vietnamese number more than 1.8 million as of 2019, representing the fourth largest Asian group in the U.S (United States Census Bureau, 2019). Compared to other Asian-Americans, U.S. Vietnamese have lower English proficiency, median household income, and educational attainment (Pew Research Center, 2012, 2017). *These disadvantages may represent barriers for U.S. Vietnamese in health services utilization, highlighting a need to study this specific subgroup (rather than Asian-Americans as an aggregate).* Additionally, data from the California Health Interview Survey also show that Vietnamese have lower rates of Pap test and colorectal cancer screening compared to other Asian groups and compared to non-Hispanic Whites (Maxwell et al., 2010; Ponce et al., 2003; Wong et al., 2005).

Further emphasizing the need to study this population is the fact that U.S. Vietnamese women have had historically the highest cervical cancer rates among all racial/ethnic groups. From 1988 to 1992, the cervical cancer incidence rate (per 100,000) among U.S. Vietnamese was 43.0, compared to the specific subgroup rates of 16.2 per 100,000 among Hispanic, 15.2 per 100,000 among Korean-Americans, 13.2 per 100,000 among Blacks, 7.5 per 100,000 among non-Hispanic Whites, 7.3 per 100,000 among Chinese-Americans, and 5.8 per 100,000 among Japanese-Americans (Miller et al., 1996; Parker et al., 1998; Surveillance Epidemiology and End Results Program, n.d.). The rates have since decreased but still remain high (Cockburn &

Deapen, 2004). From 2009 to 2011, the cervical cancer incidence rate (per 100,000) was 9.0 for U.S. Vietnamese, compared to 6.5 for all Asian-Americans and 7.5 for non-Hispanic Whites (Jin et al., 2016). *Evidence of cervical cancer burdens shows a critical need to promote HPV vaccine uptake as a HPV-related cancer prevention strategy among U.S. Vietnamese (along with others such as cervical cancer screening).* It should also be noted that time may be needed to study the population-level impact of the HPV vaccine on reducing cervical cancer burdens among U.S. Vietnamese; therefore, reducing HPV-related cancers is a long-term outcome of this proposal. The short-term outcome concerns U.S. Vietnamese parents' HPV vaccine uptake for adolescent children.

HPV Vaccine as an Effective Method for Preventing Cancer

HPV vaccine is the most effective when administered before initial exposure to the virus (e.g., sexual activity) (National Cancer Institute, 2018b). It is recommended to adolescents beginning at the age of 11 or 12 (Centers for Disease Control and Prevention, 2018). HPV vaccine are recommended in a 2-dose series if initiated prior to the age of 15, and in a 3-dose series if initiated on or after (Meites et al., 2016). In addition, the ACIP also recommends shared clinical decision-making regarding HPV vaccination for some adults aged 27-45 who are not adequately vaccinated (Meites et al., 2019). The vaccine is recommended for both sexes and provides close to 100% protection against genital warts and different cancers caused by HPV (Centers for Disease Control and Prevention, 2018), including cancers of the cervix, vagina, and vulva in women; cancers of the penis in men; and cancers of the anus in both men and women. Using cervicovaginal specimens from the National Health and Nutrition Examination Surveys, researchers found that since the HPV vaccine was introduced, among girls aged 14-19, prevalence of the HPV types targeted by the vaccines dropped from 11.5% in 2003-2006 to 4.3%

in 2009-2012 (a decrease of 64%) (Markowitz et al., 2016). Additionally, HPV rates in women aged 20-24 went from 18.5% in 2003-2006 to 12.1% in 2009-2012 (a 34% drop) (Markowitz et al., 2016).

HPV vaccine initiation is defined as receiving at least one dose of HPV vaccine. HPV vaccine completion is defined at two doses if HPV vaccine is initiated prior to the age of 15 and three doses if initiated on or after (Meites et al., 2016). In synthesizing the literature, this dissertation uses "HPV vaccine uptake" broadly as HPV vaccine initiation and/or completion, but distinguishes between the two in our methods.

HPV vaccine continues to be underutilized in the U.S. (Reagan-Steiner et al., 2016; Walker et al., 2017). The 2019 NIS-Teen, which surveyed vaccination coverage of U.S. adolescents aged 13 to 17, estimated that 72% and 54% of all adolescents had initiated and completed the HPV vaccine series, respectively (Elam-Evans et al., 2020). These rates fall below the Healthy People 2020 goals of 80% HPV vaccination coverage (Office of Disease Prevention and Health, 2014).

HPV Vaccine Uptake Disparities among Asian-Americans and U.S. Vietnamese

The National Health and Nutrition Examination Surveys (from 2013 to 2016) show that female and male Asians aged 9-26 have the lowest levels of HPV vaccine initiation among all racial/ethnic groups in the U.S. (Patel et al., 2018). The National Health Interview Surveys (from 2013 to 2015) show that Asian adult women have lower HPV vaccine initiation and completion rates compared to non-Hispanic Whites (Agénor et al., 2018; Cofie et al., 2018). Additionally, a study on trends in HPV vaccine awareness and uptake in California from 2007 to 2011 of 3,647 participants found that parents who are Asian or Pacific Islanders are less likely to be aware of the HPV vaccine compared to Whites, Latinos, and African-Americans throughout the period

studied (Nonzee et al., 2018b). Moreover, studies of college students in the U.S. also consistently show that Asian college students have lower rates of HPV vaccination compared to White students (Cohen et al., 2015; LaJoie et al., 2018; H. Y. Lee et al., 2015; Licht et al., 2010b).

To our knowledge, only five studies have investigated HPV vaccination among U.S. Vietnamese. This body of research indicates that U.S. Vietnamese have low HPV vaccine awareness and/or uptake (Gor et al., 2011; Hopfer et al., 2017; Nguyen-Truong et al., 2017; Yi, Anderson, et al., 2013; Yi, Lackey, et al., 2013). For example, a survey in Houston of 113 U.S. Vietnamese women found only 14% of them had initiated HPV vaccine (Yi, Anderson, et al., 2013). Focus groups with 40 Vietnamese women in Portland revealed low awareness of HPV vaccine (Nguyen-Truong et al., 2017). Our preliminary work with 101 Vietnamese adults in Atlanta indicated only 60% had ever heard of HPV vaccine; only 1 out of 16 with children aged 9 to 26 reported HPV vaccine initiation for their child. *Low HPV vaccine uptake among U.S. Vietnamese underscores the need for research on determinants of HPV vaccine uptake in this population, which will inform efforts to address barriers and promote higher HPV vaccine rates.*

CURRENT LIMITATIONS IN THE LITERATURE

Much of aforementioned research using national surveys on HPV vaccine among Asian-Americans does not disaggregate study results by countries of origins, *thus hindering the ability to estimate U.S. Vietnamese' HPV vaccine uptake on a national level*. Given aforementioned socioeconomic disadvantages among Vietnamese compared to other Asians in the U.S. (e.g., lower income and English proficiency) (Pew Research Center, 2012, 2017), this group may encounter more barriers to HPV vaccination.

Additionally, of the 6 existing studies on U.S. Vietnamese and HPV vaccine uptake (see above), none has leveraged a health services framework to examine factors at different health

system levels influencing HPV vaccine uptake in this population. Instead, prior studies have focused on individual-level factors such as English fluency or HPV knowledge (Gor et al., 2011; Hopfer et al., 2017; Nguyen-Truong et al., 2017; Yi, Anderson, et al., 2013; Yi, Lackey, et al., 2013). Only 2 out of the 6 studies have assessed factors beyond the individual level and only examined receipt (ever or never) of provider recommendation for HPV vaccine (Hopfer et al., 2017; Yi, Lackey, et al., 2013). *The emphasis on individual-level factors limits the utility of existing research in informing multilevel interventions to improve HPV vaccine uptake among U.S. Vietnamese.*

THEORETICAL FRAMEWORK

The Need for Theoretically-Driven Research on Multilevel Determinants.

Increasingly, researchers recognize that health behaviors and outcomes are not just driven by individual-level factors, but are often results of a dynamic interplay between factors at multiple socioecological levels, such as individuals' physiological processes and behavioral patterns; the physical, social, cultural, and economic contexts; and larger social and systemic processes (Glass & McAtee, 2006; McLeroy et al., 1988; Smedley et al., 2000). The Institute of Medicine recommends that interventions should target multiple socioecological levels of influence instead of focusing on one level of determinants (Smedley et al., 2000). *To develop effective interventions for HPV vaccine uptake among U.S. Vietnamese, research needs to not only focus on patient-level factors but also address the broader healthcare environment in which patients make healthcare decisions.*

Theoretical Framework: The P3 Model.

The P3 model was developed by Bednarczyk and colleagues to concomitantly address factors at the healthcare practice, healthcare provider, and patient levels that influence preventive

health behaviors (Bednarczyk et al., 2018). The P3 model drew on key components of many existing theoretical models, including the Health Belief Model, Theory of Planned Behavior/Theory of Reasoned Action, Social Cognitive Theory, Social Ecological Model, and the Systems Model of Clinical Preventive Care. This model provides the theoretical framework for identifying important factors impacting HPV vaccine beliefs, attitudes, and uptake among Asians in the U.S. (Aim 1) in general and U.S. Vietnamese parents' HPV vaccine uptake for adolescent children (Aim 2 and 3) in particular. ***Figure 1.1.*** illustrates the model.

Application of the P3 Model to Identify Multilevel Factors Impacting U.S. Vietnamese Parents' HPV Vaccine Uptake for Their Adolescents.

At the practice or clinic level, educational materials that are linguistically appropriate (e.g., comprehensible or in preferred language) and/or culturally appropriate (e.g., relevant to cultural beliefs) can positively impact HPV prevention-related knowledge and behaviors in diverse populations. Studies have documented the positive influences of linguistically and culturally appropriate materials on HPV vaccine knowledge, HPV vaccine uptake, cervical cancer knowledge, and/or cervical cancer screening in African-American adolescent girls (DiClemente et al., 2015), parents of diverse origins in Hawaii (Dela Cruz et al., 2016), Latina immigrants (Luque et al., 2017), and Chinese immigrants (Jackson et al., 2002). Access to culturally appropriate educational materials in Vietnamese language was also associated with increased cervical cancer screening in U.S. Vietnamese women (Lam et al., 2003).

At the provider level, providers' recommendation has been established as a strong predictor of HPV vaccine uptake and acceptance (Fernández et al., 2010; Holman et al., 2014; Javanbakht et al., 2012; Ylitalo et al., 2013) including among U.S. Vietnamese women (Hopfer et al., 2017; Yi, Lackey, et al., 2013). While not yet examined among U.S. Vietnamese, the

quality of recommendation can also play a role in influencing uptake, with parents who received high-quality recommendation (i.e. recommendation that strongly endorses HPV vaccine, focuses on cancer prevention, and urges same-day vaccination) being more likely to initiate and complete the HPV vaccine series for their children (Gilkey et al., 2016). Providers' cultural competency also positively influences healthcare utilization in general (Gaston-Johansson et al., 2007; Truong et al., 2014) and HPV vaccine and cervical cancer screening acceptance in minority populations specifically (Apaydin et al., 2018; Guimond & Salman, 2013).

At the patient level, in terms of predisposing factors (Bednarczyk et al., 2018; Green & Kreuter, 2005) (i.e., individual characteristics, beliefs, and values that facilitate or hinder HPV vaccine uptake), studies on HPV vaccine among U.S. Vietnamese have pointed to increased English proficiency (Yi, Anderson, et al., 2013; Yi, Lackey, et al., 2013) as a correlate of HPV vaccine uptake. A mechanism explaining this finding could be because English proficiency is related to increased ability to communicate with and receive recommendations from providers, though studies have not directly measured this mechanism. Additional predisposing factors that have been identified as influential for HPV vaccine uptake in the literature include the parent's HPV vaccine attitudes and beliefs (Gilkey et al., 2017; Newman et al., 2018; Reiter et al., 2009) as well as the child's older age (Gerend et al., 2009; Reiter et al., 2011) and sex (i.e., being female) (Holman et al., 2014; Newman et al., 2018). For immigrant parents, American acculturation (i.e., cultural identification and practices) is also associated with higher HPV vaccine uptake.(Gerend et al., 2013; Kepka et al., 2015). In terms of enabling factors (Bednarczyk et al., 2018; Green & Kreuter, 2005) (i.e., skills, resources, or barriers that facilitate or hinder HPV vaccine uptake), having health insurance and higher parental education can play a role, although current literature provides mixed findings (e.g., studies have documented mixed

effects of being uninsured vs. having insurance, and having lower vs. higher education on HPV vaccine uptake) (Brewer & Fazekas, 2007; Kessels et al., 2012; Nonzee et al., 2018a). In addition, there is evidence linking higher health literacy (Kim et al., 2015; Lorini et al., 2018) and higher HPV knowledge (H. Lee et al., 2016; Licht et al., 2010a; Yi, Anderson, et al., 2013) to HPV vaccine uptake. In terms of reinforcing factors (Bednarczyk et al., 2018; Green & Kreuter, 2005) (i.e., perceived rewards and feedback received from HPV vaccine uptake), social norms (e.g., approval or disapproval from family members and friends) also influence HPV vaccine decision-making (Allen et al., 2010; Krawczyk et al., 2015). *In sum, evidence supports potential practice-, provider-, and patient-level mechanisms (e.g., linguistically and culturally appropriate promotion materials, vaccine promotion by staff, HPV vaccine recommendation quality, providers' cultural competency, and predisposing, enabling, and reinforcing factors) that may influence HPV vaccine uptake* (Allen et al., 2010; Apaydin et al., 2018; Bhat-Schelbert et al., 2012; Brewer & Fazekas, 2007; Dela Cruz et al., 2016; DiClemente et al., 2015; Fernández et al., 2010; Gaston-Johansson et al., 2007; Gerend et al., 2009, 2013; Gilkey et al., 2016, 2017; Guimond & Salman, 2013; Holman et al., 2014; Hopfer et al., 2017; Jackson et al., 2002; Javanbakht et al., 2012; Kepka et al., 2015; Kessels et al., 2012; Kim et al., 2015; Krawczyk et al., 2015; Lam et al., 2003; H. Lee et al., 2016; Licht et al., 2010a; Lorini et al., 2018; Luque et al., 2017; Newman et al., 2018; Nonzee et al., 2018a; Reiter et al., 2009, 2011; Truong et al., 2014; Yi, Anderson, et al., 2013; Yi, Lackey, et al., 2013; Ylitalo et al., 2013).

CONCEPTUAL MODEL

Figure 1.2. depicts a conceptual model summarizing these potential multilevel determinants of U.S. Vietnamese parents' HPV vaccine uptake for their children.

SUMMARY

The **scientific premise** for this study builds on 1) high cervical rates among U.S. Vietnamese; 2) low HPV vaccine uptake among U.S. Vietnamese; and 3) potential mechanisms at the practice level (linguistically and culturally appropriate HPV vaccine materials and vaccine promotion by staff) (Bhat-Schelbert et al., 2012; Dela Cruz et al., 2016; DiClemente et al., 2015; Jackson et al., 2002; Lam et al., 2003; Luque et al., 2017), provider level (recommendation quality and cultural competency) (Apaydin et al., 2018; Fernández et al., 2010; Gaston-Johansson et al., 2007; Gilkey et al., 2016; Guimond & Salman, 2013; Holman et al., 2014; Hopfer et al., 2017; Javanbakht et al., 2012; Truong et al., 2014; Yi, Lackey, et al., 2013; Ylitalo et al., 2013), and patient level (predisposing, enabling, and reinforcing factors) (Allen et al., 2010; Brewer & Fazekas, 2007; Gerend et al., 2009, 2013; Gilkey et al., 2017; Holman et al., 2014; Kepka et al., 2015; Kessels et al., 2012; Kim et al., 2015; Krawczyk et al., 2015; H. Lee et al., 2016; Licht et al., 2010a; Lorini et al., 2018; Newman et al., 2018; Nonzee et al., 2018a; Reiter et al., 2009, 2011; Yi, Anderson, et al., 2013; Yi, Lackey, et al., 2013) that may influence HPV vaccine uptake. It will address **critical barriers** in the field, specifically the lack of disaggregated data (e.g., Vietnamese instead of Asians) and lack of theoretically-driven research on multilevel determinants of U.S. Vietnamese parents' HPV vaccine uptake for their adolescents. This project will **advance scientific knowledge** of practice-, provider-, and patient-level determinants impacting U.S. Vietnamese parents' HPV vaccine decision-making.

Figure 1.1 - The P3 (Practice-, Provider, and Patient-Level) Model and Relevant Impacting Factors on Health Behaviors (Bednarczyk et al. 2018)

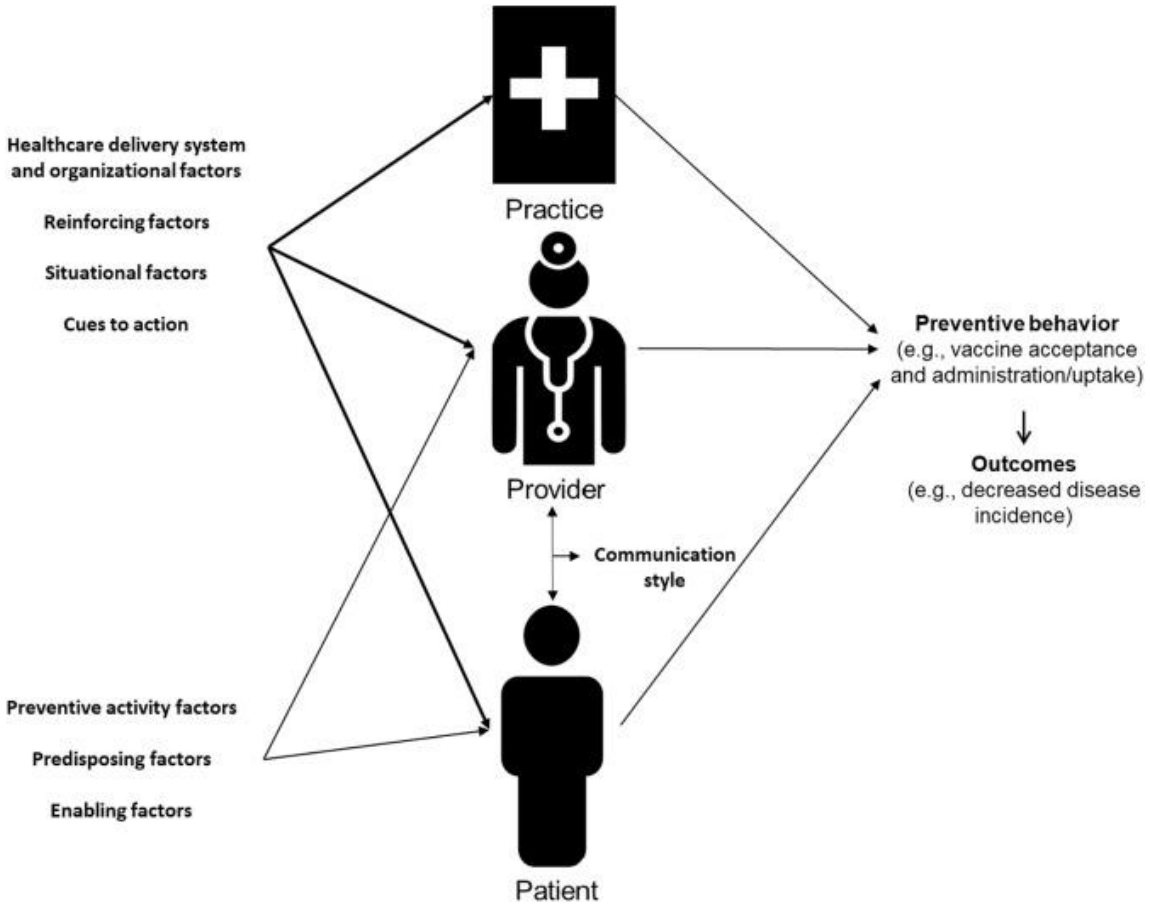
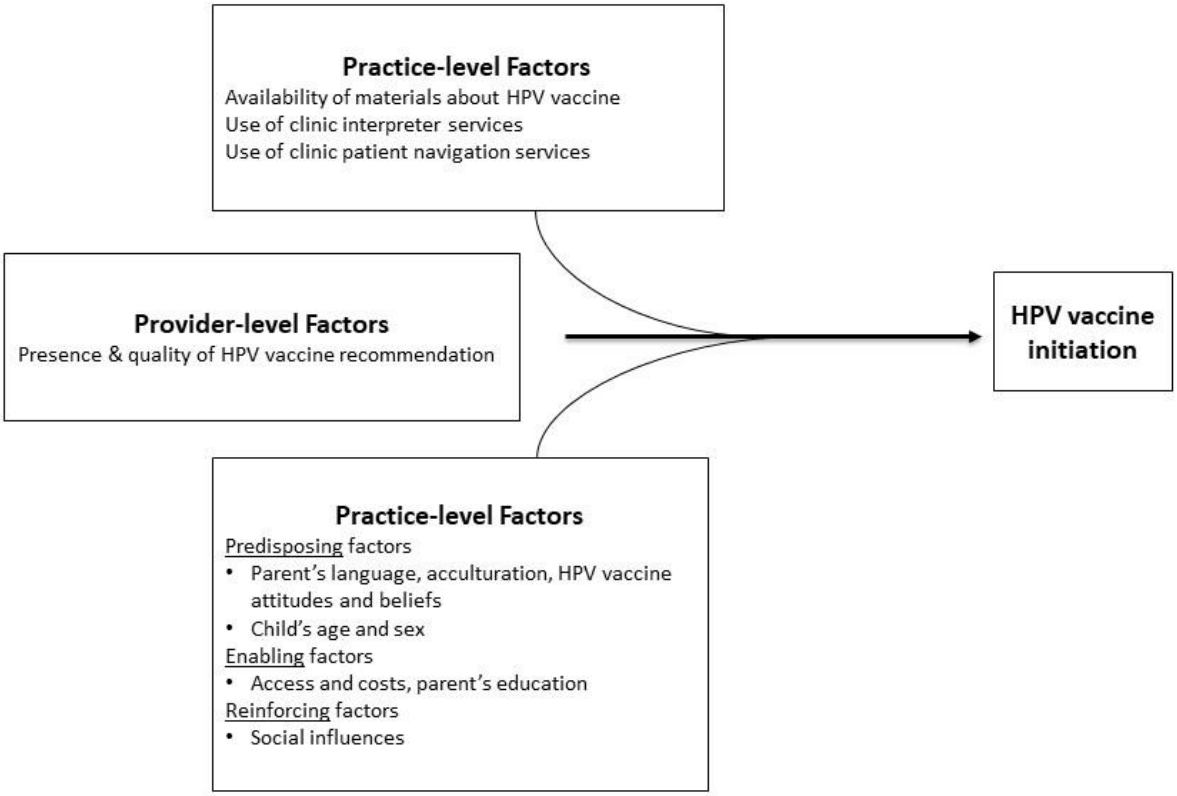


Figure 1.2 – Conceptual Model of the Project



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CHAPTER 2: A systematic review of practice-, provider-, and patient-level determinants impacting Asian-Americans' human papillomavirus vaccine intention and uptake

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INTRODUCTION

Asian-Americans are extraordinarily heterogeneous, representing people from over 30 countries and speaking over 100 languages/dialects, with diverse immigration histories, socioeconomic status, religious/cultural beliefs, social norms, and patterns of health services utilization (Hamilton et al., 2016; Thompson et al., 2016). Numbering around 22 million, Asians are currently the fastest-growing racial/ethnic group in the U.S. (Pew Research Center, 2017, 2019; United States Census Bureau, 2019). Despite their growing number, Asians have traditionally been overlooked in health disparities research (Đoàn et al., 2019; Ghosh, 2010; S. S. Yi, 2020), partially due to the "model minority" stereotype (i.e., overemphasis on Asians' ability to overcome hardship and succeed in America) (S. S. Yi et al., 2016).

One area that merits special attention is HPV vaccination among Asian adults and adolescents. The 2013-2016 National Health and Nutrition Examination Surveys (NHANES) indicated that Asians aged 9 to 26 have the lowest levels of HPV vaccine initiation among all racial/ethnic groups (Patel et al., 2018). For example, the 2015-2016 NHANES wave showed that 39.6% of female Asians had initiated the vaccine, which was lower than male non-Hispanic Whites (48.4%), non-Hispanic Blacks (49.2%), Mexican-Americans (42.4%), and other Hispanic

(42.6%). Among male Asians, prevalence of initiation was 26.4%, again lower than that of male non-Hispanic Whites (27.8%), non-Hispanic Blacks (28.1%), Mexican-Americans (28.0%), and other Hispanic (27.8%) (Patel et al., 2018).

The 2013-2015 National Health Interview Surveys (NHIS) also showed that Asian adult women have lower HPV vaccine initiation and completion coverage compared to non-Hispanic Whites (Agénor et al., 2018; Cofie et al., 2018). For example, in the 2015 NHIS wave, the prevalence of Asian women's HPV vaccine initiation and completion was 29.4% and 17.5%, respectively, in comparison to 37.9% and 26.7% for non-Hispanic Whites (Agénor et al., 2018). Furthermore, the 2018 National Immunization Teen – Survey demonstrated that 65.3% and 53.1% of Asian adolescents' had initiated and completed the HPV vaccine series, respectively, both of which were lower than Black adolescents (72.8% and 53.3%) and Hispanic adolescents (75.5% and 56.6%) (Walker et al., 2019). Research with college students also consistently reported that Asian students have lower HPV vaccination coverage compared to White students (Cohen et al., 2015; LaJoie et al., 2018; H. Y. Lee et al., 2015; Licht et al., 2010).

Despite this evidence, no research has attempted to examine underlying mechanisms of HPV vaccine uptake disparities among Asian-Americans. While a number of systematic reviews have focused on factors influencing HPV vaccine attitudes, acceptability, and uptake among general U.S. populations (Brewer & Fazekas, 2007; Kessels et al., 2012; Newman et al., 2013; Radisic et al., 2017) and among minorities such as African-Americans and Latinos (Galbraith et al., 2016) or immigrants (K. Kim & LeClaire, 2017), to date no such review has focused on Asians. This gap in the literature makes it difficult for researchers interested in this population to understand and intervene on important determinants of HPV vaccine utilization. Indeed, to date, we are aware of only three published interventions targeting HPV vaccine among Asian-

Americans: a text-messaging intervention for Korean-Americans (H. Y. Lee et al., 2016) and two storytelling interventions for Korean-Americans and Vietnamese-Americans (Chen et al., 2019; M. Kim, Lee, Kiang, & Allison, 2019).

Theoretical Framework and Outcome Measurements

Our guiding framework for this systematic review is the P3 (practice, provider, and patient) model (Bednarczyk et al., 2018). The P3 model is a framework for understanding influences on preventive health behaviors (e.g., HPV vaccination) across three levels – the ***practice*** (e.g., vaccine supply, vaccine policy, use of standing orders), ***provider*** (e.g., clinical experiences, training, self-efficacy), and ***patient*** (e.g., sociodemographic characteristics, attitudes, access to care, social influences). Within each of the three levels, influences can be further categorized into different domains, such as healthcare delivery/organizational, communication style, predisposing, enabling, and reinforcing factors (Green & Kreuter, 2005; Walsh & McPhee, 1992).

In using the P3 model, we aim to highlight possible multilevel influences on HPV vaccine intention and uptake. Increasingly, researchers recognize that health behaviors and outcomes are not just driven by individual-level factors, but are often results of interplays between factors at multiple socioecological levels, such as individuals' physiological processes and behavioral patterns; the physical, social, cultural, and economic contexts; and larger social and systemic processes (Glass & McAtee, 2006; McLeroy et al., 1988; Smedley et al., 2000). The Institute of Medicine recommends that interventions should target multilevel influences instead of focusing on one level of determinants (Smedley et al., 2000).

Our systematic review focuses on two outcomes: HPV vaccine intention and HPV vaccine uptake. We characterize studies as capturing HPV vaccine intention if they measured

intention to get the vaccine, willingness to get the vaccine, or acceptability of getting the vaccine. For example, studies capturing vaccine intention would include self-reported measurements such as “Are you willing to vaccinate your child against HPV?” or “How likely are you to get HPV vaccine?” We characterized studies as capturing constructs of HPV vaccine uptake if they measured vaccine initiation (i.e., getting 1 or more doses of the vaccine) or vaccine completion (i.e., getting 2 or 3 doses of the vaccine, depending on the age of initiation). For example, studies capturing vaccine uptake would include self-reported measurements such as “Have you ever received one or more doses of HPV vaccine?” or “How many doses of HPV vaccine has your child gotten?” Studies capturing vaccine uptake can also use verified measurements such as medical records.

OBJECTIVE

Using the P3 model. this systematic review aims to identify practice, provider, and patient-level determinants of HPV vaccine intention and uptake among Asian-Americans.

METHODS

The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) checklist (Moher et al., 2009) guided the design and reporting of this review (see Figure 2.1).

Search Strategies

In May 2019, we performed systematic searches in five databases (PubMed, CINAHL, PsycINFO, ProQuest, and EMBASE). A trained health sciences librarian (LT) helped finalized the search terms and carried out the systematic searches. All search terms are included in Appendix 2.A.

Inclusion and Exclusion Criteria

A study was included if it (a) was written in English, (b) was U.S.-based, (c) was a peer-reviewed article, dissertation, thesis, or report (e.g., research reports by the CDC or non-profit organizations) presenting empirical/original data, (d) was published between January 1994 and May 2019, (e) focused exclusively on Asian populations OR included Asian populations along with other racial/ethnic groups (e.g., Whites, Hispanic, Blacks but analyzed data from Asian populations separately from other groups, (f) included outcomes related to HPV vaccine intention and uptake, and (g) analyzed data on factors associated with these outcomes.

Study Selection

Two researchers independently screened titles and abstracts of records to select studies for full-text review. The Principal Investigator (PI) finalized the selection of studies for full-text review, reconciling any disagreements through discussions. Then, the PI and an additional researcher accessed full texts of these selected records and reviewed them to decide on studies included in the final analysis, resolving disagreements through discussions.

Data Extraction

The Principal Investigator performed data extraction and two other researchers reviewed these data to ensure accuracy. Information extracted from each article included: study design, data source, sample size, ethnic group, sex, and prevalence and determinants of HPV vaccine intention and uptake.

Data Analysis

Using the P3 model as the framework, data were qualitatively synthesized. Determinants were organized into domains at each level (practice, provider, and patient). We further distinguished between outcomes of the studies (e.g., vaccine intention versus actual uptake). If

studies reported both bivariate and multivariable analyses, we documented multivariable associations with p-values < 0.05 as influential determinants. If studies reported descriptive statistics (e.g., prevalence of reasons given for uptake), we documented categories reported at 20% or higher as influential determinants. In qualitative studies, main themes were documented as influential determinants.

Quality Appraisal

We used the Quality Assessment Tool for Studies with Diverse Designs (QATSDD) (Sirriyeh et al., 2012) to critically appraise studies. The PI scored each study; another researcher reviewed scoring to ensure accuracy. The QATSDD includes 16 criteria (e.g., theoretical framework, aims/objectives, data collection procedure, justification of analysis, and discussion of strengths and limitations), of which 12 apply to both quantitative and qualitative designs, 2 apply to only quantitative designs, and 2 apply to only qualitative designs. Each criterion was scored 0 to 3. A summary quality score was derived by summing scores and dividing by 14.

RESULTS

Figure 2.1 shows the selection process. We identified 2,388 records through database searches. After duplicates were removed, we screened the titles and abstracts of 1,743 articles for relevance, identifying 124 articles for full-text review. Of these 124 articles, 100 articles were excluded based on our criteria: not-based in the U.S. (n=17), not peer-reviewed/dissertation/thesis with empirical research (n=23), not including populations of Asians descents (n=12), Asians not analyzed separately (n=18), not including outcomes related to vaccine intention or uptake (n=5), not analyzing or reporting determinants of vaccine intention or uptake (n=24), and data already reported in another article (n=1). Twenty-four articles were included in the final review. Additionally, through a Google Scholar search with the keywords

"Asian Americans" and "HPV vaccine," we identified 2 additional articles meeting criteria for inclusion in the review.

Study Characteristics

Table 2.1 shows characteristics of the included 26 studies. Ethnic groups studied included: Koreans (n=9; 35%), Chinese (n=6; 23%), Cambodians (n=5; 19%), South Asians (n=2; 8%), Vietnamese (n=2; 8%), Hmong (n=2; 8%), Filipino (n=1; 4%), and Japanese (n=1; 4%). Three studies (12%) did not disaggregate participants by ethnic groups. Nineteen studies (73%) focused exclusively on Asian groups; the other 7 studies (27%) included other racial/ethnic groups in their analyses.

The studies captured perspectives of the following participant groups: caregivers (e.g., parents; n=14; 54%), college students (n=7; 27%), general adult populations (n=7; 27%), adolescents (n=2; 8%), community leaders (n=1; 4%), community health workers (n=1; 4%), and health center staff (n=1; 4%). Eighteen studies (69%) only included women in their sampling. Nineteen studies (73%) employed a quantitative design, all of which used cross-sectional surveys. The other seven studies (27%) used a qualitative design (interviews, n=2 and focus groups, n=6).

Ten studies (38%) reported prevalence of HPV vaccine intention and 11 studies (42%) reported determinants of HPV vaccine intention. Thirteen studies (50%) reported prevalence of HPV vaccine uptake (not including the 3 studies in which only unvaccinated participants were recruited), and 16 studies (62%) reported determinants of HPV vaccine uptake. Studies showed a considerable variation in prevalence of intention and uptake. Reported intention prevalence ranged from 23.4% to 72%. Reported initiation prevalence ranged from 14% to 67% and completion prevalence ranged from 9% to 63% (Table 2.2).

Quality Appraisal

Study quality ranged from 1.57 to 2.57. Among all studies, most common issues encountered were a lack of sample size calculation (n=19; 73%), user involvement in design (n=19; 73%), and explicit theoretical framework (n=14, 46%). Among quantitative studies, the most common issue encountered was a lack of assessment of reliability and validity (n=10; 53%). Among qualitative studies, the most common issue encountered was a lack of reliability assessment for analytical procedures (n=3; 43%).

Practice-Level Determinants of HPV Vaccine Intention and Uptake

Only three studies (12%) measured practice-level determinants of HPV vaccine intention and uptake; all of them found influential practice-level determinants related to ***healthcare delivery or organizational factors*** (Table 2.3 and Appendix 2.B). Two studies with Korean women highlighted the importance of *language services at the clinic*. Participants reported difficulties grasping English medical jargon (H. Y. Lee & Lee, 2017) and worrying about going to the doctor due to difficulties understanding English (M. Kim et al., 2017). One study interviewed clinicians at a Planned Parenthood clinic serving Vietnamese women and found that *insurance policy of the clinic* could be a barrier to vaccine uptake (Hopfer et al., 2017), as women could only get the vaccine at their primary care doctor and not at the Planned Parenthood.

Provider-Level Determinants of HPV Vaccine Intention and Uptake

Twelve studies (46%) measured provider-level determinants of HPV vaccine intention and uptake. Ten studies found influential provider-level determinants. They were all measured through patients' perceptions and all centered around communication between patients/caregivers and providers about HPV vaccine (i.e. ***communication style*** in the P3 model) (Table 2.4 and Appendix 2.B).

Eight studies documented the role of *HPV vaccine recommendations from providers*. A provider's recommendation was given as the reason why Korean college women got HPV vaccine for themselves (M. Kim et al., 2017). Provider's recommendation was also a reason influencing parents' vaccine intention (Khan, 2014; K. Kim et al., 2015; Y.-M. Lee et al., 2019) or vaccine uptake (Dela Cruz et al., 2018; Do et al., 2009; Taylor et al., 2014) for their children. A study with Cambodian mothers of teenage daughters found a significant association between a provider's recommendation and the teenage daughter's HPV vaccine uptake (Taylor et al., 2012). Conversely, in four studies, caregivers also mentioned *not having received* a provider's recommendation as a reason why they had not gotten HPV vaccine for their children (Dela Cruz et al., 2018; Do et al., 2009; Y.-M. Lee et al., 2019; Taylor et al., 2014).

Relatedly, *discussion/conversation with providers about HPV vaccine* was also important. Vietnamese women described conversations with providers about HPV vaccine as critical to vaccine uptake (Hopfer et al., 2017). Korean parents reported limited communication with providers as a barrier to making informed decision about HPV vaccine (Y.-M. Lee et al., 2019). South Asian parents cited a lack of discussion with providers as a reason for vaccination noncompliance (Khan, 2014).

Two studies with Korean women found that providers advised that Korean women were at lower *risk for cervical cancer* or that only "promiscuous" women would get cervical cancer, which factored into participants' decision to not get the vaccine (M. Kim et al., 2017; H. Y. Lee & Lee, 2017). Finally, studies with Cambodian mothers found that daughters' vaccine initiation was associated with *mothers hearing of HPV vaccine from providers* (Taylor et al., 2014) or that daughters' vaccine uptake was associated with *mothers having asked providers for HPV vaccination* (Taylor et al., 2012).

Patient-Level Determinants of HPV Vaccine Intention and Uptake

All 26 studies (100%) measured patient-level determinants. Twenty four out of 26 studies found influential patient-level determinants (Table 2.5 and Appendix 2.B).

Healthcare Delivery or Organizational Factors

Parents' barriers to HPV vaccine uptake for adolescents included *not knowing where to get HPV vaccine* (Bastani et al., 2011) and *not knowing whether insurance covers HPV vaccine* (Dela Cruz et al., 2018). Additionally, a study found that Cambodian *mothers' receipt of a Pap test* was associated with daughters' vaccine initiation (Taylor et al., 2014). Interestingly, a study with Korean parents noted that compared to those who with vaccinated children, those with unvaccinated children perceived the ability to *access providers or clinics with HPV vaccine* as less of a barrier (Y.-M. Lee et al., 2018). Among adult participants, *unfamiliarity with U.S. healthcare services* or *discomfort in using women's health services* were barriers to seeing providers and receiving HPV vaccine (H. Y. Lee & Lee, 2017). Participant's *use of women's health services* was also associated with vaccine completion (H. Y. Lee et al., 2015).

Communication Style

A study with Korean women found that those with older children tended to engage in *conversations and a collaborative decision-making about HPV vaccine with the children* (K. Kim et al., 2015).

Predisposing Factors

Regarding *age*, younger participants were more likely to have received the vaccine (H. Y. Lee et al., 2015; Tung et al., 2019), and younger parents were more willing to get HPV vaccine for their children (Khan, 2014). At the same time, parents' belief that *their children were too young to get the vaccine* was a barrier to vaccine intention (Y.-M. Lee et al., 2019) and uptake

(Dela Cruz et al., 2018) for children. Moreover, *sex* also influenced vaccine intention and uptake. Among South Asians, compared to fathers of daughters, mothers of daughters were more willing to get HPV vaccine for daughters (Khan, 2014). Adult women also had higher vaccine intention (Gao, 2015) or vaccine uptake (Truong-Vu, 2018; Tung et al., 2019) compared to men. Additionally, *English language fluency* also played a role. Unfamiliarity with English medical terms was a barrier to seeing providers and receiving HPV vaccine for Korean women (M. Kim et al., 2017). Adult women with higher English fluency were more supportive of getting HPV vaccine for their children and grandchildren (Nguyen et al., 2012) or more likely to have received HPV vaccine for themselves (J. K. Yi et al., 2013).

A lack of *awareness of HPV vaccine* was noted as a barrier to parents' vaccine uptake for children (Dela Cruz et al., 2018; Do et al., 2009; Taylor et al., 2014) and adult women's own vaccine uptake (M. Kim, Lee, Kiang, Aronowitz, et al., 2019). Relatedly, surveys found that higher parental *knowledge of HPV or HPV vaccine* was associated with higher parental vaccine intention (Khan, 2014; Otanez & Torr, 2018) and uptake (H. Lee et al., 2016) for their children. Adult participants with higher knowledge of HPV or HPV vaccine were more supportive of getting HPV vaccine for themselves (M. Kim, Lee, Kiang, Aronowitz, et al., 2019) or more likely to have received HPV vaccine (H. Y. Lee et al., 2015; Tung et al., 2019; J. K. Yi et al., 2013).

A study with South Asian parents (Khan, 2014) measured *general attitudes towards vaccination* through a scale exploring effectiveness, side effects, and benefits for children's health. It also measured *HPV vaccine attitudes* (i.e. thoughts on whether HPV vaccine was necessary for males). The study found that parents' higher vaccine intention was associated with more positive general attitudes towards vaccination and thinking that HPV vaccine was

necessary for males (Khan, 2014). Another study using a scale to measure attitudes towards HPV vaccination among Chinese college students also found that more positive attitudes were associated with higher vaccine initiation (Tung et al., 2019).

In the Cambodian community, *beliefs regarding disease prevention* (e.g., priority placed on preventive health measures) could both negatively and positively impact vaccine uptake (Do et al., 2009). Additionally, those with lower *trust in Western medicine* may refuse to get the vaccine for their children (Do et al., 2009). Relatedly, a study with Asian college students noted that compared to vaccinated women, unvaccinated women had higher levels of *medical mistrust* (defined as "distrust and suspicion of medical personnel and institutions") (Kolar et al., 2015).

Parents with higher *perceived importance of HPV vaccine* had higher vaccine intention for their children (Khan, 2014; Zhao et al., 2014). Parents with higher *perceived effectiveness of HPV vaccine* also had higher vaccine intention (Khan, 2014) or uptake (Do et al., 2009; Y.-M. Lee et al., 2018) for their children. Moreover, parents who had higher *perceived side effects or low safety of HPV vaccine* were less accepting of the vaccine (Khan, 2014; K. Kim et al., 2015; Y.-M. Lee et al., 2019) or chose not to get the vaccine for their children (Bastani et al., 2011; Dela Cruz et al., 2018; Do et al., 2009). Korean women mentioned side effects of the vaccine as a barrier to vaccine uptake (M. Kim et al., 2017). In addition, parental perception of *HPV vaccine being too new* was mentioned as a barrier to vaccine intention (Khan, 2014; Y.-M. Lee et al., 2019) and vaccine uptake (Dela Cruz et al., 2018) for adolescent children.

Perceived susceptibility played an important role in influencing vaccine intention and uptake. For example, Filipino and Japanese parents cited their children not being at risk for HPV as a reason why they did not vaccinate their children (Dela Cruz et al., 2018). Qualitative studies found that Korean and Chinese adults did not think of themselves as susceptible to HPV

infection, genital warts, or HPV-related cancers; some also believed that only those who were gay or those frequently engaged in sexual activity were at risk, leading to non-vaccination (Gao et al., 2016; M. Kim et al., 2017; M. Kim, Lee, Kiang, Aronowitz, et al., 2019; H. Y. Lee & Lee, 2017).

In several studies, parents believed that *HPV vaccine was not necessary if* their children were *not sexually active* (Do et al., 2009; Khan, 2014; Y.-M. Lee et al., 2019). This belief was also reported as a reason why Chinese students did not intent to get the vaccine for themselves (Gao et al., 2016) and why Korean female college students did not get vaccinated (M. Kim, Lee, Kiang, Aronowitz, et al., 2019). Chinese students also reported not intending to get the vaccine if they were *practicing safe sex* (Gao et al., 2016) and Vietnamese women reported not getting the vaccine because they *trusted that their partners were HPV-free* (Hopfer et al., 2017).

The belief that *HPV vaccine promoted adolescents' sexual activity* was mentioned as a reason against parents' vaccine intention (K. Kim et al., 2015) and vaccine uptake (Dela Cruz et al., 2018; Do et al., 2009) for adolescent children. In a study with international Chinese students, participants were concerned about the fact that HPV vaccine was developed in "Western countries" and questioned the *suitability of the vaccine for Chinese people* (Gao et al., 2016). Participants in the same study also mentioned how *living in America and dating Americans increased one's susceptibility to getting HPV* and thus the vaccine seemed more needed once they left China (Gao et al., 2016). Filipino and Japanese parents discussed "*getting all vaccines*" as a reason for vaccine uptake for their children (Dela Cruz et al., 2018). South Asians cited *worry about their children's health* as a reason for vaccine intention for their children (Khan, 2014). Korean students mentioned *being too busy* as a reason for non-vaccination (M. Kim et al., 2017; M. Kim, Lee, Kiang, Aronowitz, et al., 2019).

Enabling Factors

Perceived high costs were a barrier to HPV vaccine intention and uptake among Cambodian and Korean parents (Do et al., 2009; K. Kim et al., 2015; Y.-M. Lee et al., 2019) and Korean women (M. Kim et al., 2017). In addition, Korean women reported receiving and following a *recommendation from the school* to get HPV vaccine for their daughters (K. Kim et al., 2015). Parents discussed *not having enough information or needing more information* about HPV vaccine as a barrier to vaccine intention (Khan, 2014) and uptake (Bastani et al., 2011) for their children.

Reinforcing Factors

Vietnamese and Korean women discussed their *mothers' influences in vaccine decision-making* for themselves (Hopfer et al., 2017; M. Kim et al., 2017). A study of Cambodian mother-daughter pairs found an association between a daughter's vaccine intention and her perception of her mother's intention for her to get vaccinated (H. Lee et al., 2018). Additionally, among Korean female college students, *HPV vaccine recommendation by parents* was associated with vaccine intention (M. Kim, Lee, Kiang, Aronowitz, et al., 2019) while hearing negative messages about the vaccine *through family members* was a barrier to uptake (M. Kim et al., 2017).

A study with Korean women found that those with higher subjective norms (e.g., *perceived approval of HPV vaccine from family and friends*) had higher intention of getting their children vaccinated (Zhao et al., 2014). In a study with international Chinese students, *influence from friends* (i.e. having a friend who got vaccinated against HPV) was a predictor of vaccine intention (Gao, 2015). Among Korean women, negative messages about HPV vaccine heard through friends played a role in vaccine intention (H. Y. Lee & Lee, 2017).

Korean parents discussed how *other parents' opinions* influenced their decision-making about HPV vaccine for their children (K. Kim et al., 2015). Filipino and Japanese parents indicated *having friends whose children who were vaccinated* as a reason why they got the vaccine for their children (Dela Cruz et al., 2018). Korean female students also discussed hearing negative messages about the vaccine *through social media* as a barrier to vaccination (M. Kim et al., 2017).

Knowing someone with cancer was significantly associated with vaccine completion among Asian female college students (H. Y. Lee et al., 2015). Moreover, Vietnamese women discussed *motivation to get protection from diseases* as a reason for getting the vaccine (Hopfer et al., 2017). Studies also reported that motivation to protect their children from diseases was a reason underlying parents' vaccine intention (K. Kim et al., 2015) as well as vaccine uptake (Dela Cruz et al., 2018; Taylor et al., 2014) for their children.

Other barriers to vaccine intention and uptake included *not having a family history of cervical cancer* and thus not thinking of themselves as being at risk (H. Y. Lee & Lee, 2017) and *family stigma around discussing sex and sexual health* (Hopfer et al., 2017). In addition, a study with Korean women found that *higher interdependent self-construal* (defined as "an orientation of self in which individuals define themselves primarily through their relationships with others") was associated with higher HPV vaccine intention (Zhao et al., 2014).

Preventive Activity

Having to get *multiple doses of the vaccine* was cited as a barrier to vaccine uptake for Korean female college students (M. Kim et al., 2017). Additionally, a study with Chinese students discussed how participants *disagreed with the recommended age* of 9 to 26 for

vaccination because they thought Chinese youths did not engage in sexual activity as early as their American counterparts (Gao et al., 2016).

DISCUSSION

Our study represents the first effort to systematically examine multilevel determinants of HPV vaccine intention and uptake among Asian-Americans. Using the P3 model as the guiding framework, we documented findings across 26 studies. Only 3 studies included practice-level measurements, nearly half (12 studies) included provider-level measurements, and all studies included patient-level measurements. The prevalence of vaccine intention and uptake varied across studies.

One major finding is that only 3 studies assessed practice-level influences (Hopfer et al., 2017; M. Kim et al., 2017; H. Y. Lee & Lee, 2017). Furthermore, 2 of these 3 studies (M. Kim et al., 2017; H. Y. Lee & Lee, 2017) only captured *patients'* perspectives instead of clinic staff's or providers', limiting the ability to fully examine a range of aspects at healthcare practices that potentially impact vaccine intention or uptake. Systematic reviews have shown that healthcare system-based interventions can improve HPV vaccine coverage (Niccolai & Hansen, 2015b; Smulian et al., 2016b). The Community Preventive Services Task Force also recommends the use of system-based interventions as well as the implementation of system-based interventions in combination to increase vaccination rates (Community Preventive Services Task Force, 2017). To inform these system-level interventions, future research on Asian populations should include additional measurements of practice-level determinants. Research can explore elements such as electronic health record-generated prompts, assessment and feedback strategies, or reminder and recall, which are associated with vaccine uptake in general U.S. populations (Niccolai & Hansen, 2015a; Smulian et al., 2016a). The P3 model also provides useful blueprints for additional

possible practice-level constructs to be measured, including supply, immunization champion, vaccine promotion culture, and communication regarding vaccination policies (Bednarczyk et al., 2018).

All 12 studies that examined provider-level influences focused on aspects of communication between patients/caregivers and providers (Dela Cruz et al., 2018; Do et al., 2009; Gao, 2015; Hopfer et al., 2017; Khan, 2014; K. Kim et al., 2015; M. Kim et al., 2017; M. Kim, Lee, Kiang, Aronowitz, et al., 2019; H. Y. Lee & Lee, 2017; Y.-M. Lee et al., 2019; Taylor et al., 2014, 2012). Such communication was measured most commonly through a provider's recommendation (Dela Cruz et al., 2018; Do et al., 2009; Khan, 2014; K. Kim et al., 2015; M. Kim et al., 2017; Y.-M. Lee et al., 2019; Taylor et al., 2012, 2014) but also included discussion/conversation with providers (Hopfer et al., 2017; Khan, 2014; Y.-M. Lee et al., 2019), hearing about the vaccine from providers (Taylor et al., 2014), or asking providers about the vaccine (Taylor et al., 2012). The associations between a provider's recommendation and HPV vaccine intention or uptake have also been demonstrated in studies with general U.S. populations (Gilkey & McRee, 2016; Newman et al., 2013, 2018). Lacking from the studies in our review, however, is a deeper inquiry of the content and manner of vaccine recommendation.

In the general U.S. populations, parents receiving a strong recommendation (i.e. recommendation that strongly endorses HPV vaccine, focuses on cancer prevention, and urges same-day vaccination) were more likely to get their children HPV vaccine (Gilkey et al., 2016). It will be useful to explore whether such patterns hold true across Asian populations. This knowledge can also guide provider-level interventions, particularly with training providers' communication about HPV vaccine. Future research should also incorporate perspectives of providers serving Asian communities to further understand current practices around HPV

vaccine recommendation (e.g., whether providers are adhering to “same day same way” recommendation) (Centers for Disease Control and Prevention, 2019) as well as possible barriers and facilitators for providers.

Past research has demonstrated differences between Asians and Whites as well as differences across Asian groups regarding cancer health communication with providers. For example, in a survey, Asians were 0.67 times less likely to discuss breast cancer risks with providers compared to Whites (Kaplan, 2006). In another study, Asians significantly differed from Whites regarding choice of healthcare providers as a cancer information source where they would look first in a time of need (33.2% for Asians versus 47.0% for Whites) (Nguyen & Bellamy, 2006). In addition, differences across Asian subgroups also exist regarding having difficulties talking to a provider in the context of cancer screening (Shive et al., 2007).

At the patient level, influential determinants appearing in several studies (i.e., 5 or more studies) included HPV or HPV vaccine knowledge (Khan, 2014; M. Kim et al., 2017; M. Kim, Lee, Kiang, Aronowitz, et al., 2019; H. Lee et al., 2016; H. Y. Lee et al., 2015; H. Y. Lee & Lee, 2017; Otanez & Torr, 2018; Tung et al., 2019; J. K. Yi et al., 2013) perceived safety or side effect issues (Bastani et al., 2011; Dela Cruz et al., 2018; Do et al., 2009; Khan, 2014; K. Kim et al., 2015; M. Kim et al., 2017; Y.-M. Lee et al., 2019), perceived susceptibility (Dela Cruz et al., 2018; Gao et al., 2016; M. Kim et al., 2017; M. Kim, Lee, Kiang, Aronowitz, et al., 2019; H. Y. Lee & Lee, 2017), and beliefs regarding the relationship between HPV vaccine and sexual activity (Dela Cruz et al., 2018; Do et al., 2009; Gao et al., 2016; Hopfer et al., 2017; Khan, 2014; K. Kim et al., 2015; M. Kim, Lee, Kiang, Aronowitz, et al., 2019; Y.-M. Lee et al., 2019). A systematic review on African-American and Latino parents’ HPV vaccine acceptance and uptake for their children documented similar influential factors *with the exception of HPV or*

HPV vaccine knowledge (Galbraith et al., 2016). Researchers designing programs to increase HPV vaccine uptake for minority communities should attend to these similarities and differences. Differences also exist in target audience for these determinants: in our review, HPV or HPV vaccine knowledge and beliefs regarding the relationship between HPV vaccine and sexual activity arose in studies with both Asian caregivers who discussed getting the vaccine for their children and Asian adults who discussed getting the vaccine for themselves. Meanwhile, perceived safety or side effects mainly came up in studies with caregivers (6 out of 7) (Bastani et al., 2011; Dela Cruz et al., 2018; Do et al., 2009; Khan, 2014; K. Kim et al., 2015; Y.-M. Lee et al., 2019), and perceived susceptibility mainly came up in studies with adult participants (4 out of 5) (Gao et al., 2016; M. Kim et al., 2017; M. Kim, Lee, Kiang, Aronowitz, et al., 2019; H. Y. Lee & Lee, 2017).

Altogether, these patient-level findings that emerged in our review are important targets for educational interventions on HPV vaccine, though research notes that educational interventions are more effective when implemented in conjunction with health system-based interventions (Community Preventive Services Task Force, 2017; Smulian et al., 2016b). For example, multilingual fact sheets incorporating culturally-relevant storytelling may help address issues related to knowledge and perceived susceptibility (Chan et al., 2015; M. Kim, Lee, Kiang, & Allison, 2019). Moreover, caregivers can be provided with vaccine safety data from clinical trials, in addition to research showing no evidence of vaccinated individuals developing commonly-feared conditions (e.g., autoimmune and neurological conditions) (Bednarczyk, 2019). It may also be useful to discuss risks associated with *not receiving HPV vaccine* (Zimet et al., 2013). Additionally, patients should be introduced to a strong body of evidence showing that no association exists between HPV vaccination and increased sexual activity (Bednarczyk et al.,

2012; Petrosky et al., 2017). Interventions should emphasize how given its preventive nature, HPV vaccine needs to be administered prior to exposure to HPV (e.g., sexual activity), and that getting the vaccine when one is not sexually active is actually the best strategy. More research should be done on how researchers or providers can present these data in a culturally appropriate manner that Asian caregivers and patients can easily understand.

Five studies in our review discussed familial influences on HPV vaccine intention and uptake (Hopfer et al., 2017; M. Kim et al., 2017; M. Kim, Lee, Kiang, Aronowitz, et al., 2019; H. Lee et al., 2018; Zhao et al., 2014), though measurements varied (e.g., influence from mothers, vaccine recommendation by parents, influence from family, influence from family and friends, or family stigma around sexual health). Previous research on familial influences among Asian-Americans has mainly focused on how familial influences act as barriers to healthy behaviors or health services utilization. For example, research has pointed to family stigma and lack of parent-child communication as barriers to sexual and mental health utilization (C. Han et al., 2011; M. Han & Pong, 2015; Okazaki, 2002) or patriarchal family structure as a reason why women underutilized cancer screening (H. Y. Lee & Vang, 2010). In our review, however, we found that familial influences can be both negatively and positively associated with HPV vaccination outcomes. Reviewed studies brought up family stigma around sexual health (Hopfer et al., 2017) as a barrier to vaccine uptake but also pointed to influences from mothers (M. Kim et al., 2017) and vaccine recommendation from parents (M. Kim, Lee, Kiang, Aronowitz, et al., 2019) as facilitators of vaccine intention and uptake. Future research can explore methods to leverage familial influences to positively impact vaccine behaviors among Asian caregivers and patients.

Certain patient-level findings also emphasize a need for health systems to be more attentive to Asian patients' backgrounds, beliefs, and practices. For example, the literature reviewed indicated language difficulties (M. Kim et al., 2017; Nguyen et al., 2012; J. K. Yi et al., 2013), unfamiliarity with or lack of comfort in using health services in the U.S. (H. Y. Lee & Lee, 2017), and mistrust of medical systems or Western medicine (Do et al., 2009; Kolar et al., 2015). Increasing availability of clinic language services (through on-site interpreters or Language Line) along with the use of patient navigators or community health workers may remedy these problems (Ali-Faisal et al., 2017; Genoff et al., 2016; Jacobs et al., 2001; Ku & Flores, 2005).

The designs of all reviewed studies were either cross-sectional surveys or qualitative designs, which can pose challenges in interpreting temporal relationships between variables. Most existing literature centered on Korean, Chinese, and Cambodian populations, leaving a gap of knowledge for other Asian subgroups. Due to the limited number of studies and different types of statistics (e.g., descriptive statistics versus associations/effect sizes) reported in them, we could neither perform a meta-analysis nor provide comparisons of determinants across subgroups of Asians. Note, however, that in studies included, the prevalence of intention and uptake varied greatly across communities (intention: 23.4% to 72%, initiation: 14% to 67%, and completion: 9% to 63%). Therefore, interventions should take into account the heterogeneity of Asian communities, particularly regarding socioeconomic status, religious/cultural beliefs, social norms, and patterns of health services utilization (Hamilton et al., 2016; Thompson et al., 2016).

CONCLUSIONS

As the Asian populations in the U.S. increase, evidence suggests low utilization of HPV vaccine in these populations. Existing research on determinants of HPV vaccine intention and

uptake in this population currently lacks measurements of practice-level constructs and perspectives of clinic staff and providers, all of which is needed to guide system-level interventions and provider training. Data regarding patient-level determinants indicate that interventions for Asian-American populations can focus on providing educational information in culturally-appropriate manners, leveraging familial influences, and attending to access-related or cultural beliefs about HPV vaccine. Interventions should take into account varied vaccine intention and uptake prevalence in different Asian subgroups.

Figure 2.1. PRISMA Flow Chart of the Searched, Screened, Identified, and Included Studies

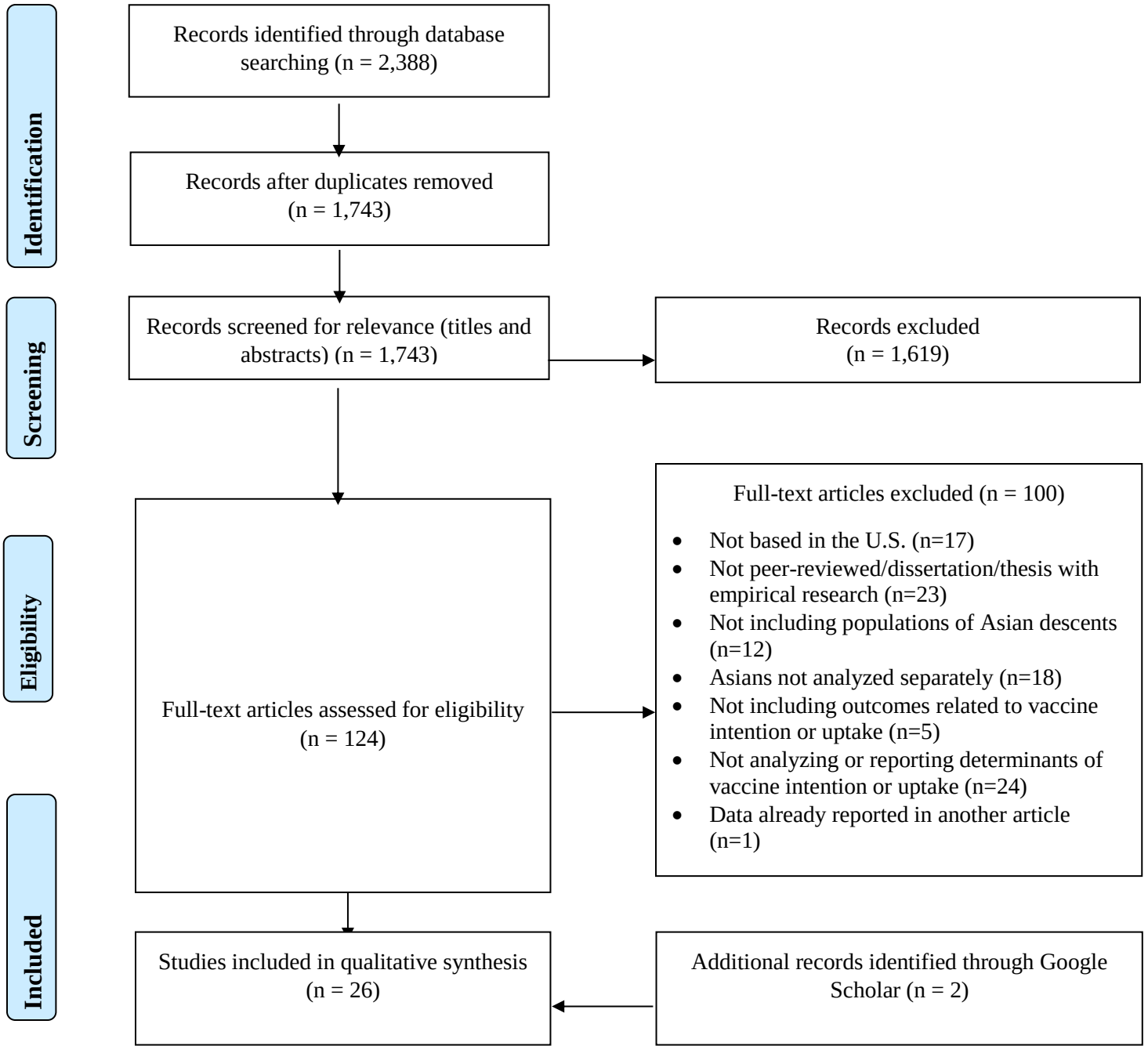

Table 2.1. – Characteristics of Studies Included in the Systematic Review (n=26)								
Citation	**Study design**	**Data source**	**Population**	**Gender**	**Quality rating (0 to 3)**	**Practice-level**	**Provider-level**	**Patient-level**
(Bastani et al., 2011)*	Cross-sectional survey	Mothers reporting vaccine uptake of teenage daughters	Chinese (n=98) and Korean (n=66) women of daughters aged 9-18	100% F	2.36			Assessed Influential
(Dela Cruz et al., 2018)*	Cross-sectional survey	Parents reporting vaccine uptake of children	Japanese (n=200) and Filipino (n=199) parents of children aged 11-18	Not available for separate Asian subgroups	2.50		Assessed Influential	Assessed Influential
(Do et al., 2009)	Qualitative interviews and focus groups	Parents reporting vaccine uptake of teenage daughters	Cambodian community leaders (n=13); Cambodian parents (n=37) of daughters aged 9-26	Community leaders: 54% F; Parents: 51% F	1.79		Assessed Influential	Assessed Influential
(Gao, 2015)[a]	Cross-sectional survey	Participants reporting their own vaccine intention	Chinese international students (n=350) aged 18-26 who had not received the vaccine	48% F	1.57		Assessed	Assessed Influential
(Gao et al., 2016)	Qualitative focus groups	Participants reporting their own vaccine intention	Chinese international students (n=44) aged 18 or older	52% F	1.64			Assessed Influential
(Hopfer et al., 2017)*	Qualitative interviews	Participants reporting their own vaccine uptake; Health center staff reporting their perspectives on clients' vaccine uptake	Vietnamese women aged 18-26 (n=24) Health center staff serving women (n=2)	Vietnamese: 100% F; Health center staff: N/A	1.79	Assessed Influential	Assessed Influential	Assessed Influential

(Khan, 2014)	Cross-sectional survey	Parents reporting intention to vaccinate children	South Asian parents (n=136) of children aged 17 and below. The sample included Bangladeshis (n=68), Indians (n=40), Pakistanis (n=15), Nepalese (n=7) and Sri Lankans (n=6).	59% F	1.71		Assessed Influential	Assessed Influential
(K. Kim et al., 2015)	Qualitative focus groups	Parents reporting intention to vaccinate children	Korean women aged 21-65 (n=12) and community health workers (n=14)	100% F	2.43		Assessed Influential	Assessed Influential
(M. Kim et al., 2017)	Qualitative focus groups	Participants reporting their own vaccine uptake	Korean female college students aged 18-26 (n=20)	100% F	1.79	Assessed Influential	Assessed Influential	Assessed Influential
(M. Kim, Lee, Kiang, Aronowitz, et al., 2019)	Cross-sectional survey	Participants reporting their own vaccine intention and uptake	Korean female undergraduate and graduate students (n=104)	100% F	2.07		Assessed	Assessed Influential
(Kolar et al., 2015)*	Cross-sectional survey	Participants reporting their own vaccine uptake	Asian female students (n=85)	100% F	1.57			Assessed Influential
(H. Y. Lee & Lee, 2017)	Qualitative focus groups	Participants reporting their own vaccine intention	Korean immigrant women (n=16)	100% F	1.79	Assessed Influential	Assessed Influential	Assessed Influential
(H. Y. Lee et	Cross-sectional survey	Participants reporting their own vaccine uptake	Asian and Pacific Islander female college	100% F	2.29			Assessed Influential

al., 2015)*			students (n=341). The sample included Chinese (n=93), Hmong (n=70), South Asians (n=42), and Koreans (n=40)					
(H. Lee et al., 2018)	Cross-sectional survey	Mothers reporting intention to vaccinate daughters; daughters reporting intention to get vaccinated	19 dyads of Cambodian mothers and their teenage daughters (aged 14-17) (n=38 in total); daughters have not received the vaccine	100% F	2.07			Assessed Influential
(H. Lee et al., 2016)	Cross-sectional survey	Mothers reporting HPV vaccine uptake of teenage daughters	Cambodian mothers (n=130) of teenage daughters aged 12-17	100% F	2.50			Assessed Influential
(Y.-M. Lee et al., 2019)	Qualitative focus groups	Parents reporting intention to vaccinate children	Korean parents (n=20) of children aged 11-18	50% F	2.57		Assessed Influential	Assessed Influential
(Y.-M. Lee et al., 2018)	Cross-sectional survey	Parents reporting vaccine uptake of children and their intention to vaccinate children	Korean parents (n=74) of children aged 11-18	64% F	2.50			Assessed Influential
(Nguyen et al., 2012)	Cross-sectional survey	Self-reported; Mothers/grand-mothers reporting intention to vaccinate daughters/grand-daughters	Chinese women aged 18 or older (n=158)	100% F	2.00			Assessed Influential
(Otanez & Torr, 2018)*	Cross-sectional survey	Adults reporting intention to vaccinate real or hypothetical daughter	Asian/Pacific Islander adults (weighted N:	N/A for Asian groups	1.64			Assessed Influential

			8789113 or 5% of sample)					
(Shweta, 2012)[b]	Cross-sectional survey	Participants reporting their own vaccine uptake	Hmong women aged 21 to 65 (n=104)	100% F	2.57			Assessed
(Taylor et al., 2014)	Cross-sectional survey	Mothers reporting HPV vaccine status of teenage daughters	Cambodian mothers (n=86) of teenage daughters aged 9-17	100% F	1.93		Assessed Influential	Assessed Influential
(Taylor et al., 2012)	Cross-sectional survey	Mothers reporting HPV vaccine status of teenage daughters	Cambodian mothers (n=96) of teenage daughters aged 9-18	100% F	1.79		Assessed Influential	Assessed
(Truong-Vu, 2018)*	Cross-sectional survey	Participants reporting their own vaccine uptake	Asians aged 9 to 21 (n=635)	N/A for Asian groups	2.07			Assessed Influential
(Tung et al., 2019)	Cross-sectional survey	Participants reporting their own vaccine uptake	Chinese college students aged 18 or older (n=449)	59% F	2.14			Assessed Influential
(J. K. Yi et al., 2013)	Cross-sectional survey	Participants reporting their own vaccine intention and uptake	Vietnamese women aged 18 or older (n=113)	100% F	2.21			Assessed Influential
(Zhao et al., 2014)	Cross-sectional survey	Mothers reporting intention to vaccinate daughters	Korean women aged 25 to 45 (n=165)	100% F	2.21			Assessed Influential

F: female; M: male
N/A: Not available
Assessed: determinant included in measurement; Influential: determinant documented to be influential
[a] The 2015 dissertation contained some similar data to the 2016 article by the same author. Only data not reported in the 2016 article are presented in this row.
[b] This study reports no significant finding on influences on HPV vaccine intention or uptake, and thus is not included in Table 2.2, 2.3, 2.4, or 2.5.
* Study includes not only Asians but also other racial/ethnic groups in their analyses

Table 2.2. – Prevalence of HPV Vaccine Intention and/or Uptake Reported in Studies (n=26)						
Citation	**Population**	**N**	**% of HPV vaccine intention**	**% of HPV vaccine initiation**	**% of HPV vaccine completion**	**% of HPV vaccine uptake ***
(Bastani et al., 2011)	Daughters aged 9-18 of Chinese mothers	97		25%	9%	
	Daughters aged 9-18 of Korean mothers	62		24%	13%	
(Dela Cruz et al., 2018)	Daughters aged 11-18 of Filipino parents	122		45.1%	21.3%	
	Daughters aged 11-18 of Japanese parents	120		60.8%	40.8%	
	Sons aged 11-18 of Filipino parents	103		35.9%	12.6%	
	Sons aged 11-18 of Japanese parents	111		50.5%	22.5%	
(Do et al., 2009)	Daughters of Cambodian community leaders	7				42.9%
	Daughters aged 9-26 of Cambodian parents	37				Only a couple of parents said their daughters had received the

						HPV vaccine.
(Gao, 2015)	Female Chinese international students aged 18-26	169	10.1% unlikely, 20.7% undecided, 69.2% likely to get the vaccine	0% (only those who had not initiated the vaccine were included for data analysis)		
	Male Chinese international students aged 18-26	179	41.1% unlikely, 24.2% undecided, 34.9% likely to get the vaccine			
(Gao et al., 2016)	Chinese international students aged 18 or older	44				
(Hopfer et al., 2017)	Vietnamese women aged 18-26	24		67%	63%	
(Khan, 2014)	South Asian parents with daughters aged 17 and below	77	55.8% intended to vaccinate their daughters			
	South Asian parents with sons aged 17 and below	80	41.3% intended to vaccinate their sons			
(K. Kim et al., 2015)	Korean women aged 21-65	12				
(M. Kim et al., 2017)	Korean female college students aged 18-26	20				

(M. Kim, Lee, Kiang, Aronowitz, et al., 2019)	Korean female undergraduate and graduate students aged 18-26	104	34.6% intended to get the vaccine	0% (only those who had not initiated the vaccine were recruited into the study)		
(Kolar et al., 2015)	Asian female students	85				
(H. Y. Lee & Lee, 2017)	Korean immigrant women aged 21-29	16				
(H. Y. Lee et al., 2015)	Asian and Pacific Islander female college students aged 18-25	341			38.6%	
(H. Lee et al., 2018)	Cambodian mothers of their daughters aged 14-17	19	68.4% of mothers intended to have their daughters vaccinated			
	Daughters aged 14-17 of Cambodian mothers	19	36.8% of daughters intended to get vaccinated	0% (only daughters who had not initiated the vaccine were recruited into the study)		
(H. Lee et al., 2016)	Daughters aged 12-17 of Cambodian mothers	129				32.6%
	Sons of Cambodian mothers	70				18.6%

	Cambodian mothers of teenage daughters aged 12-17	86	72% of mothers of unvaccinated daughters reported they would like their daughters to receive vaccinations			
(Y.-M. Lee et al., 2019)	Children aged 11-18 of Korean parents	20				
(Y.-M. Lee et al., 2018)	Children aged 11-18 of Korean parents	74				73%
(Nguyen et al., 2012)	Chinese women aged 18 or older	158	29.1% would like vaccine for self if cost involved, and 41.1% would like vaccine for self if no cost or little cost involved; 23.4% would like vaccine for daughter or granddaughter if cost involved; 31% would like vaccine for daughter or granddaughter if no cost or little cost involved			
(Otanez & Torr, 2018)	Asian/Pacific Islander adults aged 18 and above	(weighted N: 8789113				

		or 5% of sample)				
(Shweta, 2012)	Hmong women aged 21 to 65	104				14%
(Taylor et al., 2014)	Daughters aged 9-17 of Cambodian mothers	86		29%	14%	
(Taylor et al., 2012)	Daughters of Cambodian mothers	96				26%
(Truong-Vu, 2018)	Asians aged 9 to 21	635		27%		
(Tung et al., 2019)	Chinese college students aged 18 or older	449		38.3%	22%	
(J. K. Yi et al., 2013)	Vietnamese women aged 18 or older	113	Among those who were unvaccinated, 13.4% responded that they were not at all likely to receive HPV vaccine; 20.6% somewhat likely; 33% very or extremely likely	14%	10%	
(Zhao et al., 2014)	Korean women aged 25 to 45	165				

* Studies that did not specify whether the reported uptake rate was for vaccine initiation or completion.

Table 2.3. – Practice-Level Determinants of HPV Vaccine Intention and Uptake			
Domain	**Practice-level determinant**	**Intention** *(reported by participants for themselves)*	**Uptake** *(reported by participants for themselves)*
Healthcare delivery or organizational factors	Language services at the clinic (n=2)	(H. Y. Lee & Lee, 2017)	(M. Kim et al., 2017)
	Insurance policy of the clinic (n=1)		(Hopfer et al., 2017)

Table 2.4. – Provider-Level Determinants of HPV Vaccine Intention and Uptake					
Domain	**Provider-level determinant**	**Intention** *(reported by caregivers for their adolescents)*	**Intention** *(reported by participants for themselves)*	**Uptake** *(reported by caregivers for their adolescents)*	**Uptake** *(reported by participants for themselves)*
Communication style	Recommendation from providers about HPV vaccine (n=8)	(Khan, 2014; K. Kim et al., 2015; Y.-M. Lee et al., 2019)		(Dela Cruz et al., 2018; Do et al., 2009; Taylor et al., 2012, 2014)	(M. Kim et al., 2017)
	Discussion or conversation with providers about HPV vaccine (n=3)	(Khan, 2014; Y.-M. Lee et al., 2019)			(Hopfer et al., 2017)
	Providers' advice regarding likelihood of getting cervical cancer (n=2)		(H. Y. Lee & Lee, 2017)		(M. Kim et al., 2017)
	Hearing of HPV vaccine from providers (n=1)			(Taylor et al., 2014)	
	Having asked providers for HPV vaccination (n=1)			(Taylor et al., 2012)	

Table 2.5. – Patient-level Determinants of HPV Vaccine Intention and Uptake					
Domain	**Patient-level determinant**	**Intention** *(reported by caregivers for their adolescents)*	**Intention** *(reported by participants for themselves)*	**Uptake** *(reported by caregivers for their adolescents)*	**Uptake** *(reported by participants for themselves)*
Healthcare delivery or organizational factors	Knowledge of where to get HPV vaccine (n=1)			(Bastani et al., 2011)	
	Knowledge of whether insurance covers HPV vaccine (n=1)			(Dela Cruz et al., 2018)	
	Access to clinics or providers with HPV vaccine (n=1)			(Y.-M. Lee et al., 2018)	
	Pap test receipt (n=1)			(Taylor et al., 2014)	
	Level of familiarity with U.S. healthcare services (n=1)		(H. Y. Lee & Lee, 2017)		
	Level of comfort with women's health services (n=1)		(H. Y. Lee & Lee, 2017)		
	Level of use of women's health services (n=1)				(H. Y. Lee et al., 2015)
Communication style	Parent-child discussion about HPV vaccine (n=1)	(K. Kim et al., 2015)			

Predisposing factors	Age (n=3)	(Khan, 2014)			(H. Y. Lee et al., 2015; Tung et al., 2019)
	Child's age (n=2)	(Y.-M. Lee et al., 2019)		(Dela Cruz et al., 2018)	
	Sex (n=4)	(Khan, 2014)	(Gao, 2015)		(Truong-Vu, 2018; Tung et al., 2019)
	Language (n=3)	(Nguyen et al., 2012)			(M. Kim et al., 2017; J. K. Yi et al., 2013)
	HPV vaccine awareness (n=4)			(Dela Cruz et al., 2018; Do et al., 2009; Taylor et al., 2014)	(M. Kim, Lee, Kiang, Aronowitz, et al., 2019)
	HPV or HPV vaccine knowledge (n=9)	(Khan, 2014; Otanez & Torr, 2018)	(M. Kim, Lee, Kiang, Aronowitz, et al., 2019; H. Y. Lee & Lee, 2017)	(H. Lee et al., 2016)	(M. Kim et al., 2017; H. Y. Lee et al., 2015; Tung et al., 2019; J. K. Yi et al., 2013)
	General vaccine attitudes (n=1)	(Khan, 2014)			

	HPV vaccine attitudes (n=2)	(Khan, 2014)			(Tung et al., 2019)
	Belief about prevention (n=1)			(Do et al., 2009)	
	Trust in Western medicine (n=1)			(Do et al., 2009)	
	Medical mistrust (n=1)				(Kolar et al., 2015)
	Perceived HPV vaccine importance (n=2)	(Khan, 2014; Zhao et al., 2014)			
	Perceived HPV vaccine effectiveness (n=3)	(Khan, 2014)		(Do et al., 2009; Y.-M. Lee et al., 2018)	
	Perceived HPV vaccine safety or side effect (n=7)	(Khan, 2014; K. Kim et al., 2015; Y.-M. Lee et al., 2019)		(Bastani et al., 2011; Dela Cruz et al., 2018; Do et al., 2009)	(M. Kim et al., 2017)
	HPV vaccine is too new (n=3)	(Khan, 2014; Y.-M. Lee et al., 2019)		(Dela Cruz et al., 2018)	
	Perceived susceptibility (n=5)		(Gao et al., 2016; H. Y. Lee & Lee, 2017)	(Dela Cruz et al., 2018)	(M. Kim et al., 2017; M. Kim, Lee, Kiang, Aronowitz, et al., 2019)

	No need for HPV vaccine if not sexually active (n=5)	(Khan, 2014; Y.-M. Lee et al., 2019)	(Gao et al., 2016)	(Do et al., 2009)	(M. Kim, Lee, Kiang, Aronowitz, et al., 2019)
	No need for HPV vaccine if practicing safe sex (n=1)		(Gao et al., 2016)		
	Trust in partner's HPV status (n=1)				(Hopfer et al., 2017)
	HPV vaccine promotes child's sexual activity or promiscuity (n=3)	(K. Kim et al., 2015)		(Dela Cruz et al., 2018; Do et al., 2009)	
	American lifestyle increases susceptibility; thus should get vaccinated (n=1)		(Gao et al., 2016)		
	Get all vaccines for my child (n=1)			(Dela Cruz et al., 2018)	
	Worry about child's health (n=1)	(Khan, 2014)			
	Belief regarding suitability of vaccine for Chinese people (n=1)		(Gao et al., 2016)		
	Too busy (n=2)				(M. Kim et al., 2017; M. Kim, Lee, Kiang, Aronowitz, et al., 2019)

Enabling factors	Perceived costs (n=4)	(K. Kim et al., 2015; Y.-M. Lee et al., 2019)		(Do et al., 2009)	(M. Kim et al., 2017)
	School policy (n=1)	(K. Kim et al., 2015)			
	Not enough information or needing more information (n=2)	(Khan, 2014)		(Bastani et al., 2011)	

Reinforcing factors	Influence from mother (n=3)		(H. Lee et al., 2018)		(Hopfer et al., 2017; M. Kim et al., 2017)
	HPV vaccine recommendation by parents (n=1)		(M. Kim, Lee, Kiang, Aronowitz, et al., 2019)		
	Influence from family (n=1)				(M. Kim et al., 2017)
	Influence from family and friends (n=1)	(Zhao et al., 2014)			
	Influence from friends (n=2)		(Gao, 2015; H. Y. Lee & Lee, 2017)		
	Influence from other parents (n=1)	(K. Kim et al., 2015)			
	Have friends whose children are HPV vaccinated (n=1)			(Dela Cruz et al., 2018)	
	Influence from social media (n=1)				(M. Kim et al., 2017)
	Motivation to get protection from disease (n=4)	(K. Kim et al., 2015)		(Dela Cruz et al., 2018; Taylor et al., 2014)	(Hopfer et al., 2017)
	Family stigma around sexual health (n=1)				(Hopfer et al., 2017)
	Knowing someone with cancer (n=1)				(H. Y. Lee et al., 2015)

	Family history of cancer (n=1)		(H. Y. Lee & Lee, 2017)		
	Interdependent self-construal (n=1)	(Zhao et al., 2014)			
Preventive activity	Having to get multiple doses (n=1)				(M. Kim et al., 2017)
	Belief regarding recommended ages (9-26) (n=1)		(Gao et al., 2016)		

APPENDIX 2.A.

Search Terms

(human papilloma virus OR human papilloma viruses OR human papillomavirus OR human papillomaviruses OR HPV)

AND (immunization OR immunize OR vaccine OR vaccines OR vaccination OR vaccinations)

AND (accept OR accepts OR accepted OR accepting OR acceptance OR acceptances OR acceptability OR adverse effect OR adverse effects OR aware OR awareness OR attitude OR attitudes OR attitudinal OR belief OR beliefs OR believe OR believes OR believing OR believed OR believable OR believably OR believability OR behave OR behaves OR behaved OR behaving OR behavior OR behaviors OR behavioral OR behavioural OR complete OR completion OR decide OR decides OR decided OR deciding OR decidedly OR decision OR decisions OR decisional OR nondecision OR nondecisions OR predecision OR predecisions OR redecision OR redecisions OR decisive OR decisive OR effective OR effectiveness OR hesitance OR hesitancy OR hesitant OR impression OR impressions OR initiate OR initiated OR initiation OR intend OR intends OR intended OR intending OR intent OR intents OR intention OR intentions OR intentionally OR know OR knew OR knowledge OR perceive OR perceives OR perceived OR perceiving OR percept OR perception OR perceptions OR react OR reacted OR reacting OR reaction OR reactions OR reacts OR reason OR reasoned OR reasoning OR reasonings OR reasons OR refusal OR refuse OR refused OR risk OR risks OR risked OR risking OR riskier OR riskiest OR severe OR severity OR severities OR uptake OR uptakes OR willingness OR willing OR willingly)

AND (US OR U.S. OR United States OR America OR American OR Americans OR Alabama OR Alabamian OR Alabamians OR Alabaman OR Alabamans OR Alaska OR Alaskan OR Alaskans OR Arizona OR Arizonan OR Arizonans OR Arkansas OR Arkansan OR Arkansans OR Arkansawyer OR Arkansawyers OR Arkie OR Arkies OR California OR Californian OR Californians OR Californio OR Californios OR Colorado OR Coloradan OR Coloradans OR Coloradoan OR Coloradoans OR Connecticut OR Connecticuter OR Connecticuters OR Connecticotian OR Connecticotians OR Connecticutensian OR Connecticutensians OR Delaware OR Delawarean OR Delawareans OR Florida OR Floridian OR Floridians OR Georgia OR Georgian OR Georgians OR Hawaii OR Hawaiian OR Hawaiians OR Islander OR Islanders OR Kama’aina OR Kama’ainas OR Kamaaina OR Kamaainas OR Idaho OR Idahoan OR Idahoans OR Illinois OR Illinoisan OR Illinoisans OR Illinoisian OR Illinoisians OR Illinoian OR Illinoians OR Indiana OR Indianan OR Indianans OR Indianian OR Indianians OR Iowa OR Iowan OR Iowans OR Kansas OR Kansan OR Kansans OR Kentucky OR Kentuckian OR Kentuckians OR Louisiana OR Louisianan OR Louisianans OR Louisianais OR Louisianaises

OR Luisiano OR Luisianos OR Maine OR Mainer OR Mainers OR Mainiac OR Mainiacs OR Maryland OR Marylander OR Marylanders OR Massachusetts OR Massachusettsan OR Massachusettsans OR Massachusettsian OR Massachusettsians OR Massachusite OR Massachusites OR Michigan OR Michiganian OR Michiganians OR Michigander OR Michiganders OR Michiganite OR Michiganites OR Minnesota OR Minnesotan OR Minnesotans OR Mississippi OR Mississippian OR Mississippians OR Missouri OR Missourian OR Missourians OR Montana OR Montanan OR Montanans OR Nebraska OR Nebraskan OR Nebraskans OR Nevada OR Nevadan OR Nevadans OR New Hampshire OR New Hampshirite OR New Hampshirites

OR New Hampshireman OR New Hampshiremen OR New Hampshirewoman OR New Hampshirewomen OR New Jersey OR New Jerseyan OR New Jerseyans OR Jerseyite OR Jerseyites OR New Mexico OR New Mexican OR New Mexicans OR Neomexicano OR Neomexicanos OR Neomejicano OR Neomejicanos OR New York OR New Yorker OR New Yorkers OR North Carolina OR North Carolinian OR North Carolinians OR North Dakota OR North Dakotan OR North Dakotans OR Ohio OR Ohioan OR Ohioans OR Ohian OR Ohians OR Oklahoma OR Oklahoman OR Oklahomans OR Okie OR Okies OR Oregon OR Oregonian OR Oregonians OR Pennsylvania OR Pennsylvanian OR Pennsylvanians OR Pennamite OR Pennamites OR Rhode Island OR Rhode Islander OR Rhode Islanders OR Rhodean OR Rhodeans OR South Carolina OR South Carolinian OR South Carolinians OR South Dakota OR South Dakotan OR South Dakotans OR Tennessee OR Tennessean OR Tennesseans OR Texas OR Texan OR Texans OR Texian OR Texians OR Tejano OR Tejanos OR Texican OR Texicans OR Utah OR Utahn OR Utahns OR Utahan OR Utahans OR Vermont OR Vermonter OR Vermonters OR Virginia OR Virginian OR Virginians OR Washington OR Washingtonian OR Washingtonians OR West Virginia OR West Virginian OR West Virginians OR Wisconsin OR Wisconsinite OR Wisconsinites OR Wyoming OR Wyomingite OR Wyomingites OR Wyomese OR Wyomeses OR District of Columbia OR DC OR D.C. OR American Samoan OR Guam OR Guamanian OR Guamanians OR Mariana Islander OR Mariana Islanders OR Puerto Rico OR Puerto Rican OR Boricua OR Boricuas)

AND (Asia OR Asian OR Asians OR Asian Indian OR Asian Indians OR Indian OR Indians OR South Asian OR South Asians OR Japan OR Japanese OR Korea OR Korean OR Koreans OR China OR Chinese OR Bangladesh OR Bangladeshi OR Bhutan OR Bhutanese OR Cambodia OR Cambodian OR Filipino OR Filipinos OR Philippines OR Hmong Nepal OR Nepali OR Nepalese OR Pakistan OR Pakistani OR Pakistanis OR Singapore OR Singaporean OR Singaporeans OR Sri Lanka OR Sri Lankan OR Sri Lankans OR Sinhalese OR Taiwan OR Taiwanese OR Thai OR Thais OR Vietnam OR Vietnamese OR Asian Indian OR Asian Indians)

APPENDIX 2.B.

Details of Results in Reviewed Studies Organized by P3 Factors

Practice-level determinants of HPV vaccine intention and uptake

Language services at the clinic (n=2)

(H. Y. Lee & Lee, 2017): Although Korean participants were fluent enough in English to attend college or graduate school in the U.S, some participants reported the difficulty of understanding medical jargon. They knew how to describe their symptoms in Korean, but did not know the appropriate terms in English.

(M. Kim et al., 2017): First-generation Korean students worried about going to see a doctor or going to the hospital because they were concerned about not understanding English medical terminology.

Insurance policy (n=1)

(Hopfer et al., 2017): Clinicians serving Vietnamese women described insurance coverage (e.g., only for vaccines gotten at primary care and not at Planned Parenthood) as a barrier to women getting HPV vaccine.

Provider-level determinants of HPV vaccine intention and uptake

HPV vaccine recommendations from providers (n=8)

(Khan, 2014): 58% of South Asian parents of daughters (PDs) and 45% of South Asian parents of sons (PSs) chose “I usually get my daughter/son whichever vaccine her/his doctor recommends” as a reason why they accepted HPV vaccine for their children.

(K. Kim et al., 2015): Korean women who had daughters aged around 11 or 12 years and hence were recommended by pediatricians to have their daughters vaccinated seemed to have followed the decision/recommendation made by pediatricians.

(Y.-M. Lee et al., 2019): Many Korean parents who participated in the focus group interviews indicated that their health care provider did not make a strong recommendation to consent to the HPV vaccine for their children. Therefore, they decided not to vaccinate. In this study, Korean parents expressed that they would decide without hesitation on the HPV vaccine for their children if doctors strongly make a recommendation. Some parents consented to vaccination because it was doctor recommended while other parents decided to take time to gather more information and think about it.

(Dela Cruz et al., 2018): Filipino (95% of PDs and 96% of PSs) and Japanese (96% PDs and 97% PSs) chose "The doctor recommended the vaccine" as a reason why they had vaccinated their children. Additionally, Filipino (48% PDs and 58% PSs) and Japanese (49% PDs and 60% PSs) chose "The doctor didn't mention the vaccine" as a reason why they had not vaccinated their children.

(Do et al., 2009): For the Cambodian community, a provider's recommendation was a facilitator of HPV vaccine uptake for adolescents and the absence of a recommendation was a barrier.

(Taylor et al., 2012): Cambodian daughters' HPV vaccine uptake was associated with mothers having received a doctor's recommendation ($p<.001$).

(Taylor et al., 2014): 42% of Cambodian mothers of vaccinated daughters indicated that they got HPV vaccine for their daughter because they received a physician's recommendation, while 24% of those of unvaccinated daughters indicated the lack of a recommendation as the reason.

(M. Kim et al., 2017): Most Korean vaccinated participants said they received the HPV vaccine because their doctors recommended it.

Discussion/conversation with providers about HPV vaccine (n=3)

(Khan, 2014): 32% of South Asian PDs and 43% of South Asian PSs chose "I have not yet discussed this vaccine with my daughter's pediatrician" as a reason why they did not accept HPV vaccine for their children.

(Y.-M. Lee et al., 2019): Limited communication with health care providers was found as another main barrier to make an informed decision for HPV vaccination. Korean parents expressed that their pediatric doctors did not provide adequate information for the vaccine.

(Hopfer et al., 2017): 81% of the vaccinated Vietnamese women's decision stories included descriptions of conversations with a health care practitioner as the reason for vaccinating.

Provider's advice regarding likelihood of getting cervical cancer (n=2)

(H. Y. Lee & Lee, 2017): A participant described her male physician's disagreement with her intent to receive the HPV vaccine by mentioning "promiscuity" and discussing how only women who were "promiscuous" or "indulgent" would be likely to get cervical cancer.

(M. Kim et al., 2017) Some unvaccinated participants reported not getting vaccinated because their doctors said Korean or Asian women were less prone to cervical cancer.

Hearing of HPV vaccine from providers (n=1)

(Taylor et al., 2014) Cambodian daughters' HPV vaccine initiation was associated with their mothers having heard of HPV vaccine from providers (p=.007).

Having asked providers for HPV vaccination (n=1)

(Taylor et al., 2012) Cambodian daughters' HPV vaccine uptake was associated with their mothers having asked providers for HPV vaccination (p=.002).

Patient-level determinants of HPV vaccine intention and uptake

Healthcare delivery or organizational factors

Knowledge of where to get HPV vaccine (n=1)

(Bastani et al., 2011): 84% of Chinese mothers and 81% of Korean mothers chose "Do not know where to go to get the vaccine" as a reason why they had not vaccinated their daughters.

Knowledge of whether insurance covers HPV vaccine (n=1)

(Dela Cruz et al., 2018): Filipino (48% PDs and 46% PSs) and Japanese (24% PDs and 31% PSs) chose "I'm not sure if insurance covers the vaccine" as a reason why they had not vaccinated their children.

Access to clinics or providers with HPV vaccine (n=1)

(Y.-M. Lee et al., 2018): Among Korean parents, compared to those who had gotten HPV vaccine for their children, those who had not vaccinated their children perceived the ability to access providers or clinics with HPV vaccine as less of a barrier (M=3.05 vs. 2.43, p=.045).

Pap test receipt (n=1)

(Taylor et al., 2014): Cambodian daughters' vaccine initiation was associated with mothers' receipt of a Pap test (p=0.006).

Level of familiarity with U.S. healthcare services (n=1)

(H. Y. Lee & Lee, 2017): Unfamiliarity with the health care system made Korean participants feel unable to access health care services. They complained about health care clinic procedures in the U.S. They thought it was time-consuming to describe all of their symptoms to a nurse before they saw a doctor. In Korea, they were able to see a doctor directly without first meeting with a nurse.

Level of comfort with women's health services (n=1)

(H. Y. Lee & Lee, 2017) All Korean participants expressed feeling uncomfortable or embarrassed about visiting women's clinics. One of the strongest perceptions, carried over from Korea, was that women's clinics are only for married women who are sexually active, not for unmarried women. Seeking gynecological examinations as a single woman is associated with unacceptable premarital sexual activity or promiscuity.

Level of use of women's health services (n=1)

(H. Y. Lee et al., 2015): Among Asian college students, use of gynecological services was associated with completing the HPV vaccine series (OR = 1.72, p<.01)

Communication style

Parent-child discussion about HPV vaccine (n=1)

(K. Kim et al., 2015): Korean mothers with older adolescent children or young adults tended to share thoughts on HPV vaccination with their children and invite them to a collaborative process of decision making about HPV vaccine.

Predisposing factors

Age (n=3)

(Khan, 2014): South Asian parents aged 34 and older were less willing to vaccinate their daughters (OR=0.34, p=.048) or sons (OR=0.23, p=.002) compared to younger parents.

(H. Y. Lee et al., 2015): Among Asian college students, older age was associated with a lower likelihood of completing the HPV vaccine series (OR = 0.69, p<.01).

(Tung et al., 2019): Older Chinese students were less likely to have received HPV vaccine (29.7%) compared to younger students (43.7%) with AOR = 0.46.

Child's age (n=2)

(Y.-M. Lee et al., 2019): Some parents believed that the vaccine was not appropriate for their children because either they were too young or had not had their period.

(Dela Cruz et al., 2018). Filipino parents (49% PDs and 35% PSs) and Japanese parents (31% PDs and 31% PSs) chose "She/he is too young to get the vaccine" as a reason why they had not vaccinated their children.

Sex (n=4)

(Khan, 2014): Among South Asian parents, compared to fathers of daughters, mothers of daughters were more willing to get HPV vaccine for daughters (OR=3.7, p=.008).

(Gao, 2015): Compared to Chinese male students, Chinese female students had higher vaccine intention (t=6.0, p<.001).

(Truong-Vu, 2018): Compared to Asian American males, Asian American females were 69% less likely to never initiate the HPV vaccine, relative to on-time vaccinations ($p \leq 0.01$). Additionally, compared to males, females were over 50% less likely to vaccinate late, relative to on-time vaccinations ($p \leq 0.05$).

(Tung et al., 2019): Among Chinese students, significant differences were observed in receiving HPV vaccine included between gender [males 14.5% vs. females 55.1%, AOR = 0.13].

Language (n=3)

(Nguyen et al., 2012): Chinese adult women who spoke English were more likely to support their daughters or granddaughters in getting the vaccination, even if they had to pay for it themselves (OR = 10.7, p=008).

(M. Kim et al., 2017): Korean female students reported unfamiliarity with medical terminology in English (e.g., HPV, cervix, and cervical cancer). First-generation Korean students worried about going to see a doctor or to the hospital because they were concerned about not understanding English medical terminology.

(J. K. Yi et al., 2013): Among Vietnamese women, English proficiency was associated with higher likelihood of having received the HPV vaccine (OR=4.4, p=.03).

HPV vaccine awareness (n=4)

(Dela Cruz et al., 2018): Filipino (45% PDs and 53% PSs) and Japanese (47% PDs and 44% PSs) chose "I never knew about the vaccine" as a reason why they had not vaccinated their children.

(Do et al., 2009): A lack of awareness of HPV vaccine was noted as a barrier to Cambodian parents' vaccine uptake for adolescents.

(Taylor et al., 2014): Among Cambodian mothers, 43% indicated a lack of awareness as a reason why they did not get the vaccine for their daughters.

(M. Kim, Lee, Kiang, Aronowitz, et al., 2019): Among Korean women, 28% chose "I have never heard of it" as a reason why they had not gotten the vaccine.

HPV or HPV vaccine knowledge

(Khan, 2014): Among South Asian parents, higher willingness to get HPV vaccine for their children was associated with higher HPV knowledge (OR=3.8, p=.006).

(Otanez & Torr, 2018): Asians and Pacific Islanders with moderate and high HPV knowledge were more willing to vaccinate daughters against HPV as opposed to those with low knowledge or no knowledge.

(M. Kim, Lee, Kiang, Aronowitz, et al., 2019): Korean female students with higher knowledge had higher intention of getting HPV vaccine (OR=1.11, 95%CI=1.11-1.22).

(H. Y. Lee & Lee, 2017): A lack of channels to learn about HPV and HPV vaccine contributed to low vaccine intention among Korean women.

(H. Lee et al., 2016): Higher levels of mothers' HPV knowledge were associated with Cambodian-American teenage girls having received the HPV vaccine (OR=4.08, 95%CI=1.50-11.05).

(H. Y. Lee et al., 2015): Among Asian-American college students, higher HPV literacy was associated with a higher likelihood of having completed the HPV vaccine series (OR=2.00, p<.01).

(M. Kim et al., 2017): Korean students reported a lack of knowledge that the HPV vaccine could be given to adults, that men could get the HPV vaccine, and that the vaccine was preventative against HPV as barriers to vaccine uptake.

(Tung et al., 2019): Among Chinese students, receiving HPV vaccine was associated with knowledge level (high knowledge 52.0% vs. low knowledge 27.5%, AOR=2.36).

(J. K. Yi et al., 2013): Among Vietnamese women, those who correctly responded to the item "People infected with HPV can be cured with medication" were more likely to report receiving the HPV vaccine (OR=3.8, p=.03).

General vaccine attitudes (n=1)

(Khan, 2014): Among South Asians, higher willingness of HPV vaccination was associated with more positive general attitudes towards vaccination (PDs: OR=4.48, p=.003; PSs: OR=3.11, p=.017).

HPV vaccine attitudes (n=2)

(Khan, 2014): Among South Asians, higher willingness of HPV vaccination was associated with thinking that HPV vaccine was necessary for males (PDs: OR=5.33, p=.001; PSs: OR=10.32, p<.001).

(Tung et al., 2019): Among Chinese college students, more positive attitudes were associated with higher vaccine initiation (OR=0.28).

Beliefs about prevention (n=1)

(Do et al., 2009): In the Cambodian community, *beliefs regarding disease prevention* (e.g., priority placed on preventive health measures) could both negatively and positively impact parents' HPV vaccine uptake for their children.

Trust in Western medicine (n=1)

(Do et al., 2009): In the Cambodian community, those with lower *trust in Western medicine* may refuse to get the vaccine for their children.

Medical mistrust (n=1)

(Kolar et al., 2015): Among Asian female college students, unvaccinated women had higher levels of medical mistrust compared to vaccinated women (M=9.4 versus M=7.2).

Perceived HPV vaccine importance (n=2)

(Khan, 2014): Among South Asians, 41% PDs and 52% PSs chose "I believe the HPV vaccine is a necessity/important" as a reason why they accepted HPV vaccine for their children.

(Zhao et al., 2014): Among Korean mothers, perceived importance of HPV vaccine was associated with vaccine intention (β=.42, $p<.001$).

Perceived HPV vaccine effectiveness (n=3)

(Khan, 2014): Among South Asians, 21% PDs and 29% PSs chose "I believe the HPV vaccine is effective" as a reason why they accepted HPV vaccine for their children; additional reasons

included the ability to prevent cervical cancer (61% PDs and 20% PSs) and "It's a good way to protect my daughter/son against genital warts" (30% PDs and 33% PSs).

(Do et al., 2009): Concerns about the effectiveness of the vaccine influenced Cambodian parents' vaccine uptake for adolescents.

(Y.-M. Lee et al., 2018): Among Korean parents, in regards to perceived benefits, there was a significant difference in the scores for parents who did vaccinate their children for HPV (M=3.08) and parents who did not vaccinate their children for HPV (M=3.89, p=0.06). The parents who did not vaccinate their children reported a higher score compared to the other group, indicating that they believed that the HPV vaccine was less beneficial and less effective.

Perceived HPV vaccine safety or side effects (n=7)

(Khan, 2014): Among South Asians, 44% PDs and 40% PSs chose "I am fearful about side effects of the vaccine" as a reason why they did not accept HPV vaccine for their children.

(K. Kim et al., 2015): Among Korean women, concerns about safety were reasons against HPV vaccine acceptance for their children.

(Y.-M. Lee et al., 2019): The majority of Korean parents expressed distrust due to potential side effects. Parents also questioned the safety of the HPV vaccine because it is non-routine.

(Bastani et al., 2011): Chinese mothers of daughters (24%) chose "Thinks HPV vaccine may cause health problems in the future" as a reason why they had not vaccinated their daughters.

(Dela Cruz et al., 2018): Filipino (63% PDs and 50% PSs), and Japanese (53% PDs and 49% PSs) chose "I'm not sure it's safe" as a reason why they had not vaccinated their children.

(Do et al., 2009): Concerns about the side effects of the vaccine influenced Cambodian parents' vaccine uptake for adolescents.

(M. Kim et al., 2017): Korean women mentioned side effects of the vaccine as a barrier to vaccine uptake.

HPV vaccine is too new (n=3)

(Khan, 2014): Among South Asians, 50% PDs and 43% PSs chose "The vaccine is very new" as a reason why they did not accept HPV vaccine for their children.

(Dela Cruz et al., 2018): Filipinos (50% PDs and 45% PSs) and Japanese (60% PDs and 55% PSs) chose "It's a new vaccine" as a reason why they had not vaccinated their children.

(Y.-M. Lee et al., 2019): Some Korean parents also expressed distrust towards HPV vaccine because they thought it was too new.

Perceived susceptibility (n=5)

(Gao et al., 2016): Most participants thought vaccination was important for women, promiscuous people, homosexuals and Chinese international students born in the 1990s; particularly women, as HPV infection leads to more severe health consequences for women compared with men. Both male and female participants discussed that promiscuous people and sex workers should receive the vaccine as they are at high risk. Male participants said that as long as they were ''straight,'' they do not need to worry about anal cancer. Participants born in the 1980s also mentioned that younger Chinese international students born in the 1990s, whom they viewed as more westernized and sexually open, were at a higher risk of infection and in need of STI prevention and HPV vaccination.

(H. Y. Lee & Lee, 2017): Participants did not think of themselves as being susceptible to getting cervical cancer.

(Dela Cruz et al., 2018): Filipino (39% PDs and 33% PSs) and Japanese parents (44% PDs and 20% PSs) cited "She/he is not at risk for HPV" as a reason why they did not vaccinate their children.

(M. Kim, Lee, Kiang, Aronowitz, et al., 2019): Among Korean female college students, 51% chose "I'm healthy," 41% chose "I'm not likely to get sexually transmitted diseases," and 39% chose "I'm not likely to get genital warts or cervical cancer" as reasons why they did not get vaccinated.

(M. Kim et al., 2017): Korean participants reported low perceived susceptibility to HPV as a barrier to vaccine uptake.

No need for HPV vaccine if not sexually active (n=5)

(Khan, 2014): Among South Asians, 27% PDs and 26% PSs chose "It's not allowed in my culture to have sex before marriage so don't need this vaccine" as a reason why they did not accept HPV vaccine for their children.

(Y.-M. Lee et al., 2019): Some Korean parents believed that the vaccine was not appropriate for their children because their children were not sexually active.

(Gao et al., 2016): Among Chinese students, some female participants thought they could plan to have a vaccination right before they would engage in sexual behavior. Male participants thought they would not be at risk for infection if they refrained from sexual intercourse.

(Do et al., 2009): Some of the Cambodian key informants thought that the vaccine was unnecessary for young Cambodians because the children were not sexually active.

(M. Kim, Lee, Kiang, Aronowitz, et al., 2019): Among Korean female college students, 33% chose “I have never had sexual intercourse” as a reason why they did not get vaccinated.

No need for HPV vaccine if practicing safe sex (n=1)

(Gao et al., 2016): Chinese students reported not intending to get the vaccine if they were practicing safe sex.

Trust in partner’s HPV status (n=1)

(Hopfer et al., 2017): Vietnamese women reported not getting the vaccine because they trusted that their partners were HPV-free.

HPV vaccine promotes child’s sexual activity or promiscuity (n=3)

(K. Kim et al., 2015): Several Korean women worried that by vaccinating a child they could send the child a wrong, unintended message that it's ok to have sex.

(Do et al., 2009): Cambodian participants discussed how parents might not permit their daughters to be vaccinated because HPV vaccine receipt could promote promiscuity.

(Dela Cruz et al., 2018): Filipino (45% PDs and 42% PSs), and Japanese (44% PDs and 33% PSs) chose “I don’t want her/him to think it’s OK to have sex” as a reason why they did not vaccinate their children.

American lifestyle increases susceptibility; thus should get vaccinated (n=1)

(Gao et al., 2016): Some Chinese students said they should align their vaccination behavior with Americans because many Chinese international students become sexually active in the United States and consider themselves equally at risk if dating Americans outside their race.

Get all vaccines for my child (n=1)

(Dela Cruz et al., 2018): Filipino (83% PDs and 86% PSs) and Japanese (91% PDs and 91% PSs) chose "I vaccinate her/him for everything else" as a reason why they had vaccinated their children.

Worry about child's health (n=1)

(Khan, 2014): South Asians (42% PDs and 38% PSs) chose "I am worried about my daughter's/son's health" as a reason why they accepted HPV vaccine for their children.

Belief regarding suitability of vaccine for Chinese people (n=1)

(Gao et al., 2016): Some female and male participants were concerned about HPV vaccines from Western countries and argued, "it might not be suitable for Chinese or Asians" and asked whether "the vaccine finished clinical trials among Chinese people."

Too busy (n=2)

(M. Kim, Lee, Kiang, Aronowitz, et al., 2019): Among Korean female college students, 49% chose "I'm too busy" as a reason why they did not get vaccinated.

(M. Kim et al., 2017): Korean female participants mentioned being too busy as a reason for non-vaccination.

Enabling factors

Perceived costs (n=4)

(K. Kim et al., 2015): Korean women discussed high financial costs as a reason why they did not intend to get the vaccine for their children.

(Y.-M. Lee et al., 2019): Costs for vaccination was a significant barrier to HPV vaccine acceptance, especially to Korean families with multiple children.

(Do et al., 2009): Cambodians discussed costs as a barrier to parents getting HPV vaccine for their children.

(M. Kim et al., 2017): Korean female participants mentioned perceived costs as a reason for non-vaccination.

School policy (n=1)

(K. Kim et al., 2015): Korean women reported having received and followed a recommendation from the school to get HPV vaccine for their daughters.

Not enough information or needing more information (n=2)

(Khan, 2014): Among South Asians, 47% PDs and 45% PSs chose "I think there is not enough information about HPV vaccine" as a reason why they did not accept HPV vaccine for their children.

(Bastani et al., 2011): Chinese mothers (81%) and Korean mothers (66%) of daughters chose "Needing more info to make a decision" as a reason why they had not vaccinated their children.

Reinforcing factors

Influence from mothers (n=3)

(H. Lee et al., 2018): Cambodian daughter's intention to get HPV vaccine was associated with her perception of her mother's intention for her to get vaccinated ($r=0.8$, $p<.01$).

(Hopfer et al., 2017): When asked to describe their decision to vaccinate, 46% (n=11) of Vietnamese women included conversations with their mothers and described ways in which their mother–daughter relationship influenced their vaccine decisions. Vietnamese women were more likely to mention their mother as decision-makers only when they had been vaccinated as an adolescent. Mother–daughter conversations about HPV vaccination were also often initiated in the context of medical visits (69% of Vietnamese).

(M. Kim et al., 2017): Some Korean participants expressed how their mothers did not want them to get the vaccine. Other vaccinated participants stated that they got the vaccine because their mothers recommended it.

HPV vaccine recommendation by parents (n=1)

(M. Kim, Lee, Kiang, Aronowitz, et al., 2019): Among Korean female college students, HPV recommendation by parents (OR=4.58, 95%CI =1.37–15.36) was determined to be an independent predictor of intention to receive the HPV vaccine.

Influence from family (n=1)

(M. Kim et al., 2017): Among Korean women, hearing negative messages about the vaccine through family members was a barrier to vaccine uptake.

Influence from family and friends (n=1)

(Zhao et al., 2014): Among Korean women, those with higher subjective norms (e.g., perceived approval of HPV vaccine from family and friends) had higher intention of getting their children vaccinated (β=.25, $p<.01$).

Influence from friends (n=2)

(Gao, 2015): Among Chinese students, having a friend who got vaccinated against HPV was a predictor of intention to get the vaccine ($t=3.227$; $p<0.01$).

(H. Y. Lee & Lee, 2017): Korean women reported that negative messages about HPV vaccine heard through friends played a role in vaccine acceptance.

Influence from other parents (n=1)

(K. Kim et al., 2015): Korean parents discussed how other parents' opinions influenced their decision-making about HPV vaccine.

Having friends whose children are HPV vaccinated (n=1)

(Dela Cruz et al., 2018): Filipino (58% PDs and 36% PSs) and Japanese (70% PDs and 64% PSs) chose "Have friends whose children are HPV vaccinated" as a reason why they had vaccinated their children.

Influence from social media (n=1)

(M. Kim et al., 2017): Korean female students also discussed hearing negative messages about the vaccine through social media as a barrier to vaccination.

Motivation to get protection from disease (n=4)

(K. Kim et al., 2015): Motivation to protect their children from diseases was a reason underlying vaccine acceptance for adolescents among Korean parents.

(Dela Cruz et al., 2018): Filipino (95% PDs and 93% PSs) and Japanese (96% PDs and 100% PSs) chose "Protection for child" as a reason why they had vaccinated their children.

(Taylor et al., 2014): Among Cambodian mothers, 54% indicated they got the vaccine for their daughter because they wanted to protect their daughters from disease.

(Hopfer et al., 2017): Vietnamese women discussed motivation to get protection from diseases as a reason for getting the vaccine.

Family stigma around sexual health (n=1)

(Hopfer et al., 2017): Vietnamese women's decision stories described family silence around discussing sex and sexual health. Family silence impeded women from taking preventive measures to ensure good reproductive health. Women acknowledged family silence and stigma around sexual health and also mentioned having Catholic, conservative family cultures that precluded them from having family conversations around sexual health and HPV.

Knowing someone with cancer (n=1)

(H. Y. Lee et al., 2015): Knowing someone with cancer was associated with vaccine completion among Asian female college students (OR=2.28, $p<0.01$).

Family history of cancer (n=1)

(H. Y. Lee & Lee, 2017): A barrier to vaccine intention among Korean women was not having a family history of cervical cancer and thus not thinking of themselves as being at risk.

Interdependent self-construal (n=1)

(Zhao et al., 2014): Among Korean women, *higher interdependent self-construal* (defined as "an orientation of self in which individuals define themselves primarily through their relationships with others") was associated with higher HPV vaccine intention (β=.19, $p<.03$).

Preventive activity

Having to get multiple doses (n=1)

(M. Kim et al., 2017): Having to get multiple doses of the vaccine was cited as a barrier to vaccine uptake for Korean female college students.

Belief regarding recommended ages (9-26) (n=1)

(Gao et al., 2016): Chinese students disagreed with the recommended age of 9 to 26 for vaccination because they thought Chinese youths did not engage in sexual activity as early as their American counterparts.

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Chapter 3: U.S. Vietnamese parents' HPV vaccine decision-making for their adolescents: An exploration of practice-, provider-, and patient-level influences

INTRODUCTION

U.S. Vietnamese, defined as those living in the U.S. and identifying as Vietnamese, number more than 1.8 million as of 2019, representing the fourth largest Asian group in the U.S. (United States Census Bureau 2019). Compared to other Asians in the U.S., U.S. Vietnamese have lower English proficiency, median household income, and educational attainment and are more likely to be uninsured and in poverty (United States Census Bureau 2019). These disadvantages reflect potential barriers to health services utilization and highlight a need to study health behaviors and outcomes in this specific subgroup.

One important health disparity among this population is cervical cancer rates. Historically, U.S. Vietnamese had the highest cervical cancer rate among all racial/ethnic groups. From 1988 to 1992, the cervical cancer incidence rate (per 100,000) in U.S. Vietnamese was 43.0, compared to 7.5 in non-Hispanic Whites, 13.2 in Blacks, and 16.2 in Hispanic (Miller et al. 1996; Parker et al. 1998; Surveillance Epidemiology and End Results Program n.d.). The incidence rate has since decreased but still remains high. From 2009 to 2011, the cervical cancer incidence rate (per 100,000) was 9.0 in U.S. Vietnamese, versus 6.5 in all Asian-Americans and 7.5 in non-Hispanic Whites (Jin et al. 2016). No published data examine periods that are more recent or look at other HPV-related cancers (e.g., cancers of the vulva, vagina, penis, anus, or oropharynx) among U.S. Vietnamese. Nevertheless, evidence of high cervical cancer incidence rates points to the circulation of the virus in this population and necessitates solutions to reduce HPV-related cancer burden, particularly through increased HPV vaccine uptake.

HPV vaccination is a safe and effective method to prevent HPV-related cancers, including cervical cancer. To date, limited research has focused on HPV vaccination among U.S. Vietnamese (Duong and Hopfer 2020; Gor et al. 2011; Hopfer et al. 2017; Nguyen-Truong et al. 2017; Yi, Anderson, et al. 2013; Yi, Lackey, et al. 2013). Findings indicate that U.S. Vietnamese generally have low awareness or knowledge of the vaccine and low HPV vaccine uptake (Duong and Hopfer 2020; Gor et al. 2011; Hopfer et al. 2017; Nguyen-Truong et al. 2017; Yi, Anderson, et al. 2013; Yi, Lackey, et al. 2013). For example, among 113 Vietnamese women in Houston-based survey, only 14% reported vaccine initiation (Yi, Anderson, et al. 2013). Factors related to HPV vaccine intention or uptake among U.S. Vietnamese included English proficiency (Yi, Anderson, et al. 2013), HPV vaccine knowledge (Yi, Anderson, et al. 2013), vaccine recommendation from healthcare providers (Hopfer et al. 2017; Yi, Lackey, et al. 2013), influences from family members (Hopfer et al. 2017; Nguyen-Truong et al. 2017), and school-based education (Hopfer et al. 2017; Nguyen-Truong et al. 2017).

This existing literature regarding HPV vaccination among U.S. Vietnamese has two major limitations. First, existing research has primarily focused on U.S. Vietnamese young adult females (Duong and Hopfer 2020; Gor et al. 2011; Hopfer et al. 2017; Nguyen-Truong et al. 2017; Yi, Anderson, et al. 2013). Research including U.S. Vietnamese adolescents is limited to only one study assessing mothers' intention to get the HPV vaccine for their daughters (ages 9-26) (Yi, Lackey, et al. 2013) and no publications have focused on adolescent boys or men. Given that the HPV vaccine is the most effective when administered to adolescents before the age of 15 (Centers for Disease Control and Prevention 2020; Pedersen et al. 2007), is currently recommended for both sexes (Centers for Disease Control and Prevention 2020), and most likely requires parental consent (Zimet 2005), research examining U.S. Vietnamese parents' HPV

vaccine uptake for both male and female adolescents is critically needed to estimate vaccination coverage and identify modifiable barriers to utilization.

Second, limited research has leveraged a comprehensive health services framework to examine factors at different health system levels influencing HPV vaccine uptake among U.S. Vietnamese. Rather, existing research has concentrated on individual-level factors (e.g., language, vaccine knowledge) (Duong and Hopfer 2020; Gor et al. 2011; Hopfer et al. 2017; Nguyen-Truong et al. 2017; Yi, Anderson, et al. 2013; Yi, Lackey, et al. 2013) or only looked at a single healthcare system factor – provider recommendation. Research exploring a wide range of factors related to the healthcare environment in which caregivers or patients make decision is needed, particularly because healthcare system-based interventions effectively improve HPV vaccine coverage (Niccolai and Hansen 2015; Smulian et al. 2016). One framework that is well-suited to address this specific health behavior and multilevel healthcare factors associated with it is the P3 model (Bednarczyk et al. 2018). The P3 model highlights the roles of **p**ractice-, **p**rovider-, and **p**atient-level components in the healthcare encounter that influence preventive care behaviors (Bednarczyk et al. 2018) and has been used in previous research examining facilitators of or barriers to HPV vaccination (Vu, Berg, et al. 2020; Vu, King, et al. 2020).

Using the P3 model, we aimed to fill these gaps in the literature by examining U.S. Vietnamese parents' HPV vaccine decision-making for their adolescents of both sexes. Specifically, we examined factors that influence Vietnamese parents' HPV vaccine initiation for their adolescents across three levels: 1) ***practice*** (e.g., clinic-based availability of HPV vaccine materials, availability of interpreter or patient navigation services), 2) ***provider*** (e.g., provider recommendation quality), and 3) ***patient*** (e.g., predisposing, enabling, and reinforcing factors). In addition, we examined P3 factors associated with HPV vaccine completion among initiators

and with willingness to initiate HPV vaccine among non-initiators, as well as sociodemographic factors associated with receiving a provider recommendation for the HPV vaccine.

METHODS

Recruitment and Data Collection

From April to December 2020, we conducted an online, cross-sectional survey with 408 U.S. Vietnamese parents. We utilized several different venues for recruitment: community-based organizations (CBOs) serving Vietnamese and/or Asians (n=60 CBOs), Vietnamese Students Associations (VSAs, n=13 VSAs), relevant Facebook groups and listserv engaging U.S. Vietnamese (n=12 and n=2, respectively), the personal network of the first author, and snowball sampling among participants successfully recruited using the aforementioned channels (Sadler et al. 2010). We successfully recruited 68 participants from CBOs and VSAs, 97 from Facebook groups, 4 from listserv, 42 from the first author's network, and 197 from snowball sampling. The overall response rate was 72% (range: 52 – 87%), as calculated by the American Association for Public Opinion Research's (AAPOR) response rate calculator version 4.1 (American Association for Public Opinion Research 2020) (see **Appendix 3.A** for more recruitment details).

Parental eligibility criteria included: 1) self-identified as Vietnamese; 2) having lived in the U.S. for at least 12 months; 3) able to read either Vietnamese or English; and 4) having at least one child ages 9 to 18 living in the same household. Only one parent per household was allowed to participate. Participants first completed an online eligibility screener (administered via SurveyGizmo). Those eligible were directed to a webpage with a study description and a consent form. Consenting individuals indicated consent via clicking "Yes, I confirm participation in this study" and were directed to the online survey (via SurveyGizmo). The survey took

approximately 60 minutes to complete. We limited duplicate responses by permitting only one response per IP address. Participants were compensated with a $30 Amazon gift card.

Measurements

Survey measures, informed by the literature (Vu, Berg, et al. 2020), were reviewed by the research team (i.e., experts in HPV vaccine, Vietnamese health, Asian health, and survey research). Participants could choose to take the screener and main survey in either Vietnamese or English. Survey translation was conducted using the Brislin's back-translation method (Brislin 1970), an iterative translation process involving an independent translation of survey items into Vietnamese and back-translation into English by two different translators, and then reviewed by the first author (who is fully fluent in both languages) and by approximately 10 Vietnamese native speakers to ensure comprehensibility. Participants were instructed to provide answers about only one child who was between 9 and 18 years old and lived in their home. Those with more than one child in this age range living in their home were instructed to answer these questions considering their oldest child in the age range.

Outcomes: HPV Vaccine Initiation, Completion, Willingness to Initiate, and Provider's Recommendation

All outcome measures were adapted from the 2019 National Immunization Survey – Teen (Centers for Disease Control and Prevention 2019). HPV vaccine initiation was assessed by asking, "Has your child ever received HPV vaccine shots?" To assess provider recommendation for HPV vaccine, we asked, "Has a doctor or other healthcare professional ever recommended that your child receive HPV vaccine shots?" (response options of yes, no, don't know). For both questions, responses were dichotomized (0=no/don't know, 1=yes).

Among those who indicated that they did not initiate the HPV vaccine for their child or did not know whether their child had initiated the HPV vaccine, willingness to initiate HPV vaccine was assessed by asking, "How likely is it that your child will receive HPV vaccine shots in the next 12 months?" Responses were dichotomized (0=not at all/not very likely/prefer not to answer, 1=somewhat/very likely). Among those who indicated their child had initiated the HPV vaccine, we asked, "How many HPV vaccine shots has your child received?" We also asked the age that the child received the first HPV vaccine shot. Per the CDC's Advisory Committee on Immunization Practice's (ACIP) recommendations (Centers for Disease Control and Prevention 2020), HPV vaccine completion was defined as having received two doses if the child initiated the HPV vaccine before age 15 and three doses if initiated at 15 or older. Those who indicated they did not know how many vaccine shots their child received were treated as not having completed the series. In addition, we assessed reasons for initiating the HPV vaccine, reasons for not initiating, and reasons for initiating but not completing the vaccine series (adapting previously used measures (Vu, Bednarczyk, et al. 2019)).

Practice-level Predictors

Newly-created items assessed healthcare practice-level factors relevant to HPV vaccine initiation, including if they had seen materials about the HPV vaccine at their child's primary clinic or had ever used clinic-based patient navigation or language translation/interpretation services (yes or no). Those without a primary clinic were treated as missing data.

Provider-Level Predictors

For those who had received a provider recommendation for the HPV vaccine, we assessed HPV vaccine recommendation quality by asking three questions reflecting different recommendation dimensions (Gilkey, Calo, et al. 2016): 1) "How important did the provider say

the HPV vaccine was your child?" (response options of 1=not at all to 4=very important, reflecting “strength”); 2) "Did the healthcare provider tell you that the HPV vaccine prevents cancer?" (response options of 1=strongly disagree to 4=strongly agree, reflecting “prevention”); and 3) "Did the healthcare provider recommend that your child gets the vaccine that same day?" (response options of 1=strongly disagree to 4=strongly agree, reflecting “urgency”). Strength was dichotomized as 1=very important versus 0=other responses; prevention and urgency were dichotomized as 1=agree/strongly agree versus 0=other responses. We then calculated the summed score of the three items and created two categories: low-quality recommendation (scores of 0 to 1) and high-quality recommendation (scores of 2 to 3). Those who did not receive a provider recommendation were grouped into the third category of "no recommendation."

Patient-Level Predictors: *Predisposing Factors*

We administered the Vaccine Confidence Scale (Gilkey, Reiter, et al. 2016), which assesses parents' level of general vaccine confidence (i.e., not HPV vaccine-specific) and includes subscales assessing perceived vaccine benefits, vaccine harms, and trust in medical professionals. Participants were asked to indicate their level of agreement (0=strongly disagree to 10=strongly agree) to eight statements (e.g., "Vaccines are safe" and "I have a good relationship with my teenager's healthcare provider"). Two items were reverse-coded: "Teenagers receive too many vaccines" and "If I vaccinate my teenager, he/she may have serious side effects." A higher score, derived as an average of item scores, indicates more positive attitudes towards vaccination (Cronbach's alpha=0.76 in this sample).

We adapted three items from the Carolina HPV Immunization Attitudes and Beliefs Scale (McRee et al. 2009) (CHIAS) to assess perceived effectiveness of HPV vaccine in preventing genital warts, cervical cancer, and HPV (1=slightly effective to 5=extremely effective). A higher

score, derived as an average across items, indicates higher perceived effectiveness of HPV vaccine in preventing diseases (Cronbach's alpha=0.83).

We used two CHIAS items to assess beliefs about the HPV vaccine and sexual activity. Participants were asked to indicate their level of agreement (1=strongly disagree to 5=strongly agree) to: "If a teenager gets the HPV vaccine, he or she may be more likely to have sex" and "My child is too young to get a vaccine for a sexually transmitted infection (STI) like HPV."

Patient-Level Predictors: *Enabling Factor*

We used a five-item CHIAS subscale to assess perceived barriers related to HPV vaccine access and cost. Participants were asked to indicate their level of agreement (1=strongly disagree to 5=strongly agree) to the statement "I am concerned that the HPV vaccine costs more than I can pay." In addition, they were asked to indicate their perceived level of difficulty (1=not hard at all to 4=very hard) to four statements about ability to find a provider/clinic with affordable vaccine, easy access, available vaccine, and no long wait time for appointments. A higher score, derived as an average of the five item scores, indicates higher perceived barriers in accessing and being able to afford the HPV vaccine (Cronbach's alpha=0.83).

Patient-Level Predictors: *Reinforcing Factor*

We used a CHIAS item to assess social influence on HPV vaccine uptake. Participants were asked to indicate their level of agreement (1=strongly disagree to 5=strongly agree) to: "Other parents in my community are getting their children the HPV vaccine."

Sociodemographic Factors

We assessed: child's age, sex, and country of birth; and parental sex, highest education level, percentage of lifetime in the U.S., and ability to understand medical information in English. In addition, the Asian American Multidimensional Acculturation Scale (Gim Chung et

al. 2004) was used to assess parental Vietnamese acculturation and parental American acculturation (Cronbach's alphas of 0.87 and 0.92, respectively).

Statistical Analysis

All data analyses were conducted in Stata 15.1. Sociodemographic, healthcare practice-, provider-, and patient-level characteristics were summarized using descriptive statistics. Bivariate analyses were conducted using chi-square and independent sample t-tests to examine sociodemographic, healthcare practice-, provider-, and patient-level characteristics in relation to 1) HPV vaccine initiation, 2) HPV vaccine completion among initiators, 3) willingness to initiate HPV vaccine among non-initiators, and 4) receiving a provider recommendation for HPV vaccine. Simple and multivariable modified Poisson regressions with robust error variance were conducted to examine correlates of each outcome. We chose this approach instead of logistic regressions because when outcome events are common, odds ratios overestimate risk ratios (Chen et al. 2018; Greenland 1987; Zou 2004). In such scenarios, modified Poisson regressions with robust error variance have been shown to provide less biased estimates (Barros and Hirakata 2003; Chen et al. 2018; Knol et al. 2012; Zou 2004). For each outcome, variables with significant associations ($p < 0.05$) in simple regressions were entered into the multivariable regressions. Alpha level was set at 0.05 for all analyses.

RESULTS

The sample (n=408) was 83.0% female with a mean age of 44.81. A majority of parents had at least a Bachelor's degree (85.1%). More than half of the parents (54.4%) had adolescents ages 13 to 18. The distribution of child's sex were roughly similar (50.7% female); so was child's country of birth (48.5% born in the U.S.). On average, parents had spent around a third of their life in the U.S, but only 37.5% of parents reported that they could understand medical

information in English well (**Table 3.1**). Only 37.1% of parents reported seeing materials about HPV vaccine at the child's primary clinic. A small number reported using patient navigation services (6.7%) or using language interpretation or translation services (11.1%). More than half reported receiving no provider recommendation for HPV vaccine, 13.5% reported receiving a low-quality recommendation, and approximately a third reported receiving a high-quality recommendation. Approximately a quarter of parents agreed that their child was too young for an STI-preventing vaccine like the HPV vaccine. In addition, approximately a third agreed that other parents in their community are getting their children the HPV vaccine **(Table 3.2)**.

HPV Vaccine Initiation

The proportion of those who initiated the HPV vaccine for their child was 40.7% of the entire sample (n=166/408) and 51.8% of those with adolescents ages 13 to 18 (n=115/222). The most common reasons for vaccine initiation included doctor's recommendation (83.7%), wanting to protect child from diseases (49.4%), ensuring the child gets all recommended vaccines (33.1%), and thinking that HPV-related diseases are serious (24.7%) **(Table 3.3)**.

In bivariate analyses (Model 1, **Table 3.4**), HPV vaccine initiation was associated with seeing clinic-based materials about HPV vaccine and provider recommendation (both low and high quality). In addition, HPV vaccine initiation was associated with multiple patient-level vaccine-specific factors: higher vaccine confidence, higher perceived effectiveness of HPV vaccine, lower perception that the child is more likely to have sex after HPV vaccine initiation, lower perception that the child was too young for an STI-preventing vaccine like the HPV vaccine, lower perceived barriers related to HPV vaccine access and cost, and higher perception that other parents in the community are getting the HPV vaccine. HPV vaccine initiation was

also associated with child being older and female as well as higher parental education, ability to understand medical information in English, and American acculturation.

In multivariable regression (Model 2, **Table 3.4**), compared to those receiving no provider recommendation, those receiving a low-quality recommendation (adjusted relative risks or aRR=9.08; 95% CI=5.04 – 16.36) and high-quality recommendation (aRR=10.60; 95% CI=5.96 – 18.85) were more likely to have initiated the HPV vaccine for their child. Higher perception that the child was too young for an STI-preventing vaccine like the HPV vaccine was associated with lower likelihood of vaccine initiation (aRR=0.73; 95% CI=0.63 – 0.84).

HPV Vaccine Completion

The proportion of those who completed the HPV vaccine series was 23.3% of the entire sample (n=95/408), 35.1% of those with adolescents ages 13 to 18 (n=78/222), and 57.2% of those who initiated the vaccine (n=95/166). The most common reasons for having initiated but not completed the series **(Table 3.3)** included child starting the series too recent to finish (40.8%) and not knowing child needed more than one dose (15.5%).

In bivariate analyses (Model 1, **Table 3.5**), factors associated with HPV vaccine completion included higher vaccine confidence, lower perception that the child was too young for an STI-preventing vaccine like the HPV vaccine, and older child's age. In multivariable regression (Model 2, **Table 3.5**), HPV vaccine completion was associated with older child's age (aRR=1.10, 95% CI=1.04 – 1.17).

Willingness to Initiate HPV Vaccine

Of those who had not initiated the HPV vaccine for their child (n=242), 45% reported that they were somewhat or very likely to initiate the vaccine in the next 12 months. The most common reasons for not having initiated HPV vaccine (**Table 3.3**) included a lack of doctor's

recommendation (62.8%), doctor's indication that child could get vaccinated at an older age (14.1%), not thinking that child needs the vaccine because of a lack of sexual activity (13.2%), no school requirements (12.0%), and not knowing any HPV-related diseases (10.7%).

In bivariate analyses (Model 1, **Table 3.5**), factors associated with willingness to initiate HPV vaccine included receiving a high-quality recommendation, higher vaccine confidence, higher perceived effectiveness of HPV vaccine, lower perception that the child is more likely to have sex after HPV vaccine initiation, and lower perception that the child was too young for an STI-preventing vaccine like the HPV vaccine. In multivariable regression (Model 2, **Table 3.5**), compared to those receiving no provider recommendation, those receiving high-quality recommendation were more likely to be willing to initiate the HPV vaccine for their child (aRR=1.57, 95% CI=1.15 – 2.14). Higher perception that the child was too young for an STI-preventing vaccine like the HPV vaccine was associated with lower likelihoods of willingness to initiate the vaccine (aRR=0.86; 95% CI=0.77 – 0.98).

Provider Recommendation for HPV Vaccine

In the sample, 45.6% indicated that they had ever received provider recommendation and 32.1% indicated receiving a high-quality recommendation. Among all parents who received provider recommendation (n=186), only 22.0% indicated that the provider recommended for the child to start the HPV vaccine at an age of 12 or younger (not shown in tables). In bivariate analyses (not shown in tables), sociodemographic predictors of receiving provider recommendation were child being older and female, higher parental percentage of lifetime in the U.S., ability to understand medical information in English, and American acculturation. In multivariable regression (not shown in tables), receiving provider recommendation was associated with the child being older (aRR=1.15, 95% CI=1.11 – 1.20) and female (aRR=1.35,

95% CI=1.10 – 1.65), and higher parental American acculturation (aRR=1.27, 95% CI=1.09 – 1.48). Of those who had received provider recommendation, we did not find any significant associations between sociodemographic characteristics and receiving low-quality versus high-quality recommendations (not shown in tables).

DISCUSSION

Our study represents the first effort to examine healthcare practice-, provider-, and patient-level determinants of U.S. Vietnamese parents' HPV vaccine decision-making for their adolescent children. We found that only 41% had initiated and 23% had completed the vaccine series for their child; further, 46% received provider recommendation for HPV vaccine. Vaccine initiation was associated with receiving provider recommendation for vaccination (either low- or high-quality), while willingness to initiate the vaccine was associated with receiving a high-quality recommendation (which occurred among 32% of participants). In addition, both vaccine initiation and willingness to initiate the vaccine was negatively associated with parental perception that their child was too young for an STI-preventing vaccine.

Among adolescent ages 13 to 18 in our sample, the prevalence of HPV vaccine initiation and completion was 52% and 35%, respectively. In contrast, the 2019 NIS-Teen, which surveyed vaccination coverage of U.S. adolescents ages 13 to 17, estimated that 72% and 54% of all adolescents and 75% and 65% non-Hispanic Asian adolescents had initiated and completed the HPV vaccine series, respectively (Elam-Evans et al. 2020). These stark disparities necessitate strategies and interventions to address low adolescent HPV vaccination coverage among U.S. Vietnamese. Furthermore, interventions should aim to address barriers to not only HPV vaccine initiation but also vaccine completion, particularly given that 16% of parents who had initiated the vaccine did not know that their child needed more than one dose.

The strong positive association between provider recommendation and parents' HPV initiation for their child, as documented in our study, has also been reported in general populations (Newman et al. 2018), immigrant populations (Kim and LeClaire 2017), Asian populations (Dela Cruz et al. 2018; Vu, Berg, et al. 2020), and U.S. Vietnamese parents of daughters ages 9-26 (Yi, Lackey, et al. 2013). However, unlike most previous studies that only measured the presence or absence of provider recommendation, we assessed several aspects of recommendation (e.g., quality, recommended age, subgroups more likely to receive recommendation). While Vietnamese parents receiving high-quality recommendations were more likely to be willing to initiate the vaccine for their child in the next 12 months, no association was found among those receiving low-quality recommendations. A similar result was reported in a study with U.S. parents, where parents who had initially refused HPV vaccination but received a high-quality recommendation were more likely to get their child vaccinated during a later visit (i.e. secondary acceptance) (Kornides et al. 2018). This study also found that low-quality recommendations did not have an impact on secondary acceptance (Kornides et al. 2018).

Less than a quarter of all Vietnamese parents who received provider recommendation reported that their providers recommended an age of 12 or younger for their child to start the HPV vaccine. This finding may reflect documented practices where providers based their recommendations on perceptions of adolescents' sexual risks or access to care rather than the ages in ACIP's guidelines (Henrikson et al. 2016). Additionally, Vietnamese parents of sons were less likely to have received a provider recommendation compared to parents of daughters, a pattern also noted in previous research with general U.S. populations (Beavis et al. 2018). Moreover, through using validated measurements for acculturation, we found that Vietnamese parents with higher U.S. acculturation were more likely to receive a provider recommendation,

independent of their ability to understand medical information in English or duration in the U.S. It is possible that those with higher U.S. acculturation may place a higher emphasis on preventive care (Geltman et al. 2014) and thus more likely to take their child to a doctor's visit, thereby creating more opportunities to receive a provider recommendation. This association should be further explored in Vietnamese populations and other immigrant populations.

Taken together, these findings indicate the need for actions to ensure high-quality and age-based provider recommendation for HPV vaccine for U.S Vietnamese parents of both male and female adolescents. Dimensions of high-quality recommendations can include emphasizing the importance and cancer prevention values of the vaccine, recommending same-day vaccination, delivering recommendations to all adolescents by age 12, and recommending the HPV vaccine at the same time and in the same way as other adolescent vaccines (Gilkey and McRee 2016). Effective provider-focused interventions for general U.S. populations have included educational presentations, audit and feedback, and training in communication approach with parents (Leung et al. 2019). Currently, we are not aware of research implementing such interventions in healthcare systems serving U.S. Vietnamese or Asian communities.

A quarter of parents in the sample believed that their child was too young for an STI-preventing vaccine. This perception was negatively associated with HPV vaccine initiation and willingness to initiate the vaccine. In addition, of parents who had not initiated the HPV vaccine, 13% cited their child's lack of sexual activity as a reason for non-initiation. A few studies have reported similar concerns in Korean, Cambodian, and Haitian immigrant populations (Do et al. 2009; Lee et al. 2019; Stephens and Thomas 2013). The 2016 NIS-Teen data indicated that between 9 and 10% of U.S. parents reported their child's lack of sexual activity as a primary reason for why they would not get their child vaccinated in the next 12 months (Beavis et al.

2018). Educational programs and interventions should address this perception by emphasizing that HPV vaccine is the most effective when administered prior to sexual debut (Adams et al. 2007). Moreover, sexual activity is not the only possible source of exposure to HPV, as there are non-sexual and non-penetrative sources of HPV transmission (Liu et al. 2016).

Strengths and Limitations

Strengths of our study include the recruitment of U.S. Vietnamese parents from diverse sources (e.g., community-based organizations, Facebook groups) and the use of a rigorous translation process. We assessed multilevel determinants of HPV vaccine decision-making and included comprehensive, validated measurements (e.g., multiple dimensions of provider recommendation or of acculturation). Nevertheless, our survey is cross-sectional, which limits interpretations of temporal relationships between variables. We also relied on parents' self-reports of HPV vaccination status, which is subjected to inaccuracy (Vu, Luu, et al. 2019). While we did not find any association between practice-level factors and HPV vaccine outcomes, this result could be due to the fact that we captured practice-level factors from parents' perspectives. Future studies could consider exploring the perspectives of clinic staff or using ethnographic research to further understand practice-level influences on HPV vaccine decision-making.

CONCLUSIONS

U.S. Vietnamese parents reported low HPV vaccine initiation and completion for their adolescents. Future provider-facing interventions should promote high-quality, age-based, gender-neutral HPV vaccine recommendation. These and population- and individual-facing interventions should recognize the need for additional parental education, particularly related to misconceptions regarding STI prevention.

Table 3.1 – Sociodemographic characteristics in relation to HPV vaccine initiation				
Variable	**Total N=408**	**Vaccine initiation – Yes N=166**	**Vaccine initiation – No/Do not know N=242**	**p value**
	N (%) or M (SD)	**N (%) or M (SD)**	**N (%) or M (SD)**	
Child's age				< 0.001
9 to 10	89 (21.8%)	9 (5.4%)	80 (33.1%)	
11 to 12	97 (23.8%)	42 (25.3%)	55 (22.7%)	
13 to 18	222 (54.4%)	115 (69.3%)	107 (44.2%)	
Child's sex [a] (n=406)				< 0.001
Male	200 (49.3%)	64 (38.8%)	136 (56.4%)	
Female	206 (50.7%)	101 (61.2%)	105 (43.6%)	
Child's country of birth				0.93
Born in the U.S.	198 (48.5%)	81 (48.8%)	117 (48.4%)	
Born outside of the U.S.	210 (51.5%)	85 (51.2%)	125 (51.7%)	
Parent's sex [a] (n=405)				0.17
Male	69 (17.0%)	23 (13.9%)	46 (19.2%)	
Female	336 (83.0%)	142 (86.1%)	194 (80.8%)	
Parent's highest education level				0.02
Less than a Bachelor's degree	61 (15.0%)	26 (15.7%)	35 (14.5%)	
Bachelor's degree	157 (38.5%)	51 (30.7%)	106 (43.8%)	
Master's degree or doctoral degree	190 (46.6%)	89 (53.6%)	101 (41.7%)	
Parent's percentage of lifetime in the U.S.	33.72 (25.38)	35.14 (26.28)	32.75 (24.76)	0.35
Parent's ability to understand medical information in English				0.07
Not at all to somewhat easy	255 (62.5%)	95 (57.2%)	160 (66.1%)	
Very to extremely easy	153 (37.5%)	71 (42.8%)	82 (33.9%)	

Parental Vietnamese acculturation [b] (n=407)	4.15 (0.60)	4.14 (0.63)	4.16 (0.58)	0.74
Parental American acculturation	2.88 (0.82)	3.00 (0.79)	2.80 (0.84)	0.02

[a] Those who chose "Other" or "Prefer not to answer" were coded as having missing data.
[b] Those who indicated that their heritage culture was not Vietnamese (n=1) were coded as having missing data

Table 3.2 – Healthcare practice-, provider-, and patient-level characteristics in relation to HPV vaccine initiation			
Variable	**Total N=408**	**Vaccine initiation – Yes N=166**	**Vaccine initiation – No/Do not know N=242**
	N (%) or M (SD)	**N (%) or M (SD)**	**N (%) or M (SD)**
Practice-level Factors			
Parent seen materials about HPV vaccine at primary clinic [a] (n=404)			
No	141 (34.9%)	37 (22.4%)	104 (43.5%)
Yes	150 (37.1%)	89 (53.9%)	61 (25.5%)
Do not know or remember	113 (28.0%)	39 (23.6%)	74 (31.0%)
Parent used patient navigation services [a] (n=404)			
No	320 (79.2%)	128 (77.6%)	192 (80.3%)
Yes	27 (6.7%)	12 (7.3%)	15 (6.3%)
Do not know	57 (14.1%)	25 (15.2%)	32 (13.4%)
Parent used language interpretation or translation services [a] (n=404)			
No/Do not know [b]	359 (88.9%)	152 (92.1%)	207 (86.6%)
Yes	45 (11.1%)	13 (7.9%)	32 (13.4%)
Provider-level Factors			
Provider's HPV vaccine recommendation quality			
No recommendation [b]	222 (54.4%)	13 (7.8%)	209 (86.4%)
Low-quality recommendation	55 (13.5%)	39 (23.5%)	16 (6.6%)
High-quality recommendation	131 (32.1%)	114 (68.7%)	17 (7.0%)
Patient-level Factors			
Vaccine Confidence Scale	7.52 (1.45)	7.85 (1.35)	7.29 (1.48)
Perceived effectiveness of HPV vaccine	3.18 (0.85)	3.34 (0.91)	3.07 (0.80)
Child more likely to have sex after HPV vaccine initiation			
Disagree/Strongly disagree	297 (72.8%)	139 (83.7%)	158 (65.3%)
Agree/Strongly agree	33 (8.1%)	6 (3.6%)	27 (11.2%)
Do not know	78 (19.1%)	21 (12.7%)	57 (23.6%)
Child too young for a STI-prevention vaccine like the HPV vaccine			
Disagree/Strongly disagree	248 (60.8%)	143 (86.1%)	105 (43.4%)
Agree/Strongly agree	103 (25.3%)	9 (5.4%)	94 (38.8%)

Do not know	57 (14.0%)	14 (8.4%)	43 (17.8%)
Perceived barriers of HPV vaccine access and costs	1.75 (0.69)	1.51 (0.56)	1.92 (0.73)
Other parents in the community are getting children HPV vaccine			
Disagree/Strongly disagree	56 (13.7%)	21 (12.7%)	35 (14.5%)
Agree/Strongly agree	143 (35.1%)	83 (50.0%)	60 (24.8%)
Do not know	209 (51.2%)	62 (37.4%)	147 (60.7%)

[a] Those who responded that their child did not have a primary clinic (n=4) were coded as having missing data
[b] The categories of "No" and "Do not know" were combined because responses of "Do not know" were less than 10% of total responses

Table 3.3 – Most common reasons underlying HPV vaccine initiation, non-initiation, or initiation but non-completion	
Reasons	**N (%)**
Most common reasons for initiating HPV vaccine (total n=166)	
A doctor recommended it for my child	139 (83.7%)
I want to protect my child from diseases	82 (49.4%)
I get my child all recommended vaccines	55 (33.1%)
I think HPV-related diseases are serious	41 (24.7%)
Most common reasons for having initiated but not completed HPV vaccine series (total n=71)	
My child started the series too recently to finish	29 (40.8%)
I didn't know my child needed more than 1 dose	11 (15.5%)
Most common reasons for not having initiated HPV vaccine (total n=242)	
Doctor never recommended HPV vaccine for my child	152 (62.8%)
Doctor indicated that my child can get vaccinated at an older age	34 (14.1%)
My child is not sexually active, so I do not think the vaccine is necessary	32 (13.2%)
My child's school does not require vaccination, so I do not think the vaccine is necessary	29 (12.0%)
I do not know about any HPV-related disease	26 (10.7%)

Table 3.4 – Healthcare practice-, provider-, and patient-level predictors of HPV vaccine initiation		
Variable	**Model 1 (unadjusted) cRR (95% CI)**	**Model 2 (adjusted) aRR (95% CI)**
Practice-level Factors		
Parent seen materials about HPV vaccine at primary clinic		
No/Do not know	Reference	Reference
Yes	1.98 (1.57 - 2.50)***	1.16 (0.98 - 1.37)
Provider-level Factors		
Provider's HPV vaccine recommendation quality		
No recommendation	Reference	Reference
Low-quality recommendation	12.11 (6.95 - 21.09)***	9.08 (5.04 - 16.36)***
High-quality recommendation	14.86 (8.73 - 25.30)***	10.60 (5.96 - 18.85)***
Patient-level Factors		
Vaccine Confidence Scale	1.18 (1.09 - 1.28)***	0.98 (0.91 - 1.06)
Perceived effectiveness of HPV vaccine	1.24 (1.08 - 1.43)**	0.98 (0.89 - 1.08)
Child is more likely to have sex after HPV vaccine initiation	0.77 (0.66 - 0.89)***	1.04 (0.94 - 1.15
Child is too young for a STI-prevention vaccine like HPV vaccine	0.58 (0.51 - 0.65)***	0.73 (0.63 - 0.84)***
Perceived barriers related to HPV vaccine access and cost	0.52 (0.41 - 0.67)***	0.86 (0.72 - 1.01)
Other parents in the community are getting HPV vaccine	1.37 (1.18 - 1.58)***	1.05 (0.96 - 1.15)
Sociodemographic Characteristics		
Child's age	1.14 (1.10 - 1.19)***	1.01 (0.98 - 1.04)
Child's sex		
Male	Reference	Reference
Female	1.53 (1.20 - 1.96)**	1.07 (0.92 - 1.25)
Parent's highest education level		
Bachelor's degree or less	Reference	Reference
Master's degree or doctoral degree	1.33 (1.05 - 1.68)*	1.12 (0.96 - 1.31)
Parent’s ability to understand medical information in English	1.13 (1.00 - 1.27)*	0.97 (0.88 - 1.07)
Parental American acculturation	1.20 (1.03 - 1.39)*	0.93 (0.81 - 1.08)

*p < 0.05; **p < 0.01; ***p < 0.001

Table 3.5 – Healthcare practice-, provider, and patient-level predictors of HPV vaccine completion & willingness to initiate HPV vaccine		
Variable	**Model 1 (unadjusted)**	**Model 2 (adjusted)**
	cRR (95% CI)	**aRR (95% CI)**
Outcome: Vaccine completion (among those who had initiated the vaccine for their children, n=166)		
Vaccine Confidence Scale	1.12 (1.01 - 1.24)*	1.05 (0.94 - 1.17)
Child is too young for a STI-prevention vaccine like HPV vaccine	0.79 (0.65 - 0.98)*	0.84 (0.68 - 1.05)
Child's age	1.11 (1.05 - 1.18)***	1.10 (1.04 - 1.17)**
Outcome: Willingness to initiate HPV vaccine (among those with unvaccinated children, n=242)		
Provider's HPV vaccine recommendation quality		
No recommendation	Reference	Reference
Low-quality recommendation	1.22 (0.72 - 2.04)	1.22 (0.72 - 2.08)
High-quality recommendation	1.57 (1.07 - 2.32)*	1.57 (1.15 - 2.14)**
Vaccine Confidence Scale	1.14 (1.03 - 1.25)**	1.05 (0.95 - 1.17)
Perceived effectiveness of HPV vaccine	1.29 (1.08 - 1.54)**	1.16 (0.98 - 1.38)
Child is more likely to have sex after vaccine initiation	0.82 (0.70 - 0.96)*	0.91 (0.77 - 1.08)
Child is too young for a STI-prevention vaccine like HPV vaccine	0.82 (0.73 - 0.92)**	0.86 (0.77 - 0.98)*

*p < 0.05; **p < 0.01; ***p < 0.001

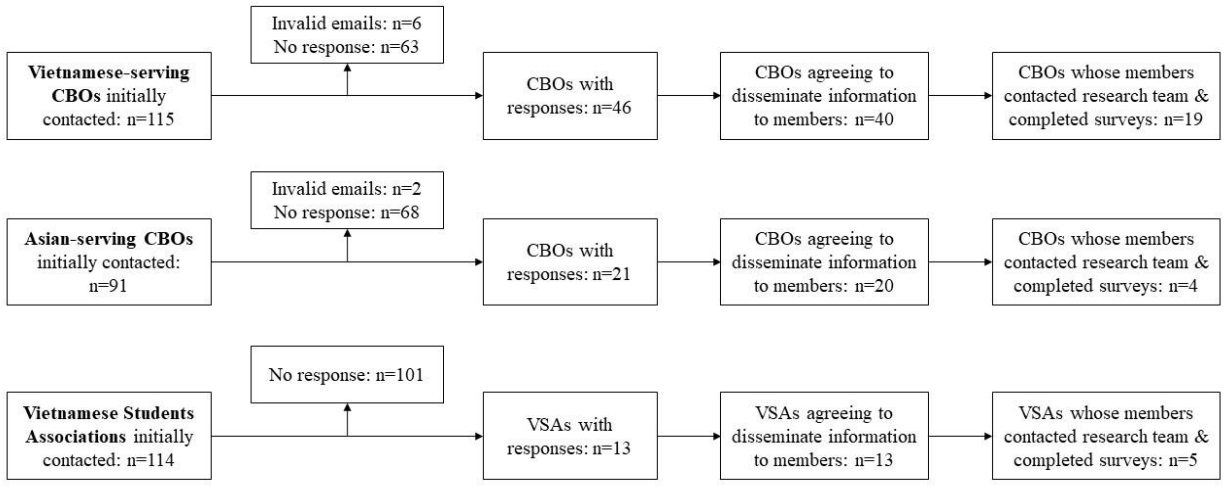
APPENDIX 3.A.

Recruitment Procedures

Community-Based Organizations

We contacted CBOs serving Asians and/or Vietnamese populations in the U.S., introduced the research study and eligibility criteria, and asked CBOs to send information about our research to their members. Additionally, we contacted Vietnamese Students Associations (VSA) at colleges and universities and requested VSA students to have their parents contact us if their parents met the eligibility criteria and were interested.

Supplementary Figure 3.1 – Recruitment Process with CBOs



In total, we contacted 115 Vietnamese-serving CBOs, 91 Asian-serving CBOs, and 114 VSAs. Among those, 40 Vietnamese-serving CBOs, 20 Asian-serving CBOs, and 13 VSAs agreed to disseminate information about the study to their members. Six Vietnamese-serving CBOs and one Asian-serving CBO declined to participate in the project; reasons for

nonparticipation included lack of members in the targeted demographics (n=2), no email addresses of members on file (n=1), insufficient staff capacity due to COVID-19 (n=2), and insufficient technological knowledge among members to navigate online surveys (n=2). In total, 51 participants from 19 Vietnamese-serving CBOs, nine participants from four Asian-serving CBOs, and eight participants from five VSAs completed the surveys.

Facebook Groups

Through a search on Facebook with terms such as "Vietnamese in the U.S.", we identified Facebook groups that operated in Vietnamese language and focused on topics that might be of interests to U.S. Vietnamese parents of adolescents (e.g., general discussion of life in the U.S., parenting advice for those with children in the U.S., immigration and visa applications, etc.). We posted information about the research study and eligibility criteria in 12 Facebook groups, which ranged in membership from 50 to approximately 58,000. Ninety-seven participants from these 12 Facebook groups completed the surveys.

Listserv

We posted information about the research study and eligibility criteria to two listserv, one focusing on Vietnamese Studies and the other on Vietnamese-related events in California. Four participants (two from each listserv) contacted the study team and completed the surveys.

Personal Network

The first author is an U.S. Vietnamese and has several years of experience partnering with Vietnamese and Asian-serving CBOs in different U.S. regions and conducting research on Vietnamese health. She disseminated information about the research study and eligibility criteria to her personal network via social media and emails. She requested those who were eligible and interested to contact the study team. She also asked others in her personal network to refer

eligible and interested acquaintances to the study team. With this method, 42 participants completed the surveys.

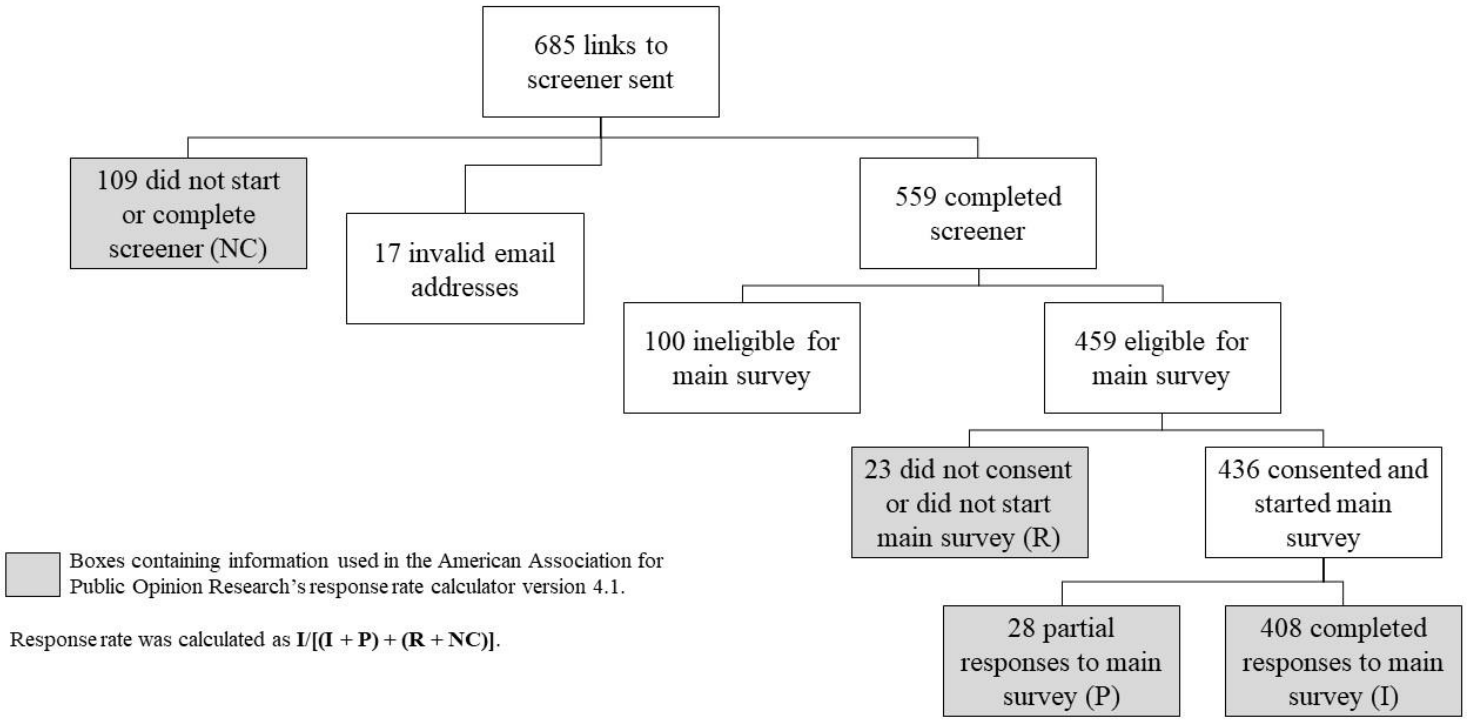
Snowball Sampling

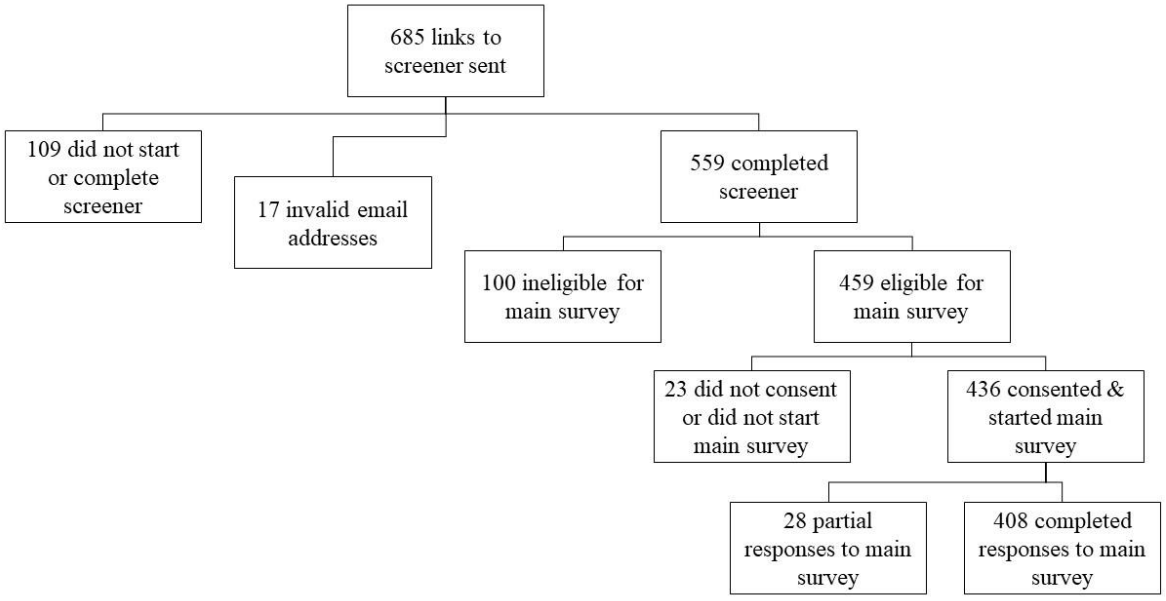
Using snowball sampling, we asked participants who completed the surveys to refer their eligible and interested acquaintances to the study team. A total of 197 participants completed the surveys through snowball sampling recruitment, in which two were referred from previous participants recruited through Vietnamese-serving CBOs, two referred from previous participants recruited through VSAs, 77 referred from those recruited through Facebook groups, and 116 referred from those recruited through the first author's personal network.

We used the American Association for Public Opinion Research's (AAPOR) response rate calculator version 4.1 to determine response rate (American Association for Public Opinion Research 2020). Overall, we received 408 completed main survey responses (AAPOR designation: I) and 28 partial responses (AAPOR designation: P). An additional 23 individuals were eligible (indicated by responses to the screener) but refused participation in the main survey or did not proceed with the main survey (AAPOR designation: R). Additionally, 109 individuals received unique links to the screener but never completed them (i.e., unknown eligibility, AAPOR designation: NC) and 100 individuals were ineligible based on responses to the screener. The overall response rate was calculated as $I/[(I + P) + (R + NC)] = 71.8\%$.

Supplementary Figure 3.2 describes the flow chart of recruitment.

Supplementary Figure 3.2 – Recruitment Flow Chart




685 links to screener sent
109 did not start or complete screener
17 invalid email addresses
559 completed screener
100 ineligible for main survey
459 eligible for main survey
23 did not consent or did not start main survey
436 consented & started main survey
28 partial responses to main survey
408 completed responses to main survey

Supplementary Table 3.1 summarizes the number of completed surveys as well as response rates with different venues using the AAPOR response rate calculator version 4.1 (American Association for Public Opinion Research 2020).

Supplementary Table 3.1 – Responses and Response Rates across Recruitment Methods					
Type of Recruitment Method	**Completed Responses (I)**	**Partial Responses (P)***	**Eligible but Refused Participation or Did not Start (R)**	**Unknown Eligibility (NC)****	**Response Rate**
Community-based organizations					
Vietnamese-serving community-based organizations	51	2	6	40	51.5
Asian-serving community-based organizations	9	0	1	1	81.8
Vietnamese Students Association	8	2	1	3	57.1
Facebook groups	97	4	4	7	86.6
Listserv	4	1	2	0	57.1
Personal network	42	5	1	9	73.7
Snowball sampling					
Via community-based organizations (Vietnamese CBO and VSA)	4	0	0	1	80.0
Via Facebook	77	3	4	18	75.5
Via personal network	116	10	4	28	73.4

Using the American Association for Public Opinion Research's (AAPOR) response rate calculator version 4.1, the response rate for each recruitment method was calculated as $I/[(I + P) + (R + NC)]$

* Column did not show 1 individual referred from those recruited via listserv

** Column did not show 2 individuals referred from those recruited via listserv

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Chapter 4: A qualitative study of U.S. Vietnamese mothers' HPV vaccine decision-making for their adolescents

ABSTRACT

This study explored practice-, provider-, and patient-level influences on U.S. Vietnamese mothers' HPV vaccine decision-making for their female and male adolescents. We conducted 32 phone-based semi-structured interviews among U.S. Vietnamese mothers. Data were analyzed using a hybrid thematic analysis approach. Findings indicated that practice-level barriers included limited clinic-based HPV promotion materials in Vietnamese and challenges in appointment scheduling. While provider recommendation emerged as a key facilitator of vaccine uptake, several mothers received either no recommendation or a low-quality recommendation. We found diverging patterns of vaccine acceptance following recommendation receipt. Patient-level barriers included misconceptions regarding the vaccine (particularly eligibility for males to get the vaccine), lack of healthcare utilization, perceived sexual inactivity, and safety concerns. These results underscore the need for interventions addressing modifiable multilevel barriers to HPV vaccine acceptance and uptake among U.S. Vietnamese.

INTRODUCTION

Human papillomavirus (HPV) vaccination is an effective and safe method conferring long-lasting and close to 100% protection against genital warts and several HPV-related cancers (e.g., cancers of the cervix, vulva, vagina, penis, anus, or oropharynx) (Centers for Disease Control and Prevention, 2020; National Cancer Institute, 2019). Despite being available in the U.S. since 2006 (U.S. Food and Drug Administration, 2009), the HPV vaccine remains underutilized among adolescents (Elam-Evans et al., 2020), currently falling short of the 80% national coverage goal (U.S. Department of Health and Human Services (Office of Disease Prevention and Health Promotion), n.d.). Latest data available from the Centers for Disease Control and Prevention show that in 2019, 72% and 54% of U.S. adolescents had initiated and completed the vaccine series (Elam-Evans et al., 2020). The National Institutes of Health recently called for research that addresses HPV vaccine acceptance and uptake in the U.S., particularly among populations at increased risk for morbidity and mortality (National Institutes of Health, 2020) and among populations experiencing significant disparities in HPV vaccine uptake (National Institutes of Health, 2019).

One such population experiencing HPV-related cancer disparities and HPV vaccine underutilization is U.S. Vietnamese (defined as those living in the U.S. and identifying as Vietnamese). Currently numbering around 1.8 million and representing the fourth largest Asian group (United States Census Bureau, 2019), U.S. Vietnamese experience high cervical cancer burden compared to other racial/ethnic groups. The most recently available data show that the cervical cancer incidence rate (per 100,000) is 9.0 in U.S. Vietnamese, versus 6.5 in all Asian-Americans and 7.5 in non-Hispanic Whites (Jin et al., 2016). While no national data are reported for HPV vaccine uptake among disaggregated Asian subgroups or among U.S. Vietnamese,

studies using convenience sampling found low vaccine initiation and completion among U.S. Vietnamese (Hopfer et al., 2017; Vu et al., 2021; Yi, Anderson, et al., 2013). For example, a recent study with U.S. Vietnamese parents of adolescents shows that only 52% and 35% of parents of adolescents aged 13 to 18 had initiated and completed the HPV vaccine series for their adolescents, respectively (Vu et al., 2021). In contrast, the 2019 National Immunization Survey – Teen with adolescents aged 13 to 17 shows that 72% and 54% of all adolescents in the U.S. and 75% and 65% of non-Hispanic Asian adolescents had initiated and completed the HPV vaccine series, respectively (Elam-Evans et al., 2020). Relevant to HPV vaccine decision-making, census statistics also show that overall, U.S. Vietnamese experience more general socioeconomic disadvantages and barriers to health services utilization compared to non-Hispanic Whites and other Asians (United States Census Bureau, 2019).

Existing literature has demonstrated several factors associated with HPV vaccine intention and uptake among U.S. Vietnamese, including English proficiency (Yi, Anderson, et al., 2013), HPV vaccine knowledge (Yi, Anderson, et al., 2013), belief that the adolescent is too young for a vaccine to prevent sexually transmitted disease (Vu et al., 2021), influences from family members (Hopfer et al., 2017; Nguyen-Truong et al., 2017), school-based education (Hopfer et al., 2017; Nguyen-Truong et al., 2017), and vaccine recommendation from healthcare providers (Hopfer et al., 2017; Vu et al., 2021; Yi, Anderson, et al., 2013). The majority of this body of research has concentrated on female young adults, with only two studies examining adolescent populations (Vu et al., 2021; Yi, Lackey, et al., 2013) and only one including male adolescents (Vu et al., 2021). In addition, existing studies have primarily focused on factors impacting HPV vaccine intention or initiation rather than HPV vaccine completion. Given that the HPV vaccine is recommended for routine vaccination at age 11 or 12 for both sexes (Centers

for Disease Control and Prevention, 2020) and additional barriers to vaccine completion exist even for those who had initiated the vaccine series (Clark et al., 2016; Liu et al., 2016; Niccolai et al., 2016; Perkins et al., 2016), more research exploring influences on vaccine initiation and completion among U.S. Vietnamese male and female adolescents is much needed.

Moreover, current literature has emphasized the role of individual-level factors associated with HPV vaccination among U.S. Vietnamese but has not paid sufficient attention to other aspects related to the healthcare systems and healthcare providers that may influence vaccine intention and uptake. Health behaviors and outcomes are not just driven by individual-level factors but are often results of a dynamic interplay between factors at multiple socioecological levels (Glass & McAtee, 2006; McLeroy et al., 1988; Smedley et al., 2000). The Institute of Medicine recommends that interventions should target multiple socioecological levels of influence instead of focusing on one level of determinants (Smedley et al., 2000), and evidence shows that healthcare system-based interventions can effectively improve HPV vaccine coverage (Niccolai & Hansen, 2015; Smulian et al., 2016). Research using a qualitative research design may be particularly ideal to fill this gap of knowledge in multilevel facilitators of and barriers to HPV vaccine uptake among U.S. Vietnamese, as it can capture a range of reasons (including those previously unknown) underlying the process of HPV vaccine decision-making of understudied groups as well as possible interrelationships between factors at different levels of the clinical environment (Dempsey et al., 2009).

To overcome gaps in the literature, our current study seeks to understand multilevel influences on U.S. Vietnamese mothers' HPV vaccine decision-making for their male and female adolescents. We focus on mothers, as research with U.S. populations has shown that mothers are typically the primary decision-maker about HPV vaccination for both male and female

adolescents (Berenson et al., 2014; Lindsay et al., 2021). In a previous study, U.S. Vietnamese female young adults also reported that their mothers played a central role in their health decisions, including HPV vaccination (Hopfer et al., 2017). Using the P3 model as the guiding framework (Bednarczyk et al., 2018), we explore how different healthcare ***p***ractice-, ***p***rovider- and ***p***atient-level elements can influence U.S. Vietnamese mothers' initiation or completion of the HPV vaccine series for their adolescents.

METHODS

Study Design and Participants

This study is part of an exploratory sequential mixed-methods (Ivankova et al., 2006) research project focusing on U.S. Vietnamese parents' HPV vaccine decision-making for their adolescents, which allows for comprehensive assessments of the perspectives of U.S. Vietnamese mothers about the HPV vaccine with qualitative data subsequently expanding on quantitative findings (DeJonckheere & Vaughn, 2019). This manuscript focuses on findings from the qualitative component of the study, specifically in-depth semi-structured qualitative interviews. Eligibility criteria for the research project included 1) self-identified as Vietnamese; 2) having lived in the U.S. for at least 12 months; 3) ability to read either Vietnamese or English; and 4) having at least one child aged 9 to 18 and living in the same household with the child. Only one parent per household was allowed to participate.

Between April and December 2020, we recruited 408 U.S. Vietnamese parents to participate in the initial quantitative web-based survey (72% response rate). From this survey sample, we invited a subset of mothers to participate in in-depth, semi-structured qualitative interviews. This subset was purposively sampled, stratified by their adolescent child's sex (male versus female) and HPV vaccination status (not yet initiated, initiated but not completed, and

completed). The *a priori* sample size of 30 to 40 was selected based on past qualitative research of similar topics (Niccolai et al., 2016) and recommendations for sample size needed to achieve code and meaning saturation (Hennink et al., 2017). Selected survey participants were sent an email with information about the qualitative interviews and a consent form to each invited participant. For those who were interested in participation, we scheduled a time and date at their convenience. Electronic/online consent was obtained prior to the interviews. Of 38 invited mothers, 4 declined and 2 did not respond; 32 in total participated in the interviews (84% response rate). The Institutional Review Board at Emory University approved of this study.

Data Collection

All interviews were conducted between November 2020 and February 2021 by the first author (MV), a bilingual U.S. Vietnamese female doctoral-level researcher with extensive training and experience in qualitative research. Participants could choose to do the interview in English or Vietnamese and via telephone or Zoom. Each interview lasted between 20 and 60 minutes and was audio-recorded. Each participant was compensated with a $60 gift card.

We followed Kallio and colleagues' framework for developing a qualitative semi-structured interview guide (Kallio et al., 2016). The interview guide was developed based on reviewing existing literature on HPV vaccination among parents (Marshall et al., 2019) and Asian populations (Vu, Berg, et al., 2020) as well as findings from Phase 1 of our project (Vu et al., 2021). Questions followed a funnel strategy and began with general inquiries about mothers' attitudes and beliefs towards general vaccination. We discussed any impacts that the COVID-19 pandemic may have had on healthcare visits and vaccination appointments. We then specifically asked about mothers' perception and decision-making regarding the HPV vaccine. Due to the possibility of changed age and vaccination status between the time of survey response and

interview participation, we reconfirmed the child's age and vaccination status in each interview. Using the P3 framework (Bednarczyk et al., 2018), we explored practice-level influences (e.g., clinic-based HPV vaccine materials, ease of making vaccination appointments), provider-level influences (e.g., content of provider's HPV vaccine recommendation, trust in providers), and patient-level influences (e.g., perceived benefits and risks). The open-ended questions also included probes to allow divergence from the predetermined interview guide and pursuing new ideas raised by mothers during interviews (DeJonckheere & Vaughn, 2019). Examples of questions and probes are listed in Table 4.1. The interview guide was pilot-tested through internal testing with members of the research teams (experts on Vietnamese health, HPV vaccination, and health disparities) and through field-testing with three mothers who were also participants in the web-based survey. The guide was subsequently revised based on feedback and comments.

In addition to interview data, we captured sociodemographic and acculturation-related characteristics of mothers and adolescents through their responses in the web-based survey. Specifically, we assessed mothers' age, combined household income, level of education, place of birth, fluency in spoken Vietnamese and English, ability to understand medical information in English, percentage of lifetime in the U.S., and Vietnamese and American acculturation scores (measured by the Asian American Multidimensional Acculturation Scale (Gim Chung et al., 2004)). We also assessed the adolescent's age, sex, place of birth, and HPV vaccination status.

Data Analysis

Twenty-four interviews were conducted in Vietnamese and eight in English. All interviews were recorded and transcribed verbatim. All 24 transcripts in Vietnamese were then translated to English by two professional translators; the translations were validated by bilingual

research team members (MV and VNH). We used a hybrid approach of qualitative thematic analysis, which incorporated both 1) a deductive *a priori* template of codes and themes from the survey items and 2) a data-driven inductive approach (Fereday & Muir-Cochrane, 2006). In addition to the first author, two other authors (DT, a Vietnamese male undergraduate student in nursing science, and AK, a non-Vietnamese male researcher with a Masters in Public Health degree, both of whom have extensive qualitative training and experience) participated in the analytical procedure. First, the three authors read five transcripts carefully and developed a codebook with code definitions, inclusion criteria, exclusion criteria, and examples. The codebook was then applied to the initial five transcripts and all remaining transcripts. Each transcript was independently coded (MV and DT). Discrepancies were resolved through discussion. Interim review showed that we achieved code saturation (i.e. the point where no additional issues were identified and the codebook began to stabilize) after 15 interviews and meaning saturation (i.e. the point where we did not detect further important dimensions, nuances, or insights) after 28 interviews (Hennink et al., 2017).

Using the P3 model (Bednarczyk et al., 2018) as the guiding framework, emergent themes were categorized based on and presented by each level of influence (practice-, provider-, and patient-level). In addition, to establish the significance of patterns and meaning while balancing the controversy regarding whether to quantify qualitative results (Maxwell, 2012), we operationalized the frequency of themes that appeared in interviews as "all" (100% of interviews), "almost all" (90-99%), "most" (70-89%), "the majority" (50-69%), "several" (20-49%), and "a few" (less than 20%) (Sandelowski, 2001). We used several techniques of establishing validity or trustworthiness in qualitative research, including triangulation of findings through multiple data collection methods (e.g., survey responses and interviews), analyst

triangulation (i.e. using multiple analysts to review findings), and negative case analysis (Creswell & Miller, 2000; Golafshani, 2015). Descriptive statistics were generated for sociodemographic characteristics in Stata 15.1.

RESULTS

Sample Characteristics

In the sample (n=32), mothers were 45 years old on average, were mostly college educated (94%), and had a combined household income above $50,000 (77%). All mothers were born outside of the U.S. and had lived, on average, nearly a third of their life in the U.S. A majority (63%) indicated low ability to understand medical information in English. On average, mothers had higher Vietnamese acculturation scores than American acculturation scores. Among mothers' adolescents, 56% were male and 41% were born outside of the U.S. In addition, 38% of the adolescents had not initiated the HPV vaccine, 22% had initiated but not completed the vaccine series, and 41% had completed the series **(Table 4.2)**. **Table 4.3** provides a summary of key practice-, provider, and patient-level themes. **Supplementary Table 4.1** provides information about sex and vaccination status of the adolescent of each mother participating in the semi-structured interviews.

Practice-Level Influences

Utility of Clinic-Based Materials About HPV Vaccine

The majority of mothers mentioned having seen or been given materials about HPV vaccine (e.g., posters, leaflets, information sheets) at their child's clinic. Different perspectives emerged about the usefulness and comprehensibility of these materials. Several mothers indicated that the materials gave them adequate information on the HPV vaccine. For example, one mother said: "I read the leaflet, and I found out that not only girls but boys should also get

the HPV vaccine" (#14). In contrast, several other mothers said these materials were overwhelming. One mother discussed how the materials about the HPV vaccine she received were not helpful for her decision-making: "I can't imagine anyone reading through that whole page full of dense text and come to a decision within minutes... I never had the patience to read through all of that on the spot... They gave me a pile of information sheets... I know it was important, but I felt overwhelmed" (#01).

Limited English language ability was also noted as a common issue that hindered U.S. Vietnamese parents from accessing information about healthcare in general and the HPV vaccine in particular. Only three mothers said that they saw or were given clinic-based materials in Vietnamese. A few mothers raised the importance of having high-quality Vietnamese translations of clinic-based materials about the HPV vaccine. A mother stated: "There are a lot of Vietnamese people like me, who can speak English fluently but may not understand all the medical terminology in English. I'd still prefer having more information in Vietnamese" (#16). Another commented: "It is very important to have explanations in our language, the Vietnamese language. Such translations also need to be checked and verified to ensure that the translation is really accurate" (#11).

Challenges in Appointment Scheduling for the HPV Vaccine

Several mothers discussed how the COVID-19 pandemic led to the delay or cancellation of their adolescents' annual checkups or HPV vaccination appointments. A mother stated her concern: "I was hesitant... because getting the vaccine is not urgent. So [my child's appointment] got pushed back several times" (#03). Another said: "[COVID-19] had some impact because we rescheduled the appointment with the doctor, and we finally met the doctor in late September. The appointment was pushed back for 2 months" (#19).

Several mothers whose adolescents had initiated the HPV vaccine series brought up issues with keeping track of the number of required shots or getting a reminder to complete the vaccine series. A mother noted that she was never told to return for future HPV vaccine shots after the first one: "The doctor should have told me that I should take him there to get the next [HPV vaccine] shot after 1 month or 2 months. The doctor did not tell me, so I forgot... I wish the doctor had told me or had scheduled an appointment for him" (#14). Another commented: "Here in the U.S., you get a reminder before a dentist or OBGYN appointment via email or text. But not for vaccines. Nobody sends me reminders... Sometimes I'd forget about it and miss the date. Or if I can't make it to [my child's] annual checkup then I'd miss the shot too" (#16).

Provider-Level Influences

Positive Impact of Provider Recommendation on HPV Vaccine Decision-Making

Almost all mothers whose adolescents had received at least one vaccine dose cited provider recommendation as the main reason. Most also explicitly discussed trust in provider recommendation. A mother said: "I always respect the recommendations of the family doctor. I follow their recommendations to get my daughter vaccinated... My husband and I listen to advice from people in the medical field... Those people have studied and done a lot of research, so we just follow their recommendations. We have no questions or hesitation at all. When they recommend a vaccine, we just get it." (#10). Another echoed the same sentiment: "I also ask [the pediatrician], 'Did your kids [get vaccinated]?' She said, 'Of course, they did.' Then, I'm like, 'Yep, we're going to take it for sure too.'... Since I trust her, if she recommends it, I do it" (#20).

Interestingly, mothers whose adolescents had received at least one vaccine dose described two different patterns of accepting vaccination after receiving their providers' recommendations. Several mothers mentioned agreeing to get same-day HPV vaccination. For example, a mother

said: "I had my child vaccinated right there. I just followed the doctor's recommendation" (#27). Another reported her initial hesitation and how the provider was able to convince her to get same-day HPV vaccination: "[The doctor] said that the HPV vaccine should be taken early and would not be as effective for adults. I never heard of [the HPV vaccine] when I was in Vietnam. I was a little hesitant. I wanted to go home and do more research. But the doctor said the vaccine was very popular in the U.S. and recommended it, so in the end I decided to have my son vaccinated on the spot" (#16). She, however, also expressed a desire to have known more about the vaccine prior to the healthcare visit: "Looking back, I would have preferred having received all the information before bringing my son to the annual checkup so that I could read it in advance... I would have preferred to have information on the HPV vaccine and other necessary vaccines sent to me before my son became a teenager. It would have given me time to do more research and get a fuller picture" (#16).

In contrast, after receiving provider recommendation, several other mothers did not get their adolescent vaccinated on the same day but went home to do more research and got their adolescent vaccinated during the next medical visits. A mother stated: "I made the decision a few months later. It was partly because I needed to think and partly because I was busy, and I could not make the appointment with the doctor... That's why my oldest child got vaccinated when she was 16" (#11). Another commented: "When the doctor recommended the HPV vaccine for the first time, I did not let my son get the vaccine right away. I told the doctor that I would learn more about the vaccine. The following year, I let my son get the vaccine" (#05).

Lack of or Low-Quality Provider Recommendation

The majority of mothers of unvaccinated adolescents noted that they did not receive a provider recommendation for the HPV vaccine. A mother reported: "When I took my son to see

the family doctor, they did not say anything about this vaccine" (#23). Importantly, several other mothers of unvaccinated adolescents said that while they received provider recommendation for the HPV vaccine, the provider did not make a strong push or urge same-day vaccination. For example, a mother said: "Do you know much as far as the age limit, if they waited until they're in their twenties, is that too late? The doctor said that my daughter could hold off [HPV vaccination], till a later age" (#22). Another mother mentioned: "[The doctor] told us the HPV vaccine was optional. No one tried to convince us that it was important or give a little nudge... So, under such circumstances, without further consultation, we decided to hold off [getting the HPV vaccine] temporarily" (#01).

Patient-Level Influences

Reasons for HPV Vaccine Acceptance among Mothers of Vaccinated Adolescents

Besides provider recommendation, the majority of mothers of vaccinated adolescents expressed trust in the protective value against HPV-related diseases that the vaccine can confer. A mother discussed: "I have heard that many people suffer from cervical cancer... I believe that if my daughter gets the vaccine, she will be protected. Because when she grows up… sexual activity will inevitably happen, so I want to protect her... That was why I got her vaccinated with the HPV vaccine" (#10). Another mother said: "I believe in science. I know the vaccine has been tested and gone through clinical trials, so I trust the science. I believe the benefits outweigh the side effects... I believe in the benefits of this vaccine because I've read that the HPV could cause many diseases. I believe the vaccine can help prevent these diseases" (#03). Additionally, a few mothers brought up their personal experience with HPV or cervical cancer and how it motivated them to get their adolescents vaccinated. Finally, a few mothers cited school requirements or mandates for the HPV vaccine as the reason for vaccinating their adolescents.

Lack of Healthcare Utilization as Barriers to HPV Vaccine Uptake

Several mothers discussed a lack of regular interactions with or utilization of the U.S. healthcare system as barriers to adolescent HPV vaccine uptake, for either themselves or their U.S. Vietnamese acquaintances. Reasons included access-related barriers (e.g., perceived high cost, long wait for available appointments, parents' shortage of time) and a lack of emphasis placed on preventive care. One mother said: "Since I came to the United States, I have been hesitant to go see the doctor because of the complicated procedures... It takes a very long time to get an appointment, so I put it off" (#13). Another mentioned: "The kids haven't been to their physical checkup for almost two years now... I'm not sure what shot [my son] is behind" (#32). A mother remarked about people in her community: "The Vietnamese blue-collar workers, the boatpeople... they're always busy working. They only see the doctor when they get sick" (#17).

Limited Knowledge of HPV Vaccine

A few mothers noted that they did not know about the HPV vaccine until they emigrated to the U.S. in their adulthood. Most knew that the HPV vaccine can prevent cervical cancer. Several, however, did not know that the HPV vaccine is also recommended for males. For example, a mother stated: "I read a lot, but I still think that the HPV vaccine only works for girls because the virus causes cervical cancer, and boys do not have a cervix, so the vaccine is not important for boys " (#18). Several mothers of unvaccinated sons cited this lack of knowledge as a reason for non-vaccination. Several also mentioned that this lack of knowledge is common in the Vietnamese community. A mother said: "The Vietnamese name [for the HPV vaccine] is misleading because it’s not just for cervical cancer. It prevents the HPV virus, which anyone can get, not just girls or women. But people in Vietnam called it the cervical cancer vaccine, so I only knew that name and thought it was for females only" (#09). Additionally, the majority of

mothers of unvaccinated adolescents and several mothers of vaccinated adolescents were unclear about the recommended ages and eligible ages for the HPV vaccine. Several mothers whose adolescents had initiated but not completed the vaccine series were also not knowledgeable about how many doses were required.

Reasons for HPV Vaccine Delay among Mothers of Unvaccinated Adolescents

Interestingly, all mothers of unvaccinated adolescents were open to future HPV vaccination and none said that they were permanently against HPV vaccination for their adolescents. The majority of mothers of unvaccinated adolescents mentioned needing more time and information to make a decision. Several brought up concerns about the safety of the HPV vaccine; notably, all of them were mothers of sons. A mother said: "You'll hear stories of healthy young boys, and then right after the Gardasil... they're pretty much brain dead" (#15). She, however, was the only person who expressed beliefs in possible life-threatening adverse effects. The other mothers with safety concerns either were worried about less severe reactions (e.g., fever) or admitted their uncertainty about what exactly the risks may be. For example, a mother said: "I read about them quite a long time ago. I do not remember the details, but I remember that the vaccine causes several side effects that may affect one’s health... I do not clearly understand the vaccine’s side effects, so I have not decided to have my child vaccinated" (#21).

Several also discussed child's sexual inactivity as a reason to delay vaccination. A mother reported: "[When the doctor recommended the HPV vaccine] I said, 'Well, my son is not interested in being around anybody, any girl... Yea, no, we will just wait until he really needs it.' The doctor didn’t disagree or anything" (#32). In addition, several mothers brought up their belief that the HPV vaccine somehow either was less important or lacked data to back up its effectiveness compared to other routine vaccines. The lack of school requirements for the HPV

vaccine also contributed to this perception. A mother said: "[The HPV vaccine] must be a new vaccine, so it is not required... [HPV] is not a disease like typhoid, tetanus, pertussis, or diphtheria. Vaccines are required for those diseases" (#21). Moreover, a few delayed the vaccine due to having to get their adolescents too many vaccines at once. A mother stated: "The last time [my daughter] went in, she had other vaccinations done... I just didn't want to bombard her with too much all at once. So that's really the reason why I held off... This is too much at once" (#22).

DISCUSSION

Our study represents one of the first efforts to qualitatively explore healthcare practice-, provider- and patient-level influences on U.S. Vietnamese mothers' HPV vaccine uptake for their male and female adolescents. At the practice level, we documented mixed perspectives about the utility of clinic-based materials about the HPV vaccine, a desire for high-quality translations of materials, and challenges in appointment scheduling. At the provider level, provider recommendation, along with trust in such recommendation, emerged as key facilitators of vaccine uptake. Several mothers received either no recommendation or a low-quality recommendation. Moreover, not all mothers got their adolescents vaccinated immediately in the same visit. At the patient level, we documented low knowledge of the vaccine, particularly regarding recommended ages, number of doses, and eligibility for males to get the vaccine. Other patient-level barriers included a lack of healthcare utilization, perceived child's sexual inactivity, and safety concerns. All Vietnamese mothers with unvaccinated children were open to future HPV vaccinations. Key reasons underlying vaccine acceptance were trust in the protective value of the vaccine, personal experience with HPV, and school requirements.

Our findings suggest that while clinic-based HPV vaccine promotion materials were generally available to U.S. Vietnamese mothers, improvements could be made to ensure that

materials are easy to understand and facilitate vaccine acceptance. Moreover, a small number of mothers had access to clinic-based materials about the HPV vaccine in the Vietnamese language. Currently, the HPV vaccine is not included in the Vietnamese National Expanded Program on Immunization (Ministry of Health Viet Nam, 2015), and the cost of delivering the vaccine in Vietnam remains a challenge (Thi Nguyen et al., 2019; Van Minh et al., 2017). Providers in Vietnam are more likely to recommend the HPV vaccine to young adult women as opposed to adolescent boys or girls (Asiedu et al., 2015). Consequently, for first-generation Vietnamese immigrants, U.S. healthcare visits can be an important opportunity to obtain the HPV vaccine for their adolescents. It is critical that those with limited ability to understand medical information in English can access materials about the HPV vaccine in Vietnamese, including resources in Vietnamese from the Immunization Action Coalition (Immunization Action Coalition, 2020).

We are not aware of interventions for U.S. Vietnamese or other Asian populations that have incorporated clinic-based brochures, posters, or other HPV vaccine promotion materials. In three interventions with English-speaking and Spanish-speaking parents of adolescents, one component of the three interventions involved distributing posters, brochures, and materials about the HPV vaccine to healthcare practices and county health departments (Cates et al., 2011, 2014, 2018). While the effect of this particular component was not assessed independently of others, all three interventions increased HPV vaccine initiation and completion rates. Future research can further examine how parents perceived different aspects of HPV vaccine promotion materials such as acceptability, attractiveness, relevancy, or readability (Dela Cruz et al., 2016). For U.S. Vietnamese parents, other minority parents, or parents with limited English proficiency, targeted or tailored interventions should pay attention to translation quality (Kiger, 2003) and presence of characters from the target populations (Dela Cruz et al., 2017).

Our study also highlights how challenges related to appointment scheduling and reminder can prevent completion of the HPV vaccine series. No previous research with U.S. Vietnamese or other Asian populations has explored these issues (Vu, Berg, et al., 2020). Practice-level interventions can address these barriers through automatic scheduling of follow-up appointments (Berenson et al., 2019; Vu, King, et al., 2020) and reminder and recall systems (e.g., via phone calls or text messages) (Aragones et al., 2015; Matheson et al., 2014; Niccolai & Hansen, 2015).

Our results underscore the importance of both receipt and quality of provider recommendation for the HPV vaccine for U.S. Vietnamese parents. Previous research with U.S. Vietnamese parents has primarily focused on the presence of provider recommendation (Hopfer et al., 2017; Yi, Lackey, et al., 2013) while overlooking the role of recommendation quality (Gilkey et al., 2016). Our findings suggest that it is critical that providers emphasize same-day vaccination and do not create the impression that the HPV vaccine is optional or different from other adolescent vaccines (Centers for Disease Control and Prevention, 2019). Providers also should be trained to counter possible myths, misinformation, or inaccurate assumptions about the HPV vaccine. For example, when parents discussed delaying HPV vaccination due to a perceived lack of their adolescents' sexual activity, providers should address why vaccination at age 9 to 12 is optimal (Centers for Disease Control and Prevention, 2019; Hughes et al., 2011). Furthermore, most U.S. Vietnamese mothers of vaccinated adolescents in the study explicitly mentioned trust in provider recommendation. In at least one instance, a mother based her vaccine acceptance partly on the fact that the provider's child was also vaccinated. These results emphasize the importance of creating strong patient-provider relationships (Vu, King, et al., 2020) and increasing Vietnamese parents' or caregivers' trust in healthcare professionals and providers (Nan et al., 2014) as means to improve HPV vaccine acceptance and coverage.

Even when U.S. Vietnamese mothers received recommendation or expressed trust in provider recommendation, several mothers still delayed HPV vaccination for their adolescents until the next visits. In such circumstances, having follow-up counseling or recommendation from the providers may be useful (Kornides et al., 2018). Importantly, U.S. Vietnamese mothers in the study discussed needing more time to learn more about the HPV vaccine following recommendation receipt. They also mentioned the desire to have known about the vaccine prior to recommendation receipt. This pattern of decision-making calls for parental education about the HPV vaccine prior to the healthcare visit, a topic that has also come up in a few other studies with general U.S. populations (Dang et al., 2020; Dilley et al., 2018). Interventions will also need to ensure that educational resources are linguistically and culturally relevant.

We identified several areas of low knowledge about the HPV vaccine that can be incorporated in educational programs or interventions, including vaccine safety, the relationship between sexual activity and vaccination, eligible and recommended ages for vaccine initiation, and the number of required doses. In addition, a lack of healthcare utilization was a barrier to HPV vaccination. This theme points to the importance of addressing healthcare access-related challenges to improve HPV vaccination coverage, for example through increasing awareness of the Vaccines for Children program that covers vaccination costs for those without insurance through 18 years of age (Centers for Disease Control and Prevention, 2014), or pharmacy-based vaccination (Calo et al., 2017; Islam et al., 2017) that can decrease scheduling difficulties.

Importantly, several mothers did not know that the HPV vaccine is recommended for males. This misconception was a major barrier to having adolescent sons vaccinated and partly stemmed from the fact that the HPV vaccine is often translated into Vietnamese as the "cervical cancer prevention" vaccine (Raffles Medical Group, 2018). Moreover, existing campaigns to

promote HPV vaccination in Vietnam have exclusively targeted female populations (Nhan Dan Online, 2019; PATH, 2012; Thi Nguyen et al., 2019), which could leave first-generation immigrant Vietnamese mothers thinking that only females, but not males, are eligible for the HPV vaccine. Therefore, our findings underscore a critical need for communication to U.S. Vietnamese parents regarding the need to vaccinate adolescent sons against HPV. Such education is even more urgent, given that a recent CDC report found that cases of HPV-attributable oropharyngeal cancers (19,000) in the U.S. have surpassed those of cervical cancers (12,015), and that incidence rates of HPV-attributable oropharyngeal cancers in men (8.5 per 100,000) are five times higher than in women (1.7 per 100,000) (Senkomago et al., 2019).

Strengths and Limitations

The strengths of our study include the use of a multilevel theoretical framework, sampling of mothers with both male and female adolescents, and exploration of facilitators of and barriers to both vaccine initiation and completion. Interviews were conducted in both English and Vietnamese and transcript translations were validated by bilingual research team members. Nevertheless, our study is qualitative, which means findings may not be generalized across settings and contexts. In particular, Vietnamese mothers in the sample were all born outside of the U.S. and reported, on average, relatively high income and education; as such, results may not be entirely applicable to Vietnamese parents who were U.S.-born or have lower socioeconomic status. While we only assessed mothers' perceptions of practice- and provider-level influences, future research can consider exploring these aspects from the perspectives of clinic staff and providers serving U.S. Vietnamese.

CONCLUSIONS

U.S. Vietnamese experience HPV-related cancer disparities and HPV vaccine underutilization. Our study identified practice-, provider-, and patient-level influences on U.S. Vietnamese mothers' HPV vaccine decision-making for their female and male adolescents. Practice-level interventions to improve HPV vaccine uptake in this population should address challenges in appointment scheduling and vaccine reminders and consider the role of clinic-based HPV vaccine materials in facilitating vaccine acceptance. High-quality provider recommendation plays a crucial role in promoting vaccine uptake. Providing parental education prior to the medical visit may help increase same-day vaccination. Parental education should emphasize the need for vaccinating males, address misconceptions regarding vaccine safety and ages for vaccine initiation, and increase awareness of access.

Table 4.1 – Selected examples of interview questions and probes

Practice-level influences

- During your child's visits to the doctor, have you ever seen materials about HPV vaccine?

Probe (if answer was yes): Can you describe what you remember about these materials? What language(s) were the materials in? How did these materials influence your thoughts about the vaccine? Is there anything you wish was different or better about these materials?

Probe (if answer was no): Would you have liked to see such materials at the clinic? Why or why not?

- *(if child had initiated the vaccine series)* Has your child completed the vaccine series? Were you told to come back for additional doses? How easy was it to make the next appointment for the vaccine?

Provider-level influences

- In general, how comfortable are you in talking to your child's doctor? Which language(s) do you talk in?
- How much trust do you have in your doctor's advice or recommendation about adolescent vaccinations?
- How do you think of your interactions with your child's doctor here versus in Vietnam regarding your child's vaccinations? Was there any similarity or difference?
- *(if parent had received a provider's recommendation for HPV vaccination of child)* How did your doctor recommend the HPV vaccine for your child?

Probe: What reasons were given for why your child should get vaccinated? What information was provided to you? Were there any concerns you brought up after the vaccine was recommended to you? How did the doctor respond to these concerns? After getting the recommendation, did you decide on same-day vaccination or did you delay it?

Patient-level influences

- What do you know about the HPV vaccine?

Probe: How effective do you think the HPV vaccine is? Do you think there are any risks? What diseases do you think it can prevent?

Probe: What do you know about the CDC's recommendation for HPV vaccine for adolescents? At what age should adolescents start receiving the vaccine? For how many doses, and which gender?

- *(if child had initiated the vaccine series)* What are the reasons why you decided to get the HPV vaccine for your child? Do you know of other Vietnamese parents in the U.S., for example your Vietnamese relatives or friends, who got the HPV vaccine for their children? What might be some reasons why they get the HPV vaccine for their children?
- *(if child had not initiated the vaccine series)* What are the reasons why you had not gotten the HPV vaccine for your child? What kind of concerns or issues you would like to address before getting the vaccine for your child?

Table 4.2 - Sociodemographic and acculturation-related characteristics of U.S. Vietnamese mothers and their adolescents	
Variable	**Mean (SD) or N (%)**
Mothers' characteristics	
Age (range 39-53)	45.06 (2.23)
Combined household income (n=26 due to missing data)	
Less than $50,000	6 (23.1%)
$50,000 to $100,000	10 (38.5%)
$100,000 and above	10 (38.5%)
Level of education	
Less than a Bachelor's degree	2 (6.3%)
Bachelor's degree	11 (34.4%)
Master's degree or doctoral degree	19 (59.4%)
Place of birth	
Born in the U.S.	0 (0.0%)
Born in Vietnam	31 (96.9%)
Born elsewhere	1 (3.1%)
Fluency in spoken Vietnamese	
A little bit/somewhat well	4 (12.5%)
Very/extremely well	28 (87.5%)
Fluency in spoken English	
A little bit/somewhat well	11 (34.4%)
Very/extremely well	21 (65.6%)
Ability to understand medical information in English	
A little bit/somewhat well	20 (62.5%)
Very/extremely well	12 (37.5%)
Percentage of lifetime in the U.S.	29.54 (26.47)
Vietnamese acculturation score (possible range 0-5)	4.05 (0.56)
American acculturation score (possible range 0-5)	3.11 (0.71)
Adolescents' characteristics	
Age (range 12-18)	15.13 (1.45)
Sex	
Male	18 (56.3%)
Female	14 (43.8%)
Place of birth	
Born in the U.S.	19 (59.4%)
Born in Vietnam	12 (37.5%)
Born elsewhere	1 (3.1%)
HPV vaccination status	
Not initiated	12 (37.5%)
Initiated but not completed	7 (21.9%)

Completed	13 (40.6%)

Table 4.3 – Healthcare practice-, provider- and patient-level influences on U.S. Vietnamese mothers' HPV vaccine decision-making for their adolescents

Practice-level influences

- Utility of clinic-based materials about the HPV vaccine
  - Mixed perspectives on the usefulness of HPV promotion materials
    - Materials provided adequate information
    - Materials were overwhelming and not helpful
  - Need for high-quality clinic-based HPV promotion materials in Vietnamese
- Challenges in appointment scheduling for the HPV vaccine
  - Delayed or canceled healthcare visits due to the COVID-19 pandemic
  - Issues with getting a reminder to complete the vaccine series

Provider-level influences

- Positive impact of provider recommendation on HPV vaccine decision-making
  - Trust in provider recommendation
  - Diverging patterns of HPV vaccination acceptance following receiving a recommendation
    - Same-day vaccine initiation
    - Vaccine initiation in subsequent visits
- Lack of or low-quality provider recommendation
  - Mentions from provider that vaccine was optional or could be delayed

Patient-level influences

- Reasons for HPV vaccine acceptance among mothers of vaccinated adolescents
  - Protection against HPV-related diseases
  - Personal experience with HPV or cervical cancer
  - School requirements or mandates
- Lack of healthcare utilization as barriers to HPV vaccine uptake
  - Perceived high cost, long wait for appointments, shortage of time
  - Lack of emphasis placed on preventive care

- Limited knowledge of HPV vaccine
    - Lack of knowledge about gender-neutral vaccination; recommended/eligible ages; number of doses
    - Lack of discussion with other Vietnamese parents about the HPV vaccine

- Reasons for HPV vaccine delay among mothers of unvaccinated adolescents
    - Being open to future HPV vaccination
    - Need of more time and information to make a decision
    - Concerns about vaccine safety
    - Child's sexual inactivity as a reason to delay vaccination
    - Perception of HPV vaccine as a less important vaccine compared to others
    - Too many vaccines at once

Supplementary Table 4.1. provides information about adolescents.

Supplementary Table 4.1 – Information about adolescents

ID	Child's gender	Child's age	HPV vaccine status
1	Male	14	Not initiated
2	Male	13	Not initiated
3	Male	15	Initiated, not completed
4	Female	15	Initiated, not completed
5	Male	14	Completed
6	Male	15	Initiated, not completed
7	Female	13	Completed
8	Male	16	Not initiated
9	Male	16	Initiated, not completed
10	Female	16	Completed
11	Female	15	Completed
12	Female	17	Not initiated
13	Female	18	Not initiated
14	Male	16	Initiated, not completed
15	Male	15	Not initiated
16	Male	16	Initiated, not completed
17	Male	16	Initiated, not completed

18	Male	15	Not initiated
19	Male	13	Completed
20	Female	15	Completed
21	Male	14	Not initiated
22	Female	14	Not initiated
23	Male	17	Not initiated
24	Female	14	Completed
25	Male	13	Not initiated
26	Female	17	Completed
27	Female	16	Completed
28	Female	12	Completed
29	Female	15	Completed
30	Female	18	Completed
31	Male	16	Completed
32	Male	15	Not initiated

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Chapter 5: Conclusion

Through three separate research studies involved in this dissertation, we investigated practice-, provider-, and patient-level influences on U.S. Vietnamese parents' HPV vaccine decision-making for their adolescents. In Study 1, we conducted a systematic review of the literature to identify practice-, provider-, and patient-level determinants of HPV vaccine intention and uptake among Asian-Americans. In Study 2, we analyzed cross-sectional data from our national online survey to examine practice-, provider-, and patient-level factors impacting U.S. Vietnamese parents' HPV vaccine decision-making process. In Study 3, we analyzed qualitative semi-structured interview data to expand upon findings in Study 2, specifically by providing greater context regarding important factors for HPV vaccine acceptance and uptake and by identifying additional P3 influences on mothers' HPV vaccine decision-making.

SUMMARY OF FINDINGS

Findings from Study 1 of the dissertation (Chapter 2) show that only 3 studies in the systematic review assessed practice-level determinants (Hopfer et al. 2017; M. Kim et al. 2017; H. Y. Lee and Lee 2017). Twelve studies assessed provider-level determinants, all of which focused on aspects of communication between patients/caregivers and providers (Dela Cruz et al. 2018; Do et al. 2009; Gao 2015; Hopfer et al. 2017; Khan 2014; K. Kim et al. 2015; M. Kim et al. 2017, 2019; H. Y. Lee and Lee 2017; Y.-M. Lee et al. 2019; Taylor et al. 2014, 2012). Lacking from the studies that we reviewed, however, was a deeper inquiry of the content and manner of vaccine recommendation from providers. Regarding patient-level determinants, the most commonly documented determinants for HPV vaccine intention and uptake were HPV or HPV vaccine knowledge (Khan 2014; M. Kim et al. 2017, 2019; H. Lee et al. 2016; H. Y. Lee et

al. 2015; H. Y. Lee and Lee 2017; Otanez and Torr 2018; Tung et al. 2019; Yi et al. 2013), perceived safety or side effect issues (Bastani et al. 2011; Dela Cruz et al. 2018; Do et al. 2009; Khan 2014; K. Kim et al. 2015; M. Kim et al. 2017; Y.-M. Lee et al. 2019), perceived susceptibility (Dela Cruz et al. 2018; Gao et al. 2016; M. Kim et al. 2017, 2019; H. Y. Lee and Lee 2017), and beliefs regarding the relationship between HPV vaccine and sexual activity (Dela Cruz et al. 2018; Do et al. 2009; Gao et al. 2016; Hopfer et al. 2017; Khan 2014; K. Kim et al. 2015; M. Kim et al. 2019; Y.-M. Lee et al. 2019).

Findings from Study 1 guided the development of measurements to be included in Studies 2 and 3 (Chapters 3 and 4). In Study 2 (Chapter 3), quantitative data indicated that only 41% of U.S. Vietnamese parents had initiated and 23% had completed the vaccine series for their child. Further, only 46% received provider recommendation for HPV vaccine. Vaccine initiation was associated with receiving provider recommendation for vaccination (either low- or high-quality), while willingness to initiate the vaccine was associated with receiving a high-quality recommendation (which occurred among 32% of participants). In addition, both vaccine initiation and willingness to initiate the vaccine was negatively associated with parental perception that their child was too young for an STI-preventing vaccine.

In Study 3 (Chapter 4), qualitative data indicated that, at the practice level, there were mixed perspectives of U.S. Vietnamese mothers regarding the utility of clinic-based materials about the HPV vaccine, a desire for high-quality translations of materials, and challenges in appointment scheduling. At the provider level, provider recommendation, along with trust in such recommendation, emerged as key facilitators of vaccine uptake. At the same time, several mothers received either no recommendation or a low-quality recommendation. Diverging patterns of vaccine acceptance followed recommendation receipt and not all mothers got their

adolescents vaccinated immediately in the same visit. At the patient level, we documented low knowledge of the vaccine, particularly regarding recommended ages, number of doses, and eligibility for males to get the vaccine. Other patient-level barriers included a lack of healthcare utilization, perceived child's sexual inactivity, and safety concerns. All Vietnamese mothers with unvaccinated children were open to future vaccinations. Key reasons underlying vaccine acceptance were trust in the protective value of the vaccine, personal experience with HPV, and school requirements.

IMPLICATIONS OF PRACTICE-LEVEL FINDINGS

Taken together, the findings highlight the current gap in research on the assessment of practice-level measurements in relation to HPV vaccination among Asian-Americans and U.S. Vietnamese. This issue is a major shortcoming given that systematic reviews have shown that healthcare system-based interventions can improve HPV vaccine coverage (Niccolai and Hansen 2015; Smulian et al. 2016). The Community Preventive Services Task Force also recommends the use of system-based interventions as well as the implementation of combined system-based interventions to increase vaccination rates (Community Preventive Services Task Force 2017). The P3 model provides useful blueprints for practice-level assessments, including supply, immunization champion, vaccine promotion culture, and communication regarding vaccination policies (Bednarczyk et al. 2018).

Studies 2 and 3 are among the first efforts to assess multiple practice-level influences on U.S. Vietnamese parents' HPV decision-making for their adolescents. In Study 2, multivariable regressions did not identify any practice-level correlates of the outcomes. In Study 3, we documented two practice-level themes. First, clinic-based HPV vaccine promotion materials were generally available to U.S. Vietnamese mothers but warranted improvements to ensure

comprehension (particularly by being accessible in Vietnamese language). Second, practice-level interventions such as automatic scheduling of follow-up appointments (Berenson et al. 2019; Vu et al. 2020) and reminder and recall systems (e.g., via mailed letters, phone calls, or text messages) (Aragones et al. 2015; Matheson et al. 2014; Niccolai and Hansen 2015) could enhance vaccine uptake and completion.

IMPLICATIONS OF PROVIDER-LEVEL FINDINGS

Our findings indicate the need for actions to ensure high-quality and gender-neutral provider recommendation for HPV vaccine for U.S Vietnamese parents. It is critical that providers emphasize same-day vaccination and foster the impression that the HPV vaccine is a prevention strategy similar to other adolescent vaccines (Centers for Disease Control and Prevention 2019). Providers also should be trained to counter possible myths, misinformation, or inaccurate assumptions about the HPV vaccine. For example, when parents discussed delaying HPV vaccination due to a perceived lack of their adolescents' sexual activity, instead of affirming such preference, providers should address that vaccination between the ages of 9 and 12 is optimal and that vaccination before sexual debut is needed (Centers for Disease Control and Prevention 2019; Hughes et al. 2011). Additional dimensions of high-quality recommendations can include emphasizing the cancer prevention value of the vaccine, recommending vaccination to both males and females, and recommending the HPV vaccine at the same time and in the same way as other adolescent vaccines (Gilkey and McRee 2016). Effective provider-focused interventions for general U.S. populations have included educational presentations, audit and feedback, and training in communication approach with parents (Leung et al. 2019). Results also emphasize the importance of creating strong patient-provider relationships (Vu et al. 2020) and increasing Vietnamese parents' or caregivers' trust in

healthcare professionals and providers (Nan et al. 2014) as means to improve HPV vaccine acceptance and coverage.

Findings from Study 3 suggest that, even when U.S. Vietnamese mothers received provider recommendation or expressed trust in provider recommendation, several mothers still delayed HPV vaccination for their adolescents until the next visits. In such circumstances, having follow-up counseling or recommendation from the providers may be useful (Kornides et al. 2018). Importantly, U.S. Vietnamese mothers in the study discussed needing more time to learn more about the HPV vaccine following recommendation receipt. They also mentioned the desire to have known about the vaccine prior to recommendation receipt. This pattern of HPV vaccine decision-making calls for parental education about the HPV vaccine prior to the healthcare visit, a topic that has also come up in a few other studies with general U.S. populations (Dang et al. 2020; Dilley et al. 2018). With U.S. Vietnamese and other populations for whom English is a second language, interventions also must ensure that these parental health educational resources are linguistically and culturally relevant.

IMPLICATIONS OF PATIENT-LEVEL FINDINGS

Study 1 found that influential patient-level determinants included HPV or HPV vaccine knowledge, perceived safety or side effect issues, perceived susceptibility, and beliefs regarding the relationship between HPV vaccine and sexual activity. These patient-level findings that emerged in our review are important targets for educational interventions on HPV vaccine, though research suggests that educational interventions are more effective when implemented in conjunction with health system-based interventions (Community Preventive Services Task Force 2017; Smulian et al. 2016).

Among U.S. Vietnamese parents, Studies 2 and 3 both found that one barrier to parental willingness to initiate the HPV vaccine for their adolescents was parental perceptions that the vaccine was primarily to prevent sexually transmitted diseases and thus irrelevant for their young adolescent. Educational programs and interventions should address this perception by emphasizing that HPV vaccine is the most effective when administered prior to sexual debut (Adams et al. 2007). Moreover, sexual activity is not the only possible source of exposure to HPV, as there are non-sexual and non-penetrative sources of HPV transmission (Liu et al. 2016).

Additional patient-level targets identified in Study 3 included concerns about vaccine safety and lack of knowledge regarding recommendations for males, eligible and recommended ages, and the number of required vaccine doses. U.S. Vietnamese parents can be provided with vaccine safety data from clinical trials, in addition to research showing no evidence of vaccinated individuals developing commonly-feared conditions (e.g., autoimmune and neurological conditions) (Bednarczyk 2019). It may also be useful to discuss risks associated with *not receiving HPV vaccine* (Zimet et al. 2013). Our findings also underscore a critical need for communication to U.S. Vietnamese parents regarding the need to vaccinate adolescent sons against HPV. Given that the HPV vaccine is often translated into Vietnamese as the "cervical cancer prevention" vaccine (Raffles Medical Group 2018), many parents may not know that males are also eligible for the vaccine. Such education about the need to vaccinate adolescent sons is even more urgent, given that a recent CDC report found that the number of cases of HPV-attributable oropharyngeal cancers (19,000) in the U.S. have surpassed that of cervical cancers (12,015), and that incidence rates of HPV-attributable oropharyngeal cancers in men (8.5 per 100,000) are five times higher than in women (1.7 per 100,000) (Senkomago et al. 2019).

Future patient-level interventions and education for U.S. Vietnamese parents also may be particularly useful if taking place at community-based organizations or health fairs. For example, previous interventions in such venues have shown effectiveness in increasing knowledge and utilization of cervical cancer screening among U.S. Vietnamese women (Fang et al. 2019; Jenkins et al. 1997; Mcphee et al. 1996). Furthermore, while we focus on parental perspectives of adolescent HPV vaccination, future research can continue to explore facilitators and barriers to HPV vaccination in other populations such as young adult U.S. Vietnamese. Given the low adolescent HPV vaccination coverage, promoting catch-up HPV vaccination through the age of 26 can also be useful for increasing HPV vaccination rates among U.S. Vietnamese.

STRENGTHS AND LIMITATIONS

Strengths of the dissertation include the use of a comprehensive health services theoretical framework for all studies and a mixed-methods explanatory sequential design. Measurements in primary data collection were informed by the results in the systematic review. For Study 2, we also recruited a nationwide sample as opposed to recruiting from a specific geographic region or clinic. For Study 3, interviews were conducted in both English and Vietnamese and transcript translations were validated by bilingual research team members.

Nevertheless, findings should also be interpreted in light of a few limitations. For Study 1, due to the limited number of studies and different types of statistics (e.g., descriptive statistics versus associations/effect sizes) reported in them, we could neither perform a meta-analysis nor provide comparisons of determinants across subgroups of Asians. For both Study 2 and 3, we relied on self-reported data for HPV vaccination status, which may be subject to social desirability and recall bias (Vu et al. 2019). We only assessed U.S. Vietnamese parental perspectives and did not examine other perspectives, such as U.S. Vietnamese adolescents'

perspectives or perspectives of providers or healthcare staff serving this population. For Study 2, the use of convenience sampling may have limited the generalizability of findings. Our survey is cross-sectional, which limits interpretations of temporal relationships between variables. Furthermore, Study 3 is qualitative, which means findings may not be generalized across settings and contexts. In particular, Vietnamese mothers in the sample were all born outside of the U.S. and reported, on average, relatively high income and education. Our results may not be entirely applicable to Vietnamese parents who were U.S.-born or have lower socioeconomic status.

CONCLUSIONS

This dissertation expands our understanding of practice-, provider-, and patient-level determinants impacting U.S. Vietnamese parents' HPV vaccine uptake for their adolescent children. It responds to recent calls from the National Institutes of Health to addresses HPV vaccine acceptance and uptake in the U.S., particularly among populations at increased risk for morbidity and mortality (National Institutes of Health 2020). Moreover, it also advances cancer health equity through exploring multilevel determinants of HPV vaccine uptake among a high-risk minority group. Findings also contribute to understanding of vaccine hesitancy, a rising critical global public health threat (World Health Organization 2019). Last but not least, this dissertation highlights the need for disaggregated data for Asian subgroups in order to understand disparities in health behaviors and outcomes experienced by different communities and to design culturally and linguistically relevant health interventions addressing such disparities.

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