



ELSEVIER

Contents lists available at ScienceDirect

Papillomavirus Research

journal homepage: www.elsevier.com/locate/pvr

Healthcare providers' beliefs and attitudes regarding risk compensation following HPV vaccination

Monica L. Kasting^{a,*}, Shannon Wilson^b, Brian E. Dixon^{a,c,d}, Stephen M. Downs^{b,c}, Amit Kulkarni^e, Gregory D. Zimet^b^a Indiana University Fairbanks School of Public Health, Department of Epidemiology, 1050 Wishard Blvd, RG5, Indianapolis, IN 46202, USA^b Indiana University School of Medicine, Department of Pediatrics, 410 W 10th Street Suite 1001, Indianapolis, IN 46202, USA^c Regenstrief Institute, Inc., Center for Biomedical Informatics, 1101 W. 10th St., Indianapolis, IN 46202, USA^d Center for Health Information and Communication, Department of Veterans Affairs, Veterans Health Administration, Health Services Research and Development Service CIN 13-416, 1481 W. 10th St, 11H, Indianapolis, IN 46202, USA^e Merck & Co., 2000 Galloping Hill Road, Kenilworth, NJ 07033, USA

ARTICLE INFO

Article history:

Received 18 January 2016

Received in revised form

24 May 2016

Accepted 27 May 2016

Available online 28 May 2016

Keywords:

Behavior

Risk compensation

Human Papillomavirus vaccination

Cervical cancer screening

Healthcare provider

ABSTRACT

Background: Provider recommendation is a significant predictor of HPV vaccine uptake. Prior research suggests that concerns regarding risk compensation could cause some providers to hesitate recommending the HPV vaccine.**Methods:** During 15–30 min semi-structured interviews in early 2015, 22 U.S. pediatric providers were asked about their beliefs regarding sexual risk compensation and cervical cancer screening following HPV vaccination. Providers were asked if these beliefs result in reservations recommending the vaccine. Interviews were audio-recorded, transcribed, and analyzed using inductive content analysis.**Results:** None of the providers believed the HPV vaccine would result in risky sexual behavior. Half indicated it was better to start vaccination early, before sexual activity was a worry. Others noted that patients' risky behavior decisions happen independently of vaccination. When providers were asked if they were concerned about decreased cervical cancer screening, half said they did not know and some stated they had never thought about it before. The main themes addressed were the significant time lapse between vaccination and screening and that women tend to get over-screened as opposed to under-screened.**Conclusion:** Providers were generally in favor of HPV vaccination and do not perceive risk compensation as a barrier to HPV recommendation.© 2016 The Authors. Published by Elsevier B.V. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

In 2015 the Centers for Disease Control and Prevention (CDC) estimated that approximately 79 million Americans are currently infected with Human Papillomavirus (HPV) and 14 million new infections occur every year, making it the most common sexually transmitted infection (STI) in the U.S. [1]. Infection with HPV is a causal factor for serious health issues including cervical cancer, anal cancer, penile cancer, oropharyngeal cancers, genital warts, and recurrent respiratory papillomatosis [2].

Currently, there are three different vaccines against HPV licensed by the U.S. Food and Drug Administration (FDA). The

current vaccine has the potential to prevent up to 80–90% of cervical cancers, 90% of genital warts [3], and is routinely recommended by the Advisory Committee on Immunization Practices (ACIP) for both males and females age 11–12 [4,5]. Despite the potential benefits, HPV vaccination rates in the U.S. remain very low [6]. In 2014, only 60.0% of adolescent girls and 41.7% of adolescent boys between the ages of 13 and 17 received one or more doses in the HPV vaccine series [7]. The numbers are even lower for series completion (39.7% of girls and 21.6% of boys). Barriers to HPV vaccination include cost of the vaccine, lack of knowledge about HPV transmission, and parental concerns about vaccinating their children against a sexually transmitted infection (STI) [8]. Recent research has shown that a sizeable portion of physicians do not strongly endorse the HPV vaccine (27%) and do not deliver timely recommendations (26% for girls, 39% for boys) [9]. This is of particular concern because one of the strongest predictors of vaccine uptake is healthcare provider (HCP) recommendation and a lack of HCP recommendation has been listed as a reason for non-

* Corresponding author.

E-mail addresses: mlkasting@iupui.edu (M.L. Kasting), wilsosha@iupui.edu (S. Wilson), bedixon@regenstrief.org (B.E. Dixon), stmdowns@iu.edu (S.M. Downs), amit.kulkarni4@merck.com (A. Kulkarni), gzimetz@iu.edu (G.D. Zimet).

vaccination among those who are unvaccinated [10–14].

One concern among parents, clinicians, and public health officials that has received particular attention in the media is that the introduction of the HPV vaccine may lead to risk compensation. Risk compensation is the idea that each person has an individual level of tolerance for the amount of risk they will take and if some aspect of risk is reduced, he or she will increase risky behavior in order to get back up to that set point [15,16]. Opponents of the HPV vaccine have argued that vaccination could cause adolescents to engage in more risky sexual behavior due to a perceived decreased risk of sexually transmitted infections [17], a concern that has no empirical support [18]. Furthermore, an additional area addressed when risk compensation is examined is a possibility that women who have received the HPV vaccine may be less likely to get screened for cervical cancer, or may cease cervical cancer screening altogether [19–21]. It is therefore important to understand if HCPs are concerned about risk compensation and if these concerns affect their HPV vaccination practices.

The purpose of this study was to: 1) understand HCP beliefs surrounding risk compensation with regards to sexual behaviors; 2) understand HCP beliefs surrounding risk compensation with regards to cervical cancer screening practices; and 3) ascertain how these beliefs affect HCP HPV vaccination recommendation practices.

2. Methods

2.1. Study participants

As part of a larger study examining computerized HCP reminders for HPV vaccination, we conducted semi-structured, qualitative interviews from January to March 2015. The study was approved by the Indiana University Institutional Review Board and more information on the larger study can be found at ClinicalTrials.gov (Identifier: NCT02551887). Participants for this study were pediatrician HCPs working in publicly-funded urban health clinics, had patients between the ages of 11–12 who were in need of vaccination, and consented to be interviewed. All eligible HCPs were contacted via e-mail. Two additional follow-up e-mails were sent to each participant who did not respond to the initial e-mail. A total of 39 HCPs were eligible to be interviewed and 22 (56.4%) consented and completed the interview. Participants were recruited until saturation was reached, that is, until we acquired limited new information from the interviews [22].

2.2. Interviews and data analysis

Qualitative methodology is ideal when exploring an area where little is known because it allows the investigators to identify, via in-depth analysis, personal and contextual factors [23]. The majority of the interviews were conducted face-to-face ($n=20$), but some were conducted over the phone if the HCP could not meet in person ($n=2$). All interviews were one-on-one and conducted by the lead author (MLK). Interviews lasted 15–30 min, and participants were compensated with a \$50 gift card. After providing brief information regarding the study, participants were asked about their general beliefs regarding HPV and HPV vaccination. They were further asked additional questions for the larger study pertaining to computerized reminders prompting HPV vaccine recommendation. Finally, HCPs were asked: 1) if they believe their patients will practice riskier sexual behaviors (for both male and female patients) after they are vaccinated, 2) if they believe vaccination will result in their female patients feeling they do not need to get screened for cervical cancer, and 3) if either of these issues affect HCP recommendation. Along with these questions,

demographic characteristics (including sex, race/ethnicity, and years in practice) as reported during the interview were also collected.

Interviews were audio-recorded with a hand-held digital recorder and transcribed verbatim by a professional transcriptionist. They were hand-coded and analyzed using inductive content analysis [24]. Transcripts of the interviews were read independently by two coauthors (MLK & SW) using open-coding to identify meaningful themes and categories. Once categories were developed, coders developed subcategories of comments. The codes were reviewed after each coding phase and areas of disagreement between coders were resolved through discussion until there was at least 80% agreement within each category.

3. Results

3.1. Study sample

We contacted a total of 39 HCPs, of which 21 physicians and 1 nurse practitioner (56% response rate; 17 female, 5 male), agreed to be interviewed. All HCPs specialized in pediatrics. It is worth noting that the nurse practitioner's responses were not qualitatively different from the physicians' responses. Participants averaged 14 years in practice and the majority ($n=14$) identified as non-Hispanic White, with 4 reporting their race as non-Hispanic Black, 3 Hispanic, and 1 Asian.

The hospital system, Eskenazi Health, is one of the five largest safety net health systems in the U.S. The health system contains a 315-bed hospital and nine community health centers located across the metropolitan area of Indianapolis. Each community health center provides adult primary care, pediatrics, obstetrics, gynecology, and mental health services.

The 11–12 year old patient population served by these providers, that is, the population of interest to for increasing HPV vaccine uptake, is 50.1% female and the largest proportion (49.3%) identify as Black while 12.6% identify as White, 26.7% identify as Hispanic, and 11.4% identify as Other or unknown. Over 70% of the pediatric patient population in this healthcare system is on Medicaid, 3.3% receive charity care, and 5.5% self-pay.

3.2. Sexual risk compensation

None of the HCPs indicated they believe that getting vaccinated against HPV would lead a young adolescent to engage in riskier sexual behavior. Within that question, five of the HCPs pointed the interviewer to research supporting their opinion. Instead of stating their personal beliefs, they would state evidence from the literature by saying, for example, "I think that's been shown in not just one publication but multiple publications to not be true (female, 10 years in practice)." For a list of themes and other exemplar quotes, see Table 1.

3.2.1. Belief that sexual behaviors are independent of vaccination

Half of HCPs specifically mentioned they feel it is better to start vaccinating their patients before sexual activity was a worry. Some felt that this was important in order to ensure their patients are protected before they are sexually active and HCPs would communicate this by saying, "This is about the idea that the vast majority of people at some point in their life are sexually active. And so we want this protection before that starts (male, 6 years in practice)." While other HCPs prefer to vaccinate before sexual activity is a worry, so they do not have to talk about sexual activity in the context of vaccination. For example, one HCP said, "If somebody asks me—like I usually talk about how [HPV] is the number one cause for cervical cancer, and things like that, but I don't

Table 1
Qualitative themes and exemplar quotes.

Concept	Theme	Exemplar quotes
Sexual disinhibition	Sexual behaviors are independent of vaccination	"...it's case dependent. So you have those children who are going to be more at risk, but you have a majority of the children who are not going to deal with those type of issues at this early on age (male, 9 years in practice)." "No, I'm really not...they're going to do what they want to do anyway. It's a good time to educate them, of course, but I'd rather just protect them. It doesn't really give them a license to do anything (male, 16 years in practice)."
	Patients are unaware of what they're getting vaccinated for	"Kids don't have an idea of what shots they really get... [Children] go glossy eyed and not even listening...they're just concerned about how many shots they're getting, but they don't know what they're for (female, 7 years in practice)."
	No support for disinhibition in the literature	"I think the literature doesn't support that. I think there might be parents who think that, but I think there's no evidence of it (female, 37 years in practice)."
Decrease in cervical cancer screening	Physicians haven't thought about it	"I don't know. I don't know, actually. It's a good question. I've never suggested that, or implied that, or even thought about it, so I would think that the patients probably haven't made that connection, would be my guess (female, 25 years in practice)." "There are so many reasons why the girls that I vaccinate or the boys that I vaccinate are going to fall out of care that the HPV vaccine has truthfully not crossed my worry (female, 19 years in practice)." "I don't know the data around this one- I haven't looked for that data specifically (female, 9 years in practice)."
	Women are unaware of the purpose of a Pap smear	"I honestly don't think most people know why they're getting pap smears, but everybody kind of expects to get one. So I haven't experienced that or heard that at all with people saying, 'Oh, I don't need to get pap smears now' (female, 4 years in practice)." "They're not thinking about cervical cancer so we're trying to explain what we're doing it for but I'm not sure they really make the connection. With us doing Pap smears at later ages anyway, delaying the onset of Pap smears is really not in their mind anyway (male, 16 years in practice)."
	Time lag between vaccination and Pap testing	"No, because I think by the time our girls are going for Pap screens they are going to have forgotten that they got HPV vaccines. So no, I don't think it will. I don't think it will impact them getting Pap smears. I hope it won't... I don't know that it's that deep (female, 14 years in practice)." "I think a majority of the kids I see that we do start the HPV are usually 10, 11, 12 so those conversations, ten years from now when you're going for you annual exams, don't forget to do this, this, and this, it's probably not going to be appropriate (male, 12 years in practice)." "I don't think that when they're 21 years old, that link is - they're thinking in their head, 'Oh, well I got the shot 10 years ago, I'm not going to get my pap now.' I just think that link is too long (female, 7 years in practice)."
	Women actually get over screened	"They're either good about getting their Pap smears and want to get them all the time because we actually backed off from yearly Pap smears for a lot of people to every three years, but still people want to come in every year and get their Pap smear, or people are just not good about getting them anyway. I don't think the vaccine affects that (male, 16 years in practice)." "[F]olks are typically more resistant to the idea of not having enough Pap smears as opposed to feeling overprotected and not needing to go get a Pap smear (male, 6 years in practice)." "I actually think that a lot of people will default to getting screened more often than they really need to. There's still a lot of, like, you need an annual Pap myth that's out there among the providers and patient (female, 9 years in practice)."

actually talk about sexual activity in the context of the vaccine (female, 25 years in practice)." Another participant said they tell their parents, "[Y]ou can certainly believe that you can control the behavior of your child, but you certainly can't control the behavior of other peoples' children and that's what immunization is all about; herd immunity (female, 14 years in practice)," indicating that even if a parent states their child does not need it because they will abstain from sexual activity until marriage, they cannot predict the behavior of their child's future spouse. One HCP indicated the opposite belief, stating that bringing up sexual activity at a young age would make the parents more averse to vaccination.

Some HCPs believed that in general, people who engage in risky behaviors will do so regardless of vaccination status. One said, "[T]he reasons why teenagers engage in sex, risky or not, are really multi-factorial and the degree to which vaccination status plays into it is probably zero-to-none (female, 9 years in practice)." This quote echoes the sentiment expressed by most HCPs, that vaccinating their patients was a good time to educate them about

safe sex but it was better to protect them if at all possible because their decision to engage (or not engage) in risky behaviors was independent of vaccination status.

3.2.2. *Patients are unaware of which vaccine they are getting*

One of the crucial components of risk compensation is that the person engaging in the risky behavior has to be aware of what the protective behavior is protecting them from and they have to understand the connection between the risky behavior and the protective behavior. If a patient is not aware that they are getting vaccinated against HPV, not aware that HPV is sexually transmitted, or not aware that the vaccine is protecting them against a STI, then they will be unlikely to respond to vaccination with riskier sexual behavior. Some HCPs indicated that many of their patients do not know or pay attention to the vaccines being administered. One participant in the study said, "My thoughts are that most adolescents don't know which vaccines they have or haven't gotten. And so the idea that they would [be] so aware of it that it would influence their behaviors is a little far-fetched

(female, 9 years in practice)."

While none of the HCPs thought sexual risk compensation happened, it should also be noted that none of them indicated that it would influence their vaccination practices even if they did think it happened. Generally, most of the HCPs seemed almost exasperated when they were asked this question with one of them asking, "Is it unprofessional for me to say that I think that's the dumbest thing I've ever heard (male, 6 years in practice)?"

3.3. Concern about a decrease in cervical cancer screening

In general, when we asked HCPs if they thought getting the HPV vaccine would result in their patients feeling completely protected from cervical cancer and therefore less likely to get screened in the future, half (n=11) said they did not know and some (n=3) stated they had not ever thought about it before. If an HCP has not even thought about the possibility that their patient might reduce cervical cancer screening, the idea that this might be a reason an HCP would be hesitant to recommend the vaccine is unfounded. Five of the HCPs said it was an interesting question, indicating it could be an area for future research in order to educate HCPs on patient behavior post-vaccination in an attempt to increase vaccine uptake.

When HCPs thought about it, all but one said they did not think their patients would get screened for cervical cancer less often after they were vaccinated. The HCP who did think patients would get screened less stated it more as a fact that she thought they did not need to be screened as much and that the guidelines would probably change soon to allow for decreased screening frequency. She said, "I don't see why we should be doing as frequent cervical or Pap smears if they have an effective vaccine to prevent cervical cancer (female, 10 years in practice)".

3.3.1. Women are unaware of the purpose of a Pap smear

The HCPs who did not think their patients would get screened less frequently said they believed that most women do not understand the purpose of a Pap smear. Therefore, it would be unlikely for the patient to make the connection that the HPV vaccine protects against HPV, HPV causes cervical cancer, a Pap smear is a screening test for cervical cancer, and they could therefore reduce their screening. "I think they might make the connection with cervical cancer because that's—I talk about that. But I don't know that they make a connection between that (HPV vaccination) and not needing to get a Pap smear (female, 25 years in practice)."

3.3.2. Time lag between vaccination and Pap testing

There exists a time lapse of several years between the age of vaccination (typically 11–12 years old) and when a woman should start cervical cancer screening (21 years old). Most HCPs indicated their patients will likely forget they are vaccinated against HPV and what the vaccine protects against by the time they have to make a decision about cervical cancer screening. "I would agree that I think the teenagers aren't thinking that far ahead. They have risky behavior anyway, so I don't know that this has anything to do with it (female, 37 years in practice)".

3.3.3. Women get over screened

Largely, HCPs indicated the problem they face with their patients is that they are screened too often, as opposed to not often enough. They noted that most patients and HCPs are unaware of the current guidelines and tend to think screening should occur on a yearly basis. "That's not something I'm particularly worried about and I actually think that a lot of people will default to getting screened more often than they really need to (female, 9 years in practice)". Some HCPs also noted that annual screening is just part of a woman's routine and some patients feel uncomfortable

decreasing screening to every three years.

Even if a reduction in cervical cancer screening was identified, HCPs indicated this would not influence their vaccination practices. They said they do not think their patients would get screened less but if they did, the HCP would still want to vaccinate as many people as possible. They stated preventing cancer is almost always better than screening and catching it early. One stated that it is important to emphasize that to the patient and said, "Discussing that even though you've had the HPV vaccine, this is—this (cervical cancer) could still be an issue, so you need to get your regular Pap screens (female, 3 years in practice)." Furthermore, since there are many other reasons patients fall out of care, the thought that they would choose not to continue to be screened for cervical cancer based solely on having the HPV vaccination is unlikely. "Like people that don't get Paps, it's not because they don't think they're at risk it's because they're doing resource allocation differently in terms of time and money and access to healthcare (female, 9 years in practice)."

4. Discussion

Opponents of the HPV vaccine have argued that the receipt of the vaccine could cause adolescents to engage in more risky sexual behavior due to a perceived decreased risk of sexually transmitted infections [17]. Some clinicians have expressed concern that women who have received the HPV vaccine will be less likely to get screened for cervical cancer, or will cease cervical cancer screening altogether [19]. Since HCP recommendation is one of the strongest predictors of HPV vaccine uptake, it is important to understand if HCPs believe risk compensation occurs after HPV vaccination and if this belief results in the HCP being hesitant to recommend the vaccine. This is one of the first studies to qualitatively analyze HCP beliefs regarding risk compensation in the context of both sexual behaviors and cervical cancer screening.

Our results indicate that none of the HCPs in our sample believed sexual risk compensation occurred as a result of HPV vaccination. The HCPs were up-to-date on current literature stating that there is no evidence of increased risky sexual behaviors following HPV vaccination when examining both biological outcomes and reported sexual behaviors [25–28]. HCPs tended to point the interviewer to the literature regarding sexual behaviors, this seemed to be an interesting way for the HCP to avoid giving their own personal opinion on the matter. Furthermore, HCPs indicated a concern about increased risky sexual behaviors would not result in them being hesitant to offer the HPV vaccine to their patients.

HCPs also seemed to be unconcerned about a decrease in cervical cancer screening behavior following HPV vaccination. Most HCPs in this study indicated that they did not think patients would decrease cervical cancer screening. They indicated several reasons for this belief. The first is that most women do not make a connection between HPV, Pap smears, and cervical cancer. HCPs stated that frequently women tend to get over-screened for cervical cancer and not under-screened. They also shared the belief found in similar studies that vaccination and screening are both preventive health behaviors and a woman who engages in one is more likely to engage in the other due to an emphasis on positive health behaviors and access to healthcare. This is consistent with a 2015 study that found that unvaccinated women were actually less likely to have had a recent Pap test as compared to vaccinated women [29]. HCPs in this study indicated that even if they did believe cervical cancer screening would decrease, it would not be a reason to withhold vaccination. They stated preventing cancer is better than screening so they would prefer to prevent it if at all possible.

While this study is one of the first of its kind to evaluate HCP

beliefs regarding risk compensation after HPV vaccination, there are limitations to note. Participants were a convenience sample of HCPs in an urban hospital system that generally serves minority and economically disadvantaged patients and their responses may not be representative of all HCPs. Additionally, this sample included primarily female HCPs. Research has shown that having a male HCP was associated with lower HPV vaccine initiation [30] and that female HCPs were more likely to recommend HPV vaccine in a bivariate analysis [31]. This could mean our mostly female sample had inherently more positive views toward HPV vaccine. Selection bias also might have occurred as the HCPs who agreed to participate might have different attitudes to vaccination than the participants who did not wish to participate. Furthermore, the face-to-face nature of the study might have contributed to HCPs answering questions in a way they deemed socially desirable as opposed to indicating their actual personal beliefs. This bias was limited by assuring the participants their individual responses would be kept in strict confidence and all study information would be de-identified.

5. Conclusion

Overall, HCPs in this study indicated they were not concerned about HPV vaccination leading to risk compensation. This was true in the context of both risky sexual behaviors and decreases in cervical cancer screening behaviors. This contradicts the findings from previous research that indicated HCPs are reluctant to vaccinate due to a possible negative effects on cervical cancer screening and risky sexual behaviors [20,32]. The reasons HCPs cited for their lack of concern, including patients not knowing what they have been vaccinated against, women not understanding the connection between HPV and Pap screening, and women's preferences for over screening are areas that are necessary to examine in future research. This study is the first of its kind to examine HCP beliefs regarding risk compensation following HPV vaccination and adds to the growing body of literature that there is not an increase in risky behaviors after vaccination and is not a reason for non-vaccination.

Conflict of interest statement

The authors are investigators on research funded by Merck & Co. in the last year, Gregory Zimet served as a consultant to Merck & Co., Inc.

Acknowledgments

This study was supported by the Merck – Regenstrief Program in Personalized Health Care Research and Innovation (Project #14). Its contents are the sole responsibility of the authors and do not reflect the official view of Merck & Co., Inc.

MLK is supported by the National Cancer Institute of the National Institutes of Health under Award number R25CA117865. The Department of Veterans Affairs, Veterans Health Administration, Health Services Research and Development Service (CIN 13-416) further employs BED as a Health Research Scientist at the Richard L. Roudebush Veterans Affairs Medical Center in Indianapolis, Indiana, USA. The contents are solely the responsibility of the authors and does not necessarily represent the official views of the Department of Veterans Affairs or the National Institutes of Health, including the National Cancer Institute and the National Institute of Nursing Research.

References

- [1] Centers for Disease Control and Prevention, Genital HPV infection—CDC Fact Sheet, Atlanta, GA. Retrieved from: (<http://www.cdc.gov/std/HPV/STDFact-HPV.htm>), 2014.
- [2] National Institutes of Health. HPV and Cancer. Bethesda, MD. Retrieved from: (<http://www.cancer.gov/about-cancer/causes-prevention/risk/infectious-agents/hpv-fact-sheet>), 2015.
- [3] U.S. Food and Drug Administration, FDA Approves Gardasil 9 for prevention of Certain Cancers caused by Five Additional Types of HPV. Silver Spring, MD. Retrieved from: (<http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm426485.htm>), 2014.
- [4] L.E. Markowitz, E.F. Dunne, M. Saraiya, H.W. Chesson, C.R. Curtis, J. Gee, et al., Human papillomavirus vaccination: recommendations of the Advisory Committee on Immunization Practices (ACIP), *Morb. Mortal. Wkly Rep.* 63 (2014) 1–30.
- [5] E. Petrosky, J.A. Bocchini Jr, S. Hariri, H. Chesson, C.R. Curtis, M. Saraiya, et al., Use of 9-valent human papillomavirus (HPV) vaccine: updated HPV vaccination recommendations of the Advisory Committee on Immunization Practices, *Morb. Mortal. Wkly Rep.* 64 (11) (2015) 300–304.
- [6] S. Stokley, J. Jeyarajah, D. Yankey, M. Cano, J. Gee, J. Roark, et al., Human papillomavirus vaccination coverage among adolescents, 2007–2013, and post-licensure vaccine safety monitoring, 2006–2014 - United States, *Morb. Mortal. Wkly Rep.* 63 (29) (2014) 620–4.
- [7] S. Reagan-Steiner, D. Yankey, J. Jeyarajah, L.D. Elam-Evans, J.A. Singleton, C. R. Curtis, et al., National, regional, state, and selected local area vaccination coverage among adolescents aged 13–17 years—United States, 2014, *Morb. Mortal. Wkly Rep.* 64 (29) (2015) 784–92.
- [8] A.F. Dempsey, M.M. Davis, Overcoming barriers to adherence to HPV vaccination recommendations, *Am. J. Manag. Care* 12 (Suppl. 17) (2006) S484–S491.
- [9] M.B. Gilkey, T.L. Malo, P.D. Shah, M.E. Hall, N.T. Brewer, Quality of physician communication about human papillomavirus vaccine: findings from a national survey, *Cancer Epidemiol. Biomark. Prev.* 24 (11) (2015) 1673–1679.
- [10] M. Bendik, R.M. Mayo, V.G. Parker, Contributing factors to HPV vaccine uptake in college-age women, *J. Cancer Educ.* 24 (2009) 17.
- [11] Centers for Disease Control and Prevention, National and state vaccination coverage among adolescents aged 13–17 years—United States, 2011, *Morb. Mortal. Wkly Rep.* 61 (34) (2012) 671–7.
- [12] N.T. Brewer, S.L. Gottlieb, P.L. Reiter, A.L. McRee, N. Liddon, L. Markowitz, et al., Longitudinal predictors of human papillomavirus vaccine initiation among adolescent girls in a high-risk geographic area, *Sex. Transm. Dis.* 38 (3) (2011) 197–204.
- [13] N.C. Liddon, J.E. Hood, J.S. Leichter, Intent to receive HPV vaccine and reasons for not vaccinating among unvaccinated adolescent and young women: findings from the 2006–2008 National Survey of Family Growth, *Vaccine* 30 (16) (2012) 2676–2682.
- [14] G.D. Zimet, T.W. Weiss, S.L. Rosenthal, M.B. Good, M.D. Vichnin, Reasons for non-vaccination against HPV and future vaccination intentions among 19–26 year-old women, *BMC Women's Health* 10 (1) (2010) 27.
- [15] G.J. Wilde, The theory of risk homeostasis: implications for safety and health, *Risk Anal.* 2 (4) (1982) 209–225.
- [16] G.J. Wilde, Risk homeostasis theory: an overview, *Inj. Prev.* 4 (2) (1998) 89–91.
- [17] K. Pollitt, Virginity or death! *The Nation*. Retrieved from: (<http://www.thenation.com/article/virginity-or-death/>), 2005.
- [18] M.L. Kasting, G.K. Shapiro, Z. Rosberger, J.A. Kahn, G.D. Zimet, Tempest in a teapot: a systematic review of HPV vaccination and risk compensation research, *Hum. Vaccin. Immunother.* 12 (6) (2016).
- [19] J.A. Tiro, M. Saraiya, N. Jain, N. Liddon, V. Cokkinides, S.M. Lai, et al., Human papillomavirus and cervical cancer behavioral surveillance in the US, *Cancer* 113 (S10) (2008) 3013–3030.
- [20] D. Lutringer-Magnin, J. Kalecinski, C. Cropet, G. Barone, V. Ronin, V. Regnier, et al., Prevention of sexually transmitted infections among girls and young women in relation to their HPV vaccination status, *Eur. J. Public Health* 23 (6) (2013) 1046–1053.
- [21] T. Mather, K. McCaffery, I. Juraskova, Does HPV vaccination affect women's attitudes to cervical cancer screening and safe sexual behaviour? *Vaccine* 30 (21) (2012) 3196–3201.
- [22] G. Guest, A. Bunce, L. Johnson, How many interviews are enough? An experiment with data saturation and variability, *Field Methods* 18 (1) (2006) 59–82.
- [23] M.Q. Patton, *Qualitative Evaluation and Research Methods*, 4th ed, SAGE Publications, Inc., 2014.
- [24] S. Elo, H. Kyngäs, The qualitative content analysis process, *J. Adv. Nurs.* 62 (1) (2008) 107–115.
- [25] R.A. Bednarczyk, R. Davis, K. Ault, W. Orenstein, S.B. Omer, Sexual activity-related outcomes after human papillomavirus vaccination of 11- to 12-year-olds, *Pediatrics* 130 (5) (2012) 798–805.
- [26] A.B. Jena, D.P. Goldman, S.A. Seabury, Incidence of sexually transmitted infections after human papillomavirus vaccination among adolescent females, *JAMA Int. Med.* 175 (4) (2015) 617–623.
- [27] T. Cummings, G.D. Zimet, D. Brown, W. Tu, Z. Yang, J.D. Fortenberry, et al., Reduction of HPV infections through vaccination among at-risk urban adolescents, *Vaccine* 30 (37) (2012) 5496–5499.
- [28] A.S. Forster, L.A. Marlow, J. Stephenson, J. Wardle, J. Waller, Human papillomavirus vaccination and sexual behaviour: cross-sectional and longitudinal

- surveys conducted in England, *Vaccine* 30 (33) (2012) 4939–4944.
- [29] A.G. Sauer, A. Jemal, E.P. Simard, S.A. Fedewa, Differential uptake of recent Papanicolaou testing by HPV vaccination status among young women in the United States, 2008–2013, *Cancer Epidemiol.* 39 (4) (2015) 650–655.
- [30] C. Chao, C. Velicer, J.M. Slezak, S.J. Jacobsen, Correlates for human papillomavirus vaccination of adolescent girls and young women in a managed care organization, *Am. J. Epidemiol.* 171 (3) (2010) 357–367.
- [31] S.T. Vadaparampil, J.A. Kahn, D. Salmon, J.-H. Lee, G.P. Quinn, R. Roetzheim, et al., Missed clinical opportunities: Provider recommendations for HPV vaccination for 11–12 year old girls are limited, *Vaccine* 29 (47) (2011) 8634–8641.
- [32] European Centre for Disease Prevention and Control (ECDC), Introduction of HPV vaccines in European Union Countries—an update. Stockholm, ECDC. Available: http://ecdc.europa.eu/en/publications/Publications/20120905_GUI_HPV_vaccine_update.pdf, 2012.