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Factors Influencing Familial Decision-Making Regarding Human Papillomavirus Vaccination

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Abstract

Objective The purpose of this review is to summarize the research regarding Human Papillomavirus (HPV) vaccination uptake among families with adolescent/preadolescent daughters. **Methods** Literature searches (utilizing PubMed and PsychInfo databases) were conducted and research examining psychological and environmental factors which relate to HPV vaccine uptake and intentions was reviewed. **Results** Factors such as physician

recommendations, perceptions of the beliefs of peers and significant others, history of childhood immunizations, and communication with adolescents regarding sexual topics appear to influence HPV vaccination outcomes. **Conclusions** Although primary prevention of cervical and other cancers is available for preadolescent and adolescent girls, rates of HPV vaccine uptake are low. Future interventions should target vaccine intent and physician/family communication as a means to increasing HPV vaccination.

Introduction

Genital human papillomavirus (HPV) is the most common sexually transmitted infection (STI; Weinstock, Berman, & Cates, 2004). Epidemiological studies indicate that ~50–70% of sexually active women contract HPV at some point during their lifetime (Mariam, 2005). Human papillomavirus infection rates are highest in younger women and rise sharply soon after the median age of first sexual activity—16.9 years for females (Wulf, 2002). More specifically, the prevalence of HPV has been estimated to be as high as 39.6% among 14–19-year olds and 49.3% among 20–24-year old sexually active females (Dunne et al., 2007). The United States Youth Risk Behavior Surveillance of 2007, a national school-based survey of health-risk behaviors among high school students, reports that 45.9% of female students have ever engaged in sexual intercourse (Eaton et al., 2008). Women who begin having sex at young ages, have more sexual partners, and engage in more unprotected sex are at increased risk for HPV [American Cancer Society (ACS), 2008b; Burchell, Winer, de Sanjose, & Franco, 2006].

Of the over 100 identified types of HPV, ~40 strains affect the genital tract

(Markowitz et al., 2007). Furthermore, oncogenic HPV strains have been linked to cervical, vaginal, vulvar, penile, and anal cancers. Cervical cancer is the second most common cancer among women worldwide and is the leading cause of cancer-related deaths among women in developing countries (Bosch & de Sanjose, 2003; Parkin, Bray, Ferlay, & Pisani, 2005). The ACS estimated that in the United States alone 11,070 women would be diagnosed with cervical cancer in 2008, and that 3,870 deaths occurred secondary to cervical cancer (ACS, 2008a). Screening for cervical cancer is conducted via Papanicolaou (Pap) testing to identify abnormal cells in the cervix that may lead to cancer. Approximately 55 million Pap tests are performed each year in the United States, and of these ~3.5 million (6%) yield abnormal results which require medical follow-up (National Cancer Institute, 2007). Some HPV infections may be asymptomatic and most infected women have normal Pap test results, as the infection clears without incident.

Although most HPV infections are transient (i.e., will resolve on their own within 1–2 years), persistent HPV infection is a necessary cause of cervical cancer (Ault, 2007), because 100% of cervical cancers are HPV related (Waggoner, 2003; Walboomers et al., 1999). In particular, HPV types 16 and 18 are responsible for 70% of cervical cancers (Paavonen & Lehtinen, 2008). It is estimated that the slow progression of abnormal cell growth due to HPV infection leading to cervical cancer may take 10–15 years (Association of Reproductive Health Professionals, 2005). Thus, although HPV is contracted most often in sexually active adolescents and women aged 15–24 years, cervical cancer diagnosis most often occurs in women over the age of 40, with median age at diagnosis being 48 years ("SEER Cancer Statistics Review, 1975–2003, National Cancer Institute", 2006).

Recent cancer prevention efforts have led to the development of a vaccine against HPV, which is currently available and has been demonstrated to be safe and clinically effective (Harper et al., 2006; Koutsky & Harper, 2006; Markowitz et al., 2007). Specifically, in June 2006, the U.S. Food and Drug Administration (FDA) approved a quadrivalent HPV vaccine (i.e., Gardasil produced by Merck & Co., Inc.) designed to protect young women from the four types of HPV (6, 11, 16, and 18) which account for 70% of cervical cancers and 90% of genital warts cases (FDA, 2006a; Villa et al., 2005). In clinical trials, the quadrivalent HPV vaccination demonstrated nearly 100% efficacy in protecting females against these four HPV types (Villa, 2007). Although a bivalent HPV vaccine (i.e., Cervarix manufactured by GlaxoSmithKline) is expected to be approved by the FDA for use in the USA in late 2009, our discussion will focus on the quadrivalent HPV vaccine.

The present review evaluates existing literature on factors influencing familial decision making regarding HPV vaccination. It is important to understand and utilize these factors in developing interventions for vaccination uptake. Because the vaccine is relatively new, little is known about the complexity of familial and other factors that may affect vaccine-related decision making. Previous studies have examined attitudes toward HPV immunization and concluded that a greater understanding of the complicated decision-making process for families to vaccinate is needed, as it involves sensitive issues including vaccination history, physician negotiation, and adolescent sexual behavior. Insight into the parental decision-making process regarding HPV vaccination may be found in previous research addressing childhood vaccinations and adolescent sexual behavior. This article is organized into three sections. First, we describe HPV vaccination in terms of indication and administration, impact on

cervical cancer outcomes, importance for high risk populations, and current uptake. Next, factors that influence familial decision making regarding HPV vaccination are identified in the context of childhood vaccination and adolescent sexual health literatures. Finally, future directions for maximizing HPV vaccination uptake are presented.

HPV Vaccination

Indication and Administration

Routine HPV vaccination is recommended by the Advisory Committee on Immunization Practices (ACIP) for adolescent females aged 11 and 12 years, though the series of three injections administered over 6 months can be started as young as 9 years of age (Markowitz et al., 2007). The FDA has approved the quadrivalent HPV vaccine for girls and women between the ages of 9 and 26 years, as vaccine administration is recommended prior to sexual onset (FDA, 2006b). Vaccination is also recommended for those aged 13–26 years who have not been vaccinated or completed the 3-shot vaccine series (Markowitz et al., 2007). In addition to the importance of targeting sexually naïve preadolescents and adolescents for routine HPV vaccination, age at vaccination was demonstrated to be inversely related to anti-HPV immune response (Giuliano et al., 2007). Transmission of HPV primarily occurs via vaginal and anal intercourse. Oral and digital infection with genital HPV strains also occurs; however, the risk of transmission by digital–genital or oral–genital contact appears minimal (Burchell et al., 2006). Nevertheless, evidence is mounting to support the association of orally transmitted HPV infection with head and neck squamous cell carcinomas, and oropharyngeal cancer in particular (Gillison et al., 2000; Gillison & Shah, 2001; Hennessey, Westra, & Califano, 2009), as risk for oral and genital HPV infection increases with greater numbers of lifetime

oral and vaginal sexual partners (D'Souza, Agrawal, Halpern, Bodison, & Gillison, 2009).

Impact on Cervical Cancer Outcomes

Because the prophylactic quadrivalent vaccine only protects against four HPV types and is not therapeutic (does not treat HPV infections or cervical cancer), it alone will not eliminate cervical cancer. Therefore, continued cervical cancer screening is recommended (Harper & Paavonen, 2008). The projected benefits of mass HPV immunization are considerable, as the ACS estimates a potential reduction of cervical cancer risk by 70% with the vaccine's use over many decades (Saslow et al., 2007). Such a decline in cervical cancer rates will depend on the number of carcinogenic HPV types targeted by the prophylactic vaccine, durability of protection, degree of vaccination coverage of the at-risk population, and whether the medical community and the public continue to follow recommended screening guidelines (Saslow et al., 2007). Therefore, promotion of HPV vaccine uptake is critical.

Importance for High-risk Populations

Of particular importance is vaccination among immunocompromised groups at high risk for HPV-related complications [e.g., human immunodeficiency virus (HIV)-infected youth, organ transplant recipients, pediatric survivors of Hodgkin's lymphoma, or childhood cancer survivors who received hematopoietic stem cell transplantation or pelvic irradiation]. See the "Future Directions" section of this manuscript for an expanded discussion of the HPV vaccine and its implications for pediatric high-risk populations.

Estimates of Current Uptake

There is a growing literature on the implementation of the HPV vaccine,

including the many factors contributing to a family's decision to vaccinate a daughter. Numerous clinical trials were conducted prior to the quadrivalent HPV vaccination's approval by the FDA, and at least 21,000 females were vaccinated over four clinical trials (FDA, 2006a). Currently, more than 7 million doses have been distributed [Centers for Disease Control and Prevention (CDC), 2007a]. One of the first studies to estimate rates of HPV vaccination among sexually experienced females aged 13–26 years found that only 5% of participants had received at least one HPV vaccine dose (Kahn, Rosenthal, Jin, Huang, Namakydoust, & Zimet, 2008). In October 2008, the CDC published results from the 2007 National Immunization Survey—Teen (NIS-Teen) stating that 25% of U.S. females aged 13–17 years initiated the HPV vaccine series, translating into ~2.5 million girls (CDC, 2008). Additionally, 66% of participants in the former study reported intentions to initiate the vaccine; however, 68% of these participants tested HPV-positive (Kahn, Rosenthal, Jin, Huang, Namakydoust, & Zimet, 2008). Regardless, these rates of vaccine initiation are significantly lower than the goal proposed by the Healthy People 2010 initiative to increase vaccination coverage levels for adolescents aged 13–15 years of age to 90%.

Influences on HPV Vaccination Decisions

Physician Recommendations

Health care professionals' (pediatricians' as well as obstetrician/gynecologists') recommendations for HPV vaccination are likely to influence both parent and adolescent decision making in regard to receiving the vaccine (Zimet, Mays, & Fortenberry, 2000). Adolescents are more likely to be seen by a pediatrician than any other health care provider, and medical providers have considerable influence on their patients' immunization decisions (Zimet, Mays, Winston, et al., 2000; Ziv, Boulet, &

Slap, 1999). Pediatrician attitudes and intentions of recommending HPV vaccination appear to promote successful immunization delivery (Daley et al., 2006). Immunization recommendations have been shown to be influenced by personal and professional characteristics (e.g., age, practice location, HPV knowledge, beliefs about patients' sexual experience/history, comfort in discussing sexual behaviors, beliefs regarding impact of immunization on adolescent sexual behaviors), office procedures (e.g., vaccinating children during sports physicals, ill visits, reminder calls), and vaccine cost and reimbursement (Kahn et al., 2005; Kahn et al., 2007). An additional influence is parental factors, such as vaccination requests, denial that child is at risk, concerns regarding vaccine safety and riskier adolescent behaviors, reluctance regarding STI immunization and sexuality discussion with child, and the belief that child receives too many vaccines (Daley et al., 2006; Kahn et al., 2005; Kahn et al., 2007). Pediatrician intention to recommend HPV vaccination has been found to be higher for adolescents who were older and female (Kahn et al., 2005). Additionally, there is evidence that pediatricians are less likely to recommend vaccination when they are male, uncomfortable discussing sexuality issues with female patients, and not in the practice of prescribing oral contraceptives (Daley et al., 2006).

Intention to recommend is a powerful predictor of actual recommendation behavior. In a study undertaken prior to licensure of an HPV vaccine, 10% of pediatricians surveyed reported being unlikely to recommend HPV vaccination to patients of any age; and although 90% of providers would recommend the vaccine, only 46% of sampled pediatricians anticipated administering the HPV vaccine to the targeted age group of 10–12-year-old females (Daley et al., 2006). Pediatricians' intention to recommend HPV vaccination appears also to be influenced by endorsement of vaccination

practices by nationally recognized advisory groups. For example, in a study of HPV immunization and intention to recommend, nearly all surveyed providers indicated intentions to follow immunization recommendations of the ACIP (94.5%), CDC (98%), and American Academy of Pediatrics/Redbook (99.8%); however, the study did not assess the number of pediatricians who actually have recommended the HPV vaccine (Kahn et al., 2005).

Parental Attitudes toward Vaccination

Parental attitudes are key to understanding HPV vaccination outcomes. Prior to HPV vaccination approval and soon thereafter, parents demonstrated a poor understanding of HPV (i.e., were not well informed of a vaccine for the virus, reported little or no knowledge of HPV, and were unaware of the associations of HPV with Pap testing and with cervical cancer); however, parents reported high levels of interest in STI/HPV vaccination for their adolescents (Brewer & Fazekas, 2007; Zimet, Liddon, Rosenthal, Lazcano-Ponce, & Allen, 2006). A number of factors have been evaluated with regard to parental support for/resistance to HPV immunization. Parent socio-demographic variables including ethnicity, age, education, and religion do not appear to be correlated with acceptance of HPV vaccination (Brabin, Roberts, Farzaneh, & Kitchener, 2006; Marlow, Waller, & Wardle, 2007a), although preliminary reports suggest that African-American caregivers may be less aware of and informed about HPV vaccination than Caucasian caregivers (Ragin et al., 2009). Conversely, other medical and demographic factors (e.g., history of HIV testing, having an older daughter, higher number of lifetime sexual partners) as well as socio-environmental factors (e.g., having had a family member with cancer, belief that the vaccine would be accepted by peers/partners) are associated with acceptance of HPV vaccination (Gerend, Lee, & Shepherd, 2007; Kahn, Rosenthal, Hamann, &

Bernstein, 2003; Marlow et al., 2007a). In a study conducted by Slomovitz and colleagues (2006), the majority of women surveyed were accepting HPV vaccine for themselves and their children. A history of abnormal Pap test was not shown to be related to the women's acceptance of the HPV vaccine for either themselves or their children; however, mothers' willingness to vaccinate offspring against HPV was associated with their willingness to obtain the vaccination themselves and with whether their children had received all previously recommended immunizations. A greater belief in the protection of childhood vaccines in general, as well as greater belief in the protection offered by HPV vaccination, have been found to be correlated with HPV vaccine acceptability for both sons and daughters (de Visser & McDonnell, 2008). Perceived physician encouragement, HPV-related knowledge, and other parental Health Belief factors also appear to be associated with a positive parental attitude toward immunization (Brewer & Fazekas, 2007).

In contrast, parental anxiety regarding vaccine safety, conservative religious/cultural views, belief that vaccination encourages sexual activity, specific HPV vaccine and general vaccine matters, moral issues about sexuality, denial of daughter's risk status, lack of disease-specific knowledge, risk of unknown harmful side effects, and low concern for child's HPV acquisition have characterized the opposition that some parents have to HPV vaccination (Brabin et al., 2006; Brewer & Fazekas, 2007; Constantine & Jerman, 2007; Mays, Sturm, & Zimet, 2004; Slomovitz et al., 2006). Mothers who have delayed, refused, or regretted a previous pediatric immunization have also been reportedly less inclined to accept HPV vaccination (Marlow, Waller, & Wardle, 2007b). Although HPV vaccination acceptance is high among parents, mothers have endorsed the belief that vaccination will result in risk compensation (i.e., increased risky sexual

behavior), which may predict non-acceptance of HPV vaccination (Marlow, Forster, Wardle, & Waller, 2009).

Parent–child communication regarding adolescent protective sexual health is an important component of parental consideration of HPV immunization, as parents who discussed the HPV content with their children are more likely to support vaccination (Brabin et al., 2006). Furthermore, mothers willing to discuss cervical cancer, sex, STIs, or HPV with their daughters at earlier ages are more likely to accept HPV vaccination and have been shown to be in favor of early age vaccination (Marlow et al., 2007a). Parents finding it difficult to discuss sex with their children were least likely to agree with HPV vaccination (Brabin et al.). Furthermore, it has been reported that mothers are prepared to discuss the HPV vaccine when discussing cervical cancer, though would not discuss HPV or STIs until their daughters were older. This suggests that some mothers prefer to explain HPV vaccination as one "against cancer" and avoid details about protecting against STI infection until the child is older (Marlow et al., 2007a). It may be important to examine whether a child's age influences the occurrence and/or content of parental communication about sex and subsequently family decisions regarding HPV vaccination. What parents tell their children and adolescents about HPV and its vaccination is likely to be a function of the child's developmental level.

Adolescent Attitudes toward Vaccination

As the familial decision to obtain HPV immunization involves adolescent perceptions as well as parental factors, and because it is recommended that health care decisions for older children and adolescents strive for assent of the patient in addition to parental and physician participation (Committee on Bioethics, 1995; Constantine & Jerman, 2007), the effectiveness of

cervical cancer prevention will rely on improving cancer-related knowledge among adolescents. Many young women have never heard of cervical cancer, and limited knowledge about HPV symptoms and Pap testing has been noted among adolescents (Dell, Chen, Ahmad, & Stewart, 2000; Mays et al., 2000; Mosavel & El-Shaarawi, 2007). Adolescent knowledge of HPV appears to be influenced by physicians and health educators, peer groups, and media. Young women familiar with HPV and the vaccine have reported receiving their information at school, from a doctor, and/or via television (Hoover, Carfioli, & Moench, 2000), with most receiving information from school classes and media sources (Dell et al., 2000).

Current research on adolescent attitudes regarding HPV immunization separate from parental attitudes is limited in scope, perhaps reflecting the dominant role of parents in the vaccination decision. Adolescents often contribute to the familial decisions regarding HPV vaccination, and adolescent attitudes have been found to be similar to those of their parents regarding vaccine efficacy, the influence of recommendations by health care professionals, and consideration of vaccine cost (Zimet, Mays, Winston, et al., 2000). Studies on adolescent acceptance of STI vaccination have shown high levels of acceptance, with acceptance influenced by perceptions of vaccine characteristics (cost, efficacy), adolescents' health beliefs, provider recommendations, increased perceived susceptibility to STIs such as HIV, and perceived benefits of immunization (Rosenthal, Kottenhahn, Biro, & Succop, 1995; Zimet, Blythe, & Fortenberry, 2000; Zimet, Fortenberry, & Blythe, 1999; Zimet, Mays, Winston, et al., 2000). In contrast, greater perceived obstacles (e.g., difficulty keeping clinic appointments), fear of the vaccine causing infection, low perception of risk, and fear of needles have been found to be related to lower acceptability of a vaccine for STIs (Zimet et al., 1999).

Although adolescents report high levels of acceptance, HPV vaccination intentions, self-efficacy (or belief in their ability to initiate vaccination), and actual vaccination rates are reportedly low (Kahn, Rosenthal, Jin, Huang, Namakydoust, Rosemore et al., 2008). In addition to health beliefs, history of pregnancy and consistent condom use have been associated with adolescents' intent to receive the vaccine, whereas correlates of higher self-efficacy to initiate vaccination have included insurance coverage, history of STI, fewer perceived barriers to vaccination, higher perceived severity of HPV, and current smoking (Kahn, Rosenthal, Jin, Huang, Namakydoust, Rosemore et al., 2008; Kahn, Rosenthal, Jin, Huang, Namakydoust, & Zimet, 2008). Although parents may have concerns about vaccinating before sexual debut, 90% of adolescents and young women have reported that the best time for females to receive HPV vaccination is before becoming sexually active (Hoover et al., 2000).

Adolescent Vaccination Completion

Studies assessing maternal and adolescent correlates of HPV vaccination completion have focused primarily on demographic factors and have found that lower maternal education, increased patient age and grade level, along with residing in a northern region of the USA, all related to increased vaccine completion (Rosenthal et al., 2008; Vanable, Carey, Brown, Bostwick, & Kraus, 2009). As mentioned above, results from an earlier study (Slomovitz et al., 2006) indicated that mothers' history of abnormal Pap results was not associated with the fact that they were accepting HPV vaccine for themselves and their children; on the other hand, in a more recent study, maternal health factors associated with daughters' HPV vaccine initiation included history of cervical cancer screening and abnormal Pap test result or STI (Chao, Slezak, Coleman, & Jacobsen, 2009). Among adolescents, greater knowledge, being sexually active, and greater

health care provider trust have been associated with increased rates of vaccination (Vanable et al., 2009). In a qualitative study comparing reasons why mothers do or do not vaccinate their adolescent daughters for HPV, lack of knowledge about HPV, age-related concerns, and low perceived risk of infection were commonly cited reasons for declining vaccination; whereas desire to prevent illness, physician recommendation, and a high perceived risk of infection were commonly identified motivating factors (Dempsey, Abraham, Dalton, & Ruffin, 2009).

Decision Making Regarding Childhood Vaccination

It is helpful to investigate family decision making toward general childhood immunizations in order to understand the decision to obtain the HPV vaccine in particular. Factors such as health care providers' attitudes and recommendations, as well as parent and adolescent beliefs and attitudes remain consistent domains of influence across the general vaccination literature (Sturm, Mays, & Zimet, 2005). Decisions to immunize one's child may also be influenced by social-environmental factors (e.g., cultural beliefs), and parent-specific or personal factors (e.g., perceptions of susceptibility). Additional influences on decision making are familial interface with the health care system (e.g., health care provider attitudes/recommendations), institutional policies and interventions related to vaccines (e.g., federal and states mandates for school enrollment), media influences, peer norms, as well as the physical environment of health (e.g., background prevalence of a vaccine-preventable disease; Sturm et al., 2005). Parents' acceptance of general childhood vaccines may be influenced by inaccurate beliefs, such as the worry that the measles, mumps, and rubella (MMR) vaccine causes autism that has led some parents to question whether to vaccinate their children. Additionally, vaccines have sometimes

been considered only partially successful, as parents cited susceptibility to chickenpox following vaccination as contradiction of vaccine utility (Keane et al., 1993). In order to achieve HPV vaccine acceptance among parents and adolescents, it is necessary to evaluate current perceptions of vaccine effectiveness and provide accurate HPV-specific educational information because HPV vaccine acceptability is influenced by the same theoretical constructs that have been crucial to the uptake of other vaccines (Brewer & Fazekas, 2007).

Sexual Communication

Decisions to vaccinate against a STI are influenced by parental and adolescent attitudes toward sexual behavior, because beliefs about adolescent contraception use, as well as parent–child sexual communication, may affect familial vaccination decisions. Mothers have been found to be the primary communicators with adolescents on sex-related topics, and to be more likely to discuss sexual matters with daughters than with sons. Furthermore, mother–daughter pairs are more likely to discuss topics such as birth control, reproduction, physical and sexual development, and sexual pressures, than HIV or AIDS and choosing a sexual partner (Miller, Kotchick, Dorsey, Forehand, & Ham, 1998). This may have important implications for evaluating HPV vaccine decision-making processes within the family, considering vaccination in the USA is currently only approved for females. Also, it is possible that maternal, as opposed to paternal, messages are most relevant.

Parents who communicate more openly with their adolescents regarding sexual topics are more likely to discuss the use of contraceptives, and it is crucial to examine what influences parents to discuss sexual topics since HPV is acquired via sexual behavior. Self-efficacy, beliefs about

contraception and sexuality, child's age, and accurate knowledge appear to influence parental engagement in discussions of sex-related topics with adolescents. Parent–child communication on sexual topics may be influenced by factors such as parents' skill, comfort, and openness in discussing sexuality; thus, many parents have reported feeling uncomfortable discussing sexual topics with their teens, particularly parents unfamiliar with medically accurate information (Jaccard, Dittus, & Litardo, 1999; McNeely et al., 2002; Whitaker, Miller, May, & Levin, 1999). Similar to concerns about condoning HPV vaccination, some parents have been reluctant to discuss the option of birth control with their adolescents for fear that approval of birth control will encourage adolescents to engage in sexual activity (Jaccard & Dittus, 2000); however, school-based sexual education program's safer sex educational components have not been shown to increase sexual activity (Kirby & Coyle, 1997). In other cases, parents may discuss various sexuality topics, but wait until they believe their teen has been romantically involved, missing important opportunities to influence behavior prior to sexual debut (Eisenberg, Sieving, Bearinger, Swain, & Resnick, 2006). When children are older and more physically developed, it is more likely that a discussion regarding safe sex practices will take place (Lefkowitz, Boone, Au, & Sigman, 2003). Parents' decisions for whether to vaccinate against a STI such as HPV may involve fear of increased risky sexual behavior and involve waiting until a teen is already at risk, not unlike findings from research on parents determining whether to discuss or approve contraception for their adolescent.

With regard to concerns about increased adolescent sexual behaviors if vaccinated for HPV, the adolescent sexual health literature emphasizes the importance of communication within families regarding topics of sexual behavior, because communicating with one's children regarding safe sexual

practices has been shown to influence teens' sexual behaviors. Higher levels of sexual communication between parents and teens have been associated with stronger beliefs regarding the effectiveness, safety, and usability of condoms and oral contraceptives (Swain, Ackerman, & Ackerman, 2006). Discussion regarding condom use are particularly relevant for HPV prevention since condom use has been shown to effectively reduce the risk of male-to-female genital HPV transmission (Epstein, 2005; Winer et al., 2006). Early maternal discussions about safe sexual practices promote condom use at first intercourse, and thus subsequent condom use, and emphasis should be placed on receiving information about contraception prior to initiating sexual intercourse (Miller, Levin, Whitaker, & Xu, 1998). Given that there is an intrinsic adolescent sexuality component to HPV vaccine utilization, comprehensive examination of influences on familial decision to vaccinate for HPV must consider parental demographics, efficacy beliefs, and parent–adolescent communications involving sexual health behaviors.

Future Directions

Findings from this review reveal factors that contribute to parental decisions regarding adolescent HPV vaccination including physician recommendations, history of obtaining other recommended childhood immunizations, and communication with adolescents regarding sexual topics such as contraception. Perceptions of being at-risk for HPV, perceived benefits of immunization, vaccine efficacy, and beliefs that significant others would approve, appear to meaningfully sway adolescent decisions on HPV immunization. This review emphasizes the need to develop interventions to increase HPV vaccine uptake by identifying risk factors which could be modified via intervention.

Prospective interventions should aim to educate parents and adolescents on the health benefits of HPV vaccination. Specific benefits of such immunization include a clinically acceptable safety profile, high efficacy against disease caused by the vaccine types, and widespread use of a prophylactic HPV vaccine that could reduce lesions and cancers caused by HPV (Dunne, Datta, & Markowitz, 2008; Harper et al., 2006). By addressing patient knowledge levels, physicians may no longer perceive negative parental reactions as barriers to vaccination of the targeted age group.

Though adolescents' independent requests for HPV vaccination are important to consider, because the recommended age for vaccination is considerably younger than the age at which an adolescent would seek health care on her own, HPV vaccination decisions are likely primarily driven by parents, with daughters contributing to such health decisions differentially based on their age and development. Research suggests that parents favor a joint decision with their child on whether to receive the vaccine (Brabin et al., 2006), and it has been recommended that the vaccine be offered when adolescents can participate in the immunization decision based on their developmental level (Olshen, Woods, Austin, Luskin, & Bauchner, 2005).

Future research should also focus on understanding the factors which relate to HPV vaccination particularly among high-risk populations such as those who are immunocompromised or are less likely to engage in cervical cancer screening. As a result, study of HPV vaccine acceptability and completion is needed among childhood and young adult cancer survivors with altered immunity outcomes post treatment (particularly those treated with hematopoietic stem cell transplantation or pelvic irradiation and those diagnosed with Hodgkin's lymphoma), because impaired immune function is responsible for the increased rates of cervical and oral dysplasia

experienced by these groups (Klosky et al., 2009). Those with HIV are also at increased risk for HPV-associated malignancies, are more frequently diagnosed with advanced and difficult-to-treat cervical cancers, and are more likely to experience recurrence after treatment (Di Stefano et al., 2006; Hagensee, Cameron, Leigh, & Clark, 2004; Sirivongrangson et al., 2007). Likewise, young women who have undergone renal, liver, or lung transplantation are at increased risk for HPV-related genital and oral disease, including cancer (Courtney, Leonard, O'Neill, McNamee, & Maxwell, 2009; Rose et al., 2006).

In addition to increased medical risk for HPV-related susceptibility and complication experienced by these pediatric groups, behavioral and cognitive indicators also contribute to their high-risk profile. After adjusting for age, ethnicity, education, income and health insurance, women surviving childhood cancer have been found to be significantly less likely than their healthy siblings to have undergone a Pap smear within the previous three years (Yeazel et al., 2004). It has also been suggested that survivors who perceive themselves to be infertile as a result of cancer therapy may engage in riskier sexual behaviors, which in turn, increases HPV exposure risk (Zebrack, Casillas, Nohr, Adams, & Zeltzer, 2004). Similarly, some HIV-infected youth have been reported to continue to engage in risky behaviors, including unsafe sex, following a diagnosis of HIV (Diamond & Buskin, 2000).

Cognitive declines are associated with HIV infection (Smith et al., 2006) and cancer treatment, and have been considered as contributors to riskier sexual behaviors and HPV acquisition. For example, up to 40% of survivors of childhood cancer have neurocognitive deficits, with inattention and hyperactivity being among the most commonly reported late effects of

treatment (Moleski, 2000; Mulhern, Fairclough, & Ochs, 1991). In the general population, evidence exists linking inattention and/or hyperactivity to increased risky sexual behavior, including earlier initiation of sexual activity and intercourse, increased number of sexual partners, increased casual sexual encounters, and increased partner pregnancies (Flory, Molina, Pelham, Gnagy, & Smith, 2006). Based on this risk profile, the Children's Oncology Group's Long-Term Follow-Up Guidelines for Survivors of Childhood, Adolescent and Young Adult Cancer Version 3.0 (which serves as the gold standard in the screening for late effects that may arise due to treatment of pediatric cancer) has recommended HPV vaccination for all eligible females surviving childhood cancer (American Academy of Pediatrics Section on Hematology/Oncology Children's Oncology Group, 2009).

Conclusion

Vaccination against HPV has the potential to significantly reduce lifetime risk of cervical cancer (CDC, 2007b; Goldie et al., 2004; Sanders & Taira, 2003). Primary prevention of cervical and other cancers associated with HPV is best achieved if vaccination occurs before sexual debut, because HPV is sexually transmitted and often acquired soon after onset of sexual activity (CDC, 2007b). Physician recommendations, parental and adolescent health beliefs, perceptions of significant others' and peer approval, history of childhood immunizations, and parental communication with adolescents regarding sexual topics have been found to be influential in familial decision making regarding HPV immunization. Although the endorsement of the HPV vaccine by national advisory groups is an important first step, HPV vaccination remains underutilized. Interventions are needed to translate these recommendations into a successful HPV vaccination

strategy.

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