

User-Centered Design for Developing Interventions to Improve Clinician Recommendation of Human Papillomavirus Vaccination

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ABSTRACT

Introduction: Human papillomavirus (HPV) is the most common sexually transmitted infection in the US and is associated with multiple types of cancer. Although effective HPV vaccines have been available since 2006, coverage rates in the US remain much lower than with other adolescent vaccinations. Prior research has shown that a strong recommendation from a clinician is a critical determinant in HPV vaccine uptake and coverage. However, few published studies to date have specifically addressed the issue of helping clinicians communicate more effectively with their patients about the HPV vaccine.

Objective: To develop one or more novel interventions for helping clinicians make strong and effective recommendations for HPV vaccination.

Methods: Using principles of user-centered design, we conducted qualitative interviews, interviews with persons from analogous industries, and a data synthesis workshop with multiple stakeholders.

Results: Five potential intervention strategies targeted at health care clinicians, youth, and their parents were developed. The two most popular choices to pursue were a values-based communication strategy and a puberty education workbook.

Conclusion: User-centered design is a useful strategy for developing potential interventions to improve the rate and success of clinicians recommending the HPV vaccine. Further research is needed to test the effectiveness and acceptability of these interventions in clinical settings.

INTRODUCTION

Human papillomavirus (HPV) is the most common sexually transmitted infection in the US.¹ This infection is associated with cervical, anal, and oropharyngeal cancers, as well as genital warts. The Advisory Committee on Immunization Practices recommends vaccination to prevent infection from the most common cancer-causing types of HPV.^{2,3} The first HPV vaccine became available in 2006; however, the national coverage estimates for 2014 show that only 60% of US female teenagers aged 13 to 17 years begin the vaccine series (≥ 1 dose) and 40% complete the series (≥ 3 doses). For male adolescents, initiation and completion rates in 2014 were only 42% and 22%, respectively.⁴ Although the HPV vaccination

coverage rate for both female and male adolescents has improved during the past several years, it remains lower than with other adolescent vaccinations such as tetanus-diphtheria-acellular pertussis and quadrivalent meningococcal conjugate vaccines, which had national coverage rates at 88% and 79% in 2014, respectively.⁴

A clinician's recommendation for vaccination has been consistently demonstrated as one of the best predictors of vaccine acceptance.⁵⁻¹¹ However, a 2014 national survey of parents of adolescents found that 48% of parents reported no clinician recommendation for HPV vaccination and 16% reported receiving low-quality recommendations.¹² Only 36% reported receiving high-quality recommendations. In addition, the odds of vaccine initiation were 9 times higher when parents received high-quality recommendations vs no recommendation. Gilkey et al¹² defined high-quality recommendations as having 3 components: strength of endorsement (clinician described the HPV vaccine as "very" or "extremely" important), prevention message (clinician said the HPV vaccine prevents cancer), and urgency (clinician recommended same-day vaccination). Some research suggests that clinicians may procrastinate in recommending the vaccine to younger adolescents and do not consider their patients "off schedule" until they reach age 26 years, the upper limit of the recommended age range for vaccination.¹³ Another study suggested that a clinician's recommendation might be even more critical in improving vaccination rates in male patients. When asked for a reason for not vaccinating, parents of sons were most likely to report that the clinician did not recommend the vaccine and that the parent did not know the vaccine was available for boys.¹⁴

Educational interventions can improve clinicians' knowledge and beliefs about the HPV vaccine.^{15,16} Because clinicians are uniquely positioned to educate patients and parents, providing needed supports for clinician behavior change and empowering clinicians to recommend the vaccine could greatly increase HPV vaccine coverage. However, traditional intervention methods, such as clinician education and public awareness campaigns, are not having a large impact on HPV vaccination rates, which have plateaued at a level well below those of other adolescent vaccines that are required for school attendance.^{17,18}

In this study, we employed user-centered design to develop interventions to help clinicians communicate more effectively about HPV vaccination. Although user-centered design is increasingly

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being used to drive innovation in health care and other industries,^{19,20} it has not been used to design tools for improving vaccine uptake. User-centered design is a promising method to address low uptake of the HPV vaccine because the largest hurdle to improving uptake seems to be ineffective or insufficient communication among clinicians, parents, and teenagers about the vaccine.

METHODS

This project was conducted at the Kaiser Permanente Center for Health Research in Portland, OR, between September 2014 and August 2015. The Kaiser Permanente Northwest (KPNW) institutional review board determined this project to be exempt from institutional review board review.

User-Centered Design

User-centered (also known as “human-centered”) design is increasingly being used to drive innovation in health care and other industries.¹⁹ User-centered design employs “design thinking,” system science, and ethnographic methods to obtain creative, implementation-ready solutions to complex problems. This approach focuses on the needs and preferences of the people who will ultimately be affected by clinical or policy changes. As a result, health care interventions designed according to these principles will suit the needs of time-constrained clinicians and staff and will operate within the complex structure and workflows of health care delivery organizations.^{21,22}

The user-centered design cycle includes six steps: 1) understanding the environment, 2) framing opportunities, 3) imagining possibilities, 4) prototyping, 5) piloting, and 6) spreading innovation. We adopted the Kaiser Permanente user-centered design methods²³ and referred to design resources such as the Stanford Design Program’s workshop modules²⁴ and previous experience holding workshops to engage stakeholders in priority setting to plan our approach for identifying intervention opportunities to improve postoperative recovery. For the current study, our goal was to complete the first three steps to generate one or more innovative intervention ideas that might be developed and tested in future work.

Interviews

Interview participants (N = 14) included 6 primary care clinicians, 5 subject matter experts (SMEs), and 3 representatives from analogous industries (described below). The primary care clinicians were current or former KPNW pediatric or family medicine physicians who volunteered to be interviewed for this project. The SMEs included 2 KPNW clinician performance consultants, a program coordinator from KPNW Clinical Quality Support Services, a social marketing and health communications consultant (JT), and a PhD-level researcher from a partner institution who specializes in vaccine compliance research (NH). Analogous industry representatives included a middle school guidance counselor, a marijuana legalization activist, and a retail curriculum expert from a large athletic retail company.

Two project team members (CM and AF) conducted semistructured interviews²⁵ in person or by telephone. Interview guides were developed by the project team and included questions about knowledge, attitudes, and beliefs about HPV vaccination; typical workflow; potential barriers to recommending vaccination; and

tools or processes that facilitate communication about or recommendation of the HPV vaccine. The interviews were audiorecorded and professionally transcribed to facilitate qualitative analysis.

Once the clinician and SME interviews were completed and findings synthesized by the project team, we consulted with the Kaiser Permanente Innovation Consultancy²⁶ to identify three analogous industries outside health care that had the potential to inform effective clinician endorsement of the HPV vaccine. We articulated the problems for which we were trying to design solutions before proceeding with analogous industry interviews. The problems we identified were as follows: 1) clinicians must communicate with both parents and teens, who may have different priorities and values; 2) clinicians must communicate about issues that may raise a taboo subject (ie, adolescent sexuality); and 3) clinicians need effective tools, training, or professional orientation to help them communicate more effectively with their patients. With these problems in mind, we selected a middle school guidance counselor because of that person’s relevant experience advising parents and teens who may have different or even competing priorities. The marijuana legalization activist had the potential to offer unique insight into normalizing taboo or potentially stigmatizing topics, such as the link between HPV and sexually transmitted infections. Finally, the retail curriculum expert offered insight into training retail personnel to engage with customers and endorse products effectively.

Rapid Assessment Technique

We used rapid assessment techniques^{27,28} to analyze qualitative interview data. Specifically, the interviewers (CM and AF) verbally debriefed the research team after each interview to summarize observations and key ideas. At least two team members reviewed each interview transcript; recurring themes and selected interviewee quotes were summarized in a spreadsheet (Microsoft Excel, Microsoft Corp, Redmond, WA) that was subsequently used in data analysis meetings.

Data Analysis Meetings

The research team held 3 internal data analysis sessions to synthesize findings from qualitative interviews by using methods from the Hasso Plattner Institute of Design at Stanford University, Stanford, CA.²⁹ The first 2 meetings focused on synthesizing data from the clinician, SME, and analogous industry interviews. The final meeting focused on developing and refining brainstorming prompts for use at the workshop. Each data analysis meeting lasted approximately 1.5 to 2 hours.

Workshop

We held a 4-hour data synthesis workshop at the Kaiser Permanente Center for Health Research, which was led by an investigator (CM) with assistance from the other members of our research team. Workshop participants (N = 17) included a KPNW pediatric physician, 2 KPNW clinician performance consultants, a KPNW Health Education program manager, 6 Kaiser Permanente Center for Health Research staff with experience in vaccine research or qualitative research methods, as well as all 6 authors of this article. Several of the stakeholders were also parents of preteens or teens, some of whom had recently discussed HPV vaccination with their

child’s primary care clinician. Therefore, we were able to incorporate parent perspectives in the workshop as well.

The workshop agenda included a summary of the qualitative data analysis, presentation of brainstorming prompts in the form of “How might we?” statements (see Sidebar: “How Might We ... ?” Questions Developed for a Data Synthesis Workshop), and an overview of the brainstorming process. Attendees then met in small groups to discuss the brainstorming prompts and develop at least one idea for a potential intervention. Each small group presented its favorite idea to the larger group, and all attendees voted on the best concepts. Each attendee voted for up to three intervention concepts. Approximately two weeks after the workshop, we conducted a one-hour follow-up Webinar to debrief and summarize the results of the workshop with the participants.

RESULTS

Four primary themes emerged regarding how clinicians approach discussing the HPV vaccine with parents: 1) the importance of enhancing parents’ trust in the clinician, developing rapport between

“How Might We ... ?” Questions Developed for a Data Synthesis Workshop

How might we ... ?

- Improve how clinicians communicate with parents and patients to enhance trust and rapport?
- Reframe discussions about human papillomavirus vaccination as opportunities for partnership and advocacy rather than as potentially difficult conversations?
- Help clinicians to elicit and understand each parent and patient’s concerns about vaccination so that these can be accurately and effectively addressed?

the clinician and the parent, and effective communication skills on the part of the clinician; 2) clinician knowledge about common parental concerns about vaccination; 3) the ability to develop talking points and messaging to effectively address these common concerns; and 4) increasing clinicians’ comfort with discussing difficult topics with their patients or parents (Table 1).

Table 1. Summary of clinician and subject matter expert interviews		
Theme	Insights	Illustrative quotes
Enhancing trust, rapport, and communication skills	Agenda setting/managing the visit effectively Patience and persistence with patients and parents Using scripts and talking points to engage in positive conversations Establishing trust before making a recommendation Self-disclosure (“I’m a parent too”; “Here’s what I did”) Use of motivational interviewing techniques; eliciting and addressing specific concerns of patients and parents	“For the most part I wait until the very end of the visit so I’ve had a chance to talk with them, show I care about them as a person. We have talked about other things. Of course, it is like the number one thing I’m going to do in that visit, but they don’t know that.” “I have the most success getting vaccination rates when I build trust and allow people the time to make the decision. So, I have that in the back of my mind as well—that I have a little bit of time.”
Enhancing clinician knowledge about parental concerns	Safety concerns (new vaccine, side effects, painful) Age-related concerns (11-13 too young) Sexuality concerns It’s “extra” or “optional” so not important Sexual gender-related concerns (“just for girls”)	“Because it’s a newer vaccine, they feel like they ... want to give it some more time and see how it works for other people first. Not their own kid.” “If they refuse, it’s usually because it’s an assumption that this is a license to be sexually active.” “They still want him to be a kid ... parents are in denial. They just don’t want to be talking about it yet.”
Crafting talking points/messaging	Increased focus on cancer prevention Decreased focus on sexually transmitted infections Tying vaccination recommendation into “coming of age” messaging Emphasizing benefits of early vaccination Importance of vaccination: “It changes lives” HPV for males: We recommend for everyone Protects gay men Prevention of regret later if child doesn’t get vaccinated now (personal stories)	“It’s a vaccine that works better if you start it before you become sexually active. That’s why we’re recommending it in the 11- to 13-year-old population.” “The part to me that’s just incredible is that we have a vaccine that can prevent [some cancers]. So, I’m really excited about it.” “I was skeptical when it initially came out [but] the data [have] gotten better and better ... I’m really seeing a difference in my adult patients now who’ve had the vaccine and those who haven’t, in terms of their gynecologic health.” “This is a vaccine that is changing people’s lives.”
Increasing clinicians’ comfort with discussing difficult topics	Clinicians may be uncomfortable with the topic of teen sexuality and thus hesitate to bring up vaccination, especially with younger patients (aged 10-11 years). There is a disconnect between clinicians’ perception and the reality of parents’ attitudes (parents less “hung up” on sexual activity than clinicians think) Religious beliefs: Some clinicians might not mention the vaccine because of association with sexual activity Some clinicians struggle with the conversation; others do it well	“What we saw is that hesitancy of clinicians to engage parents around the need for HPV vaccination because of perceived hang-ups around the whole sex issue thing. That clinicians basically think that parents have a lot of hang-ups because of low likelihood for kids of that age to be sexually active, when in fact it seems like parents don’t have a lot of hang-ups with that.”

HPV = human papillomavirus.

Many themes that emerged from the analogous industry interviews (Table 2) were consistent with findings from the clinician and SME interviews: the importance of developing rapport, constructing effective messages that are salient to the receiver, and the willingness to keep trying when first attempts are unsuccessful. However, we also revealed some additional strategies, such as approaching the conversation as a “wellness advocate” (rather than as an expert), speaking in terms of “benefit language” (rather than technical language), and using compelling storytelling.

Stakeholders who participated in the data synthesis workshop generated 5 potential intervention concepts (Table 3), with 2 intervention concepts receiving greater than 50% of the attendees’ votes. The most popular intervention concept, a “shared values approach,” emphasizes determining the parent’s values as they relate to vaccines and constructing messaging salient to these values. The second most popular intervention idea, *Ready, Set, Grow!* involved developing a puberty education workbook that would include information about adolescent vaccines and a tear-out worksheet to help prepare adolescent patients for discussing HPV vaccination at their next clinician visit.

DISCUSSION

Although coverage rates of other adolescent vaccines such as tetanus-diphtheria-acellular pertussis or quadrivalent meningococcal

conjugate meet or exceed Healthy People 2020 targets,³⁰ the HPV vaccination coverage rate remains lower. Four leading medical associations, in collaboration with the Immunization Action Coalition and the Centers for Disease Control and Prevention, recently issued a call to action stressing the importance of clinicians educating their patients or parents about HPV and to strongly recommend vaccination against HPV.³¹ The American Academy of Family Physicians describes a strong recommendation as one that emphasizes the safety, effectiveness, and importance of vaccination.³² As well, the Centers for Disease Control and Prevention’s “You Are the Key to HPV Cancer Prevention” campaign aims to improve the knowledge of clinicians about HPV-related cancers and vaccination, and it offers effective tools for discussing HPV vaccination with their patients or parents.³³

Prior research has suggested that clinicians may communicate differently about HPV vaccine compared with the other adolescent vaccines.¹² For example, clinicians may frame the HPV vaccine as less important than the other vaccines or may even suggest deferring the vaccine to a later visit. A 2016 systematic review by Gilkey and McRee³⁴ found only 2 published studies of interventions designed to improve clinician recommendation of the HPV vaccination. The first study evaluated a social marketing campaign to increase initiation of HPV vaccination in

Industry	Insights	Illustrative quotes
Guidance counseling	Counselor often recommends interventions that parents and kids do not want Psychological counseling Educational testing If you see yourself as an advocate, you keep trying Raise the difficult issue repeatedly	“[S]ometimes parents don’t want to hear what you have to say. And sometimes they are not going to take your advice or recommendation. That doesn’t mean I’m not going to make it.” “So, if they don’t follow through the first time, connect again. Try to make that connection again with them.”
Marijuana policy reform	Find ways to empower those who fear engaging with a topic Reframe as an opportunity to model the kind of [clinician/parent/person] you want to be Transform from expert know-it-all to a “wellness advocate” Use compelling stories Use potentially “taboo” topics as a “gateway” to discussing larger issues	“It really hasn’t been that hard to explain because as we know, ending prohibition is far more logical than continuing down the road with our failed policies ... Trust me, I used to squirm too, but we have to get over it. It’s time to evolve beyond pointing fingers and turn experiences with irresponsible use into teachable moments.”
Athletic sales	Follow three steps to make the sale: Use engagement/rapport Discovery: Explore customer’s needs Close the sale: Craft messaging that resonates Craft an effective message: Be authentic Choose words that affirm your recommendation Be prepared to respond to common objections Employ these training tools and strategies: Use a credible, strong facilitator (eg, famous athlete) Encourage role-playing Include storytelling Build intrinsic motivation Manage ego (adult learning) Speak in “benefit” language, not technical language Develop simple job aids	“In our stores we don’t call [employees] salespeople. We call them athletes. And our job is to use our athletes to equip athletes.” “You should use the words that feel right coming out of your mouth. And it should be authentic to you ... but there are some specific word choices that you can craft that makes people want to say yes.”

preteen girls in rural North Carolina.³⁵ The 3-month campaign included posters, brochures, a Web site, news releases, and physician recommendations. A follow-up survey indicated that 82% of respondent mothers had heard or seen campaign messages and 94% of respondent clinicians had used campaign materials with their patients or parents. Compared with nonintervention counties, vaccination rates in intervention counties increased by 2% within 6 months of the intervention launch.

The second study evaluated a multicomponent decision support intervention targeting both clinicians and families.¹⁷ The clinician components of the intervention included immunization alerts in the electronic medical record, education, and feedback. Additionally, families received telephone reminders when vaccinations were due and a referral to an educational Web site. The study found that although parents from intervention clinics were more likely to discuss HPV vaccination

with their child's clinician, they were no more likely to receive a strong vaccine recommendation from the clinician.

Using a user-centered design approach, this project generated five potential interventions to help clinicians communicate more effectively with parents and youth about HPV vaccination. Two interventions, the "shared values approach" and *Ready, Set, Grow!*, received the most support from multiple stakeholders involved in this project. To our knowledge, neither of these approaches has been tested empirically to date.¹⁷

The "shared values approach" emphasizes the importance of the clinician's ability to assess and to respond to the parent's value system, as well as the social context in which parents are making health care decisions, as it relates to HPV vaccination. Researchers from the Canadian Immunization Research Network have suggested that there are actually several different types of vaccine-hesitant parents and that effective clinician

Table 3. Summary of intervention concepts and preference among 17 workshop attendees

Intervention	Key components of intervention	Attendee votes, no. (%) ^a
Shared values approach (inspiration from sales)	Target intervention at clinician Determine the patient's/parent's value system as it relates to the vaccine, and craft "benefit language" specific to those values Consider the social network/context in which patients and parents are making health care decisions Capitalize on trust in clinician and health organization Draw inspiration from sales approach to help build "demand" for vaccine	13 (76)
<i>Ready, Set, Grow!</i> (puberty education workbook)	Target intervention at patient Develop a set of workbooks for preteens, teens, and parents to celebrate milestone birthdays and/or transitions to middle school and high school Format could be print and/or online, preferably graphic in design and interactive in nature Content would cover a broad range of preventive health issues, including HPV and HPV vaccine and how to communicate effectively with clinician Workbook would encourage teens and parents to discuss key issues at home and complete a tear-out sheet or printout and prepare them to discuss vaccinations with the clinician.	11 (65)
The Pathway to "Yes"	Employ social marketing approach, which could evolve into clinician intervention Develop a messaging framework to effectively promote the benefits of HPV vaccination Conduct opinion surveys and focus groups of teens, parents, and clinicians Develop and test different messaging approaches for recommending the vaccine	8 (47)
Clinician training	Target intervention at clinician Conduct in-person clinician training that uses videos and role-modeling to demonstrate effective communication styles with a focus on building trust and rapport Give clinician toolkit of materials for future reference, including communication tools for use with teens and parents Mentoring approach: Clinicians will receive feedback/data about implementation and will adjust practice iteratively as needed Give continuing medical education credit for training	6 (35)
Workflow for addressing concerns	Target intervention at clinician and clinic-based workflows Before the visit, the staff will mail vaccine reminder letter and worksheet to bring to next visit At the visit, medical assistant will place patient in room and prepare for primary care clinician by reviewing worksheet (or providing again if needed), scaling questions to assess readiness/concerns, and providing educational information as appropriate while waiting for clinician In the examination room, primary care clinician will use appropriate communication tools (eg, motivational interviewing, empathy, conversation guides, or risk reduction graphs) After the visit, for hard or soft refusals, the clinician or staff will provide additional information for home review	4 (24)

^a Each attendee was allowed to vote for up to three intervention concepts.
 HPV = human papillomavirus.

response may differ according to hesitancy type.³⁶ For example, a parent who is misinformed about the safety of the vaccine should be provided with correct information and reassurance, whereas a parent who wants to delay vaccination until the child is older should be provided with reasons why vaccinating on schedule would be preferable. By accurately assessing the parent's values regarding vaccination, the clinician can more adequately respond with "benefit language" specific to those values. This intervention strategy also emphasizes capitalizing on trust in the clinician and the health care organization, for example, empowering the clinician as a resource to help filter through discordant information readily available through the Internet or social media. Specific to the Kaiser Permanente setting, stakeholders emphasized that the vaccination campaign could piggyback on the popular and effective Kaiser Permanente Thrive campaign.³⁷

The second intervention concept, *Ready, Set, Grow!*, would involve a set of workbooks for teens and parents to celebrate milestone birthdays (transitions to middle school and high school). The stakeholders envisioned developing preteen (aged 10-12 years) and teen versions (aged 13-14 years) in print or preferably online formats. The stakeholders emphasized the importance of designing the workbooks to appeal to youth and suggested that a "graphic novel" format that was interactive in nature might be most effective. The workbooks would optimally cover a broad range of preventive health issues, including HPV and the HPV vaccine. However, the emphasis would be on helping youth learn how to critically evaluate health information available from multiple sources and communicate effectively with their clinician. The stakeholders envisioned tear-out (or printout) worksheets that youth could take to upcoming visits with clinicians, with one worksheet specifically devoted to HPV and other adolescent vaccines.

Although user-centered design is a novel and useful approach to addressing emergent health care issues, it also poses special challenges in research settings. Flexibility in incorporating health care clinicians in qualitative interviews and focus groups or workshops is essential because of scheduling constraints and, in some cases, union policies about "volunteering" work time for research efforts. Although we conducted interviews with several clinicians, we were able to arrange for only one clinician to attend the data synthesis workshop. Likewise, we had originally planned a full-day data synthesis workshop but later streamlined our agenda to a half-day workshop to better accommodate our clinician stakeholder.

Another challenge with this type of qualitative research includes ensuring that all the relevant stakeholders are involved and that they have adequate input into the development of the "How Might We?" questions (see Sidebar: "How Might We ... ?" Questions Developed for a Data Synthesis Workshop) to be resolved at the data synthesis workshop. Other limitations of this project were that parents and youth were not included as interviewees (although several of the workshop participants were parents of preteens and teens), and the brainstorming questions for the workshop were developed by the project team without stakeholder input.

The scope of this project was purposefully limited to the first three steps of user-centered design: understanding the environment, framing opportunities, and imagining possibilities. The next three steps are prototyping ideas, piloting solutions, and operationalizing to spread innovation.²³ Prototyping involves quickly and inexpensively trying out ideas and rapid iteration until a final solution is determined. Importantly, end users are actively engaged in the prototype design process. Next, we would pilot the intervention in one or two of our pediatric clinics and assess changes in vaccination rates, as well as feasibility and acceptability to patients, parents, and clinicians. Assuming the intervention was successful, the final step would be to offer the intervention to pediatric clinics throughout the KPNW Region and nationally as appropriate.

CONCLUSION

User-centered design is an effective tool for developing interventions to improve HPV vaccination rates. We identified several potential interventions that could help clinicians communicate more effectively with parents and teens about the HPV vaccine. The next steps are to develop a prototype for an intervention with the input of key stakeholders, including teenagers, parents, and clinicians, and then conduct a pilot study in a clinical setting to assess effectiveness and feasibility. ❖

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References

1. Satterwhite CL, Torrone E, Meites E, et al. Sexually transmitted infections among US women and men: Prevalence and incidence estimates, 2008. *Sex Transm Dis* 2013 Mar;40(3):187-93. DOI: <http://doi.org/10.1097/OLQ.0b013e318286bb53>.

2. Petrosky E, Bocchini JA Jr, Hariri S, et al; Centers for Disease Control and Prevention (CDC). Use of 9-valent human papillomavirus (HPV) vaccine: Updated HPV vaccination recommendations of the advisory committee on immunization practices. *MMWR Morb Mortal Wkly Rep* 2015 Mar 27;64(11):300-4.
3. Markowitz LE, Dunne EF, Saraiya M, et al; Centers for Disease Control and Prevention (CDC). Human papillomavirus vaccination: Recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep* 2014 Aug 29;63(RR-05):1-30.
4. Reagan-Steiner S, Yankey D, Jeyarajah J, et al. National, regional, state, and selected local area vaccination coverage among adolescents aged 13-17 years—United States, 2014. *MMWR Morb Mortal Wkly Rep* 2015 Jul 31;64(29):784-92.
5. Goff SL, Mazor KM, Gagne SJ, Corey KC, Blake DR. Vaccine counseling: A content analysis of patient-physician discussions regarding human papilloma virus vaccine. *Vaccine* 2011 Oct 6;29(43):7343-9. DOI: <https://doi.org/10.1016/j.vaccine.2011.07.082>.
6. Casillas A, Singhal R, Tsui J, Glenn BA, Bastani R, Mangione CM. The impact of social communication on perceived HPV vaccine effectiveness in a low-income, minority population. *Ethn Dis* 2011 Autumn;21(4):495-501.
7. Daley MF, Crane LA, Markowitz LE, et al. Human papillomavirus vaccination practices: A survey of US physicians 18 months after licensure. *Pediatrics* 2010 Sep;126(3):425-33. DOI: <https://doi.org/10.1542/peds.2009-3500>.
8. Dempsey AF, Abraham LM, Dalton V, Ruffin M. Understanding the reasons why mothers do or do not have their adolescent daughters vaccinated against human papillomavirus. *Ann Epidemiol* 2009 Aug;19(8):531-8. DOI: <https://doi.org/10.1016/j.annepidem.2009.03.011>.
9. Dorell CG, Yankey D, Santibanez TA, Markowitz LE. Human papillomavirus vaccination series initiation and completion, 2008-2009. *Pediatrics* 2011 Nov;128(5):830-9. DOI: <https://doi.org/10.1542/peds.2011-0950>.
10. Etter DJ, Zimet GD, Rickert VI. Human papillomavirus vaccine in adolescent women: A 2012 update. *Curr Opin Obstet Gynecol* 2012 Oct;24(5):305-10. DOI: <https://doi.org/10.1097/gco.0b013e3283567005>.
11. Kessels SJ, Marshall HS, Watson M, Braunack-Mayer AJ, Reuzel R, Toohar RL. Factors associated with HPV vaccine uptake in teenage girls: A systematic review. *Vaccine* 2012 May 21;30(24):3546-56. DOI: <https://doi.org/10.1016/j.vaccine.2012.03.063>.
12. Gilkey MB, Calo WA, Moss JL, Shah PD, Marciniak MW, Brewer NT. Provider communication and HPV vaccination: The impact of recommendation quality. *Vaccine* 2016 Feb 24;34(9):1187-92. DOI: <https://doi.org/10.1016/j.vaccine.2016.01.023>.
13. Henrikson NB, Tuzzio L, Gilkey MB, McRee AL. "You're never really off time": Healthcare providers' interpretations of optimal timing for HPV vaccination. *Prev Med Rep* 2016 May 16;4:94-7. DOI: <https://doi.org/10.1016/j.pmedr.2016.05.002>.
14. Gilkey MB, Moss JL, McRee AL, Brewer NT. Do correlates of HPV vaccine initiation differ between adolescent boys and girls? *Vaccine* 2012 Sep 17;30(41):5928-34. DOI: <https://doi.org/10.1016/j.vaccine.2012.07.045>.
15. Reiter PL, Stubbs B, Panozzo CA, Whitesell D, Brewer NT. HPV and HPV vaccine education intervention: Effects on parents, healthcare staff, and school staff. *Cancer Epidemiol Biomarkers Prev* 2011 Nov;20(11):2354-61. DOI: <https://doi.org/10.1158/1055-9965.epi-11-0562>.
16. Berenson AB, Rahman M, Hirth JM, Rupp RE, Sarpong KO. A brief educational intervention increases providers' human papillomavirus vaccine knowledge. *Hum Vaccin Immunother* 2015;11(6):1331-6. DOI: <https://doi.org/10.1080/21645515.2015.1022691>.
17. Mayne S, Karavite D, Grundmeier RW, et al. The implementation and acceptability of an HPV vaccination decision support system directed at both clinicians and families. *AMIA Annu Symp Proc* 2012;2012:616-24.
18. Blasi PR, King D, Henrikson NB. HPV vaccine public awareness campaigns: An environmental scan. *Health Promot Pract* 2015 Nov;16(6):897-905. DOI: <https://doi.org/10.1177/1524839915596133>.
19. McCreary L. Kaiser Permanente's innovation on the front lines. *Harv Bus Rev* 2010 Sep;88(9):92, 94-7, 126.
20. Aycan D, Lorenzoni P. The future of prototyping is now live [Internet]. Boston, MA: Harvard Business Review; 2014 Mar 17 [cited 2017 May 8]. Available from: <http://blogs.hbr.org/2014/03/the-future-of-prototyping-is-now-live/>.
21. Cain CH, Neuwirth E, Bellows J, Zuber C, Green J. Patient experiences of transitioning from hospital to home: An ethnographic quality improvement project. *J Hosp Med* 2012 May-Jun;7(5):382-7. DOI: <https://doi.org/10.1002/jhm.1918>.
22. Lin M, Heisler S, Fahey L, McGinnis J, Whiffen TL. Nurse knowledge exchange plus: Human-centered implementation for spread and sustainability. *Jt Comm J Qual Patient Saf* 2015 Jul;41(7):303-12. DOI: [https://doi.org/10.1016/s1553-7250\(15\)41040-2](https://doi.org/10.1016/s1553-7250(15)41040-2).
23. Kaiser Permanente Innovation Consultancy. About us [Internet]. Oakland, CA: Kaiser Permanente; c2017 [cited 2017 May 8]. Available from: www.kpinnovation.org/aboutus.html.
24. Stanford design impact engineering master's degree [Internet]. Stanford, CA: Stanford Design Impact Program; c2016 [cited 2016 Oct 27]. Available from: <http://designprogram.stanford.edu/>.
25. Spradley JP. The ethnographic interview. Fort Worth, TX: Harcourt Brace Jovanovich; 1979.
26. Kaiser Permanente Innovation Consultancy. [Internet]. Oakland, CA: Kaiser Permanente; c2017 [cited 2016 Oct 27]. Available from: <https://xnet.kp.org/innovationconsultancy/>.
27. Beebe J. Rapid assessment process: An introduction. Walnut Creek, CA: AltaMira Press; 2001.
28. McMullen CK, Ash JS, Sittig DF, et al. Rapid assessment of clinical information systems in the healthcare setting: An efficient method for time-pressed evaluation. *Methods Inf Med* 2011;50(4):299-307. DOI: <https://doi.org/10.3414/me10-01-0042>.
29. Chart a new course: Put design thinking to work [Internet]. Stanford, CA: Hasso Plattner Institute of Design at Stanford; c2017 [cited 2017 May 30]. Available from: <http://dschool-old.stanford.edu/dgift/chart-a-new-course/>.
30. Healthy People 2020 Topics & Objectives, Immunization and Infectious Diseases, IID-11, Increase routine vaccination coverage levels for adolescents [Internet]. Washington, DC: Office of Disease Prevention and Health Promotion, US Department of Health and Human Services; updated 2017 Jul 21 [cited 2017 Jun 12]. Available from: www.healthypeople.gov/2020/topics-objectives/topic/immunization-and-infectious-diseases/objectives.
31. Blackwelder RB, Conry J, Frieden T, McInerney TK, Cooke M, Wexler D. Give a strong recommendation for HPV vaccine to increase uptake! [Internet]. Atlanta, GA: Immunization Action Coalition; 2016 Feb 13 [cited 2017 May 8] Available from: www.immunize.org/letter/recommend_hpv_vaccination.pdf.
32. AAFP. Strong recommendation to vaccinate against HPV is key to boosting uptake [Internet]. Leawood, KS: American Academy of Family Physicians 2014 Feb 12 [cited 2016 Oct 27]. Available from: www.aafp.org/news/health-of-the-public/20140212hpv-vaccltr.html.
33. Human papillomavirus (HPV): For clinicians [Internet]. Atlanta, GA: Centers for Disease Control and Prevention; updated 2017 Mar 10 [cited 2016 Oct 27]. Available from: www.cdc.gov/hpv/hcp/index.html.
34. Gilkey MB, McRee AL. Provider communication about HPV vaccination: A systematic review. *Hum Vaccin Immunother* 2016 Jun 2;12(6):1454-68. DOI: <https://doi.org/10.1080/21645515.2015.1129090>.
35. Cates JR, Shafer A, Diehl SJ, Deal AM. Evaluating a county-sponsored social marketing campaign to increase mothers' initiation of HPV vaccine for their pre-teen daughters in a primarily rural area. *Soc Mar Q* 2011 Spring;17(1):4-26. DOI: <https://doi.org/10.1080/15245004.2010.546943>.
36. Dubé E, Gagnon D, Ouakki M, et al. Understanding vaccine hesitancy in Canada: Results of a consultation study by the Canadian Immunization Research Network. *PLoS One* 2016 Jun 3;11(6):e0156118. DOI: <https://doi.org/10.1371/journal.pone.0156118>.
37. Gage Lofgren D, Cantu D. Five lessons from Kaiser Permanente's Thrive campaign [Internet]. Chicago, IL: American Marketing Association; 2010 [cited 2017 May 8]. Available from: <https://archive.ama.org/archive/ResourceLibrary/MarketingHealthServices/Documents/Five%20Lessons.pdf>.