Supplementary Online Content


eFigure 1. Examples of HPV Vaccine Fact Sheets Derived From the Fact Sheet Library by Two Practices

eFigure 2. Screen Shots of iVac

eFigure 3. HPV Vaccine Decision Aid

eFigure 4. Practice-Specific HPV Vaccine Series Initiation Among 11-17 Year Olds at Baseline and Postintervention

eFigure 5. Practice-Specific HPV Vaccine Series Completion Among 11-17 Year Olds at Baseline and Postintervention

eFigure 6. Reduction in Missed Opportunities for HPV Vaccine Series Initiation, by Visit Types

eMethods. Supplemental Methods

eTable 1. HPV Vaccine Series Completion by Clinical Characteristics: Control/Intervention Difference in Difference Comparison of Baseline to Postimplementation Phase Periods

eTable 2. HPV Vaccine Series Completion by Patient Factors: Control/Intervention Difference in Difference Comparison of Baseline to Postimplementation Phase Periods

eTable 3. HPV Vaccine Series Initiation by Patient Factors: Control/Intervention Difference in Difference Comparison of Baseline to Postimplementation Phase Periods

eTable 4. HPV Vaccine Series Completion by Limited Patient Factors: Control/Intervention Difference in Difference Comparison of Baseline to Postimplementation Phase Periods

eTable 5. Tdap and MCV4 Vaccination by Patient Factors: Control/Intervention Difference in Difference Comparison of Baseline to Postimplementation Phase Periods

This supplementary material has been provided by the authors to give readers additional information about their work.
**eFigure 1. Examples of HPV Vaccine Fact Sheets Derived From the Fact Sheet Library by Two Practices**

**HUMAN PAPILLOMAVIRUS (HPV) FACTS**

The risk of HPV infection is high. Even with just one partner the chances of being infected with HPV after starting to have sex are:
- More than 1 out of 5 within 6 months.
- More than 1 out of 3 within a year.

**HPV is Common & May Lead to Serious Disease**
- Up to 75% of HPV infections occur among people 15 through 24 years old.
- HPV infection is equally common among both males and females.
- Because most of the symptoms of HPV cannot be seen, a person could contract or transmit HPV without knowing.
- HPV infection can lead to genital warts, abnormal pap smear tests, and/or cancer of the cervix, vagina, penis, anus, tonsils, and throat.
- There is NO CURE for HPV infection.

8 OUT OF 10 PEOPLE WILL HAVE HPV BEFORE THEY TURN 50

**The HPV Vaccine Safely Protects Boys & Girls from HPV**

**Why get vaccinated?**
The HPV vaccine is safe. The vaccine doesn’t cause the HPV virus. After more than 75 million doses, there is no evidence that the safety of HPV vaccines is any different from the other vaccines routinely given to adolescents. Vaccine side effects have been closely monitored. Common side effects include mild pain and redness where the vaccine was injected. Rarely those vaccinated have reported fainting, dizziness, nausea, and/or headache.

Treatments of problems associated with HPV, like genital warts, are painful and often require multiple treatments.

**HPV is so common that most sexually-active men and women will get at least one type of HPV at some point in their lives.**

**HPV is transmitted through intimate (genital area) skin-to-skin contact. “Having sex” (actual penetration) is not needed to contract or transmit the virus.**

Getting the HPV vaccine doesn’t increase likelihood of sexual activity. Scientific studies show that vaccinating adolescents against HPV is not related to sexual activity.

Most men will never know they had an HPV infection since there is no routine test for HPV in men.

Who should get vaccinated?
Adolescent Medicine Clinic providers agree, THE BEST time for your son or daughter to get the vaccine is when they are 11—12 years old. Boys 13-21 and girls 13-26 years old who have not had the vaccine should get the vaccine ASAP.

Benefits of vaccinating at a young age:
1. The immune response in preteens is stronger, so protection from the disease may be longer.
2. Your child will be protected before he or she even thinks about sexual activity.

Boys 13-21 and girls 13-26 years old who have not had the vaccine should get the vaccine ASAP.

The HPV vaccine works almost 100% of the time at preventing the most common HPVs from causing disease.
HUMAN PAPILLOMAVIRUS (HPV) FACTS

HPV is Common and May Lead to Serious Disease

HPV is a very common virus that is spread through intimate contact (including intimate touching with hands or mouth and also sexual intercourse).¹ ²

- There is NO CURE for HPV Infection.³
- HPV infection can lead to genital warts, abnormal pap smear tests, and/or cancer of the cervix, vagina, penis, anus, tonsils, and throat.⁴

Nearly half of high school students report they have had sexual intercourse.

8 OUT OF 10 PEOPLE WILL GET HPV

- Most symptoms of HPV can't be seen, so a person can be infected and/or spread HPV without knowing.¹ ²
- Up to 75% of HPV infections occur among people 15-24 years old.⁴
- Most men will never know they have an HPV infection since there is no routine test for HPV in men.⁴

The HPV Vaccine Safely Protects Boys and Girls from HPV

Why get vaccinated?
The HPV vaccine protects against genital warts, and cancers of the cervix, vagina, penis, anus, tonsils, and throat.⁴

The HPV vaccine works almost 100% of the time at preventing the most common HPVs from causing disease.¹

The HPV vaccine is safe. You cannot get HPV from the vaccine. More than 76 million vaccines have been given.² Common side effects include mild pain and redness where the vaccine was injected. Rarely those vaccinated have reported fainting, dizziness, and/or nausea.²

Getting the HPV vaccine doesn’t increase likelihood of sexual activity. Scientific studies show that vaccinating adolescents against HPV is not related to sexual activity.³

Who should get vaccinated?
Experts agree, THE BEST time for your son or daughter to get the vaccine is when they are 11 — 12 years old.⁶

BOYS 11 — 12 Years Old

focus on kids

GIRLS 11 — 12 Years Old

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eFigure 2. Screen Shots of iVac
Test Patient- A 25 year old, English speaking, white Female with a history of HPV, who has a 9 year old daughter named Ella.

BASELINE SURVEY
1st Page

2nd Page

3rd Page

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For the following, please answer questions about your adolescent child between ages 9 and 17 years old.

If you have more than one adolescent, pick one to do the survey about.

What is the gender of the child you have picked to answer questions about?

- Male
- Female

What is their age?

For privacy purposes, please provide a nickname for your child that we will refer to throughout the program.

For the list below, the medical office where your child usually gets medical care.

- The Youth Clinic

How many doses of the HPV vaccine has your adolescent received? If you are unsure, make your best guess.

- 0
- 1
- 2
- 3 or more

The next set of questions asks about your views on vaccines to prevent human papillomavirus infection.

Human papillomavirus (HPV) is a very common virus that is spread through intimate contact (this includes intimate touching with hands or mouth and also sexual intercourse).

In most cases HPV infection does not cause any symptoms. However, in some people, HPV infection can lead to genital warts, abnormal pap smear tests, and/or cancers of the cervix, vagina, penis, anus, tonsils, and throat.

HPV vaccines are recommended for all females ages 9-26 years and all males ages 9-21 years. You need three doses (shots) of the vaccine to be protected from HPV infection.

Now that you have read a bit about HPV infection and vaccination, how likely would you be to allow your adolescent to get a dose of the HPV vaccine the next time the doctor recommended it?

- Very likely
- Somewhat likely
- Somewhat unlikely
- Very unlikely
There are many reasons why parents may or may not want their adolescents to get the HPV vaccine.

For each statement, please indicate how much you agree or disagree.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I'm worried that Ella might get infected with HPV someday.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>✔</td>
</tr>
<tr>
<td>I am worried that Ella might get genital warts someday.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>I am worried that Ella might get cervical cancer someday.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>I am worried that Ella might get the HPV virus from the vaccine.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

For each statement, please indicate how much you agree or disagree.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am concerned that the HPV vaccine costs more than I can pay.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>I think the HPV vaccine is effective.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>I think the HPV vaccine is safe.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>I am worried about side effects from the HPV vaccine.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
<tr>
<td>The HPV vaccine is too new. I want to wait a while before deciding if Ella should get it.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>

For each statement, please indicate how much you agree or disagree.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neither Agree nor Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>I worry if I let Ella get the HPV vaccine, she might think it is OK to have sex.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>✔</td>
</tr>
<tr>
<td>I think Ella is too young to worry about sexually transmitted infections like HPV.</td>
<td>□</td>
<td>□</td>
<td>□</td>
<td>□</td>
</tr>
</tbody>
</table>
Thank You!
That's it! You've reached the end of the questionnaire. Thank you for your time and input. You will now be automatically directed to your customized information.
Please click the CONTINUE button.

Welcome to iVAC!
This program is designed to help parents like you learn about the HPV (Human Papillomavirus) vaccine.
Based on your survey answers, it looks like Ella may not be up to date on her HPV vaccine.
You can check with her doctor if you are unsure.

Home Page

Introduction

HPV and the HPV Vaccine
You clearly take Ella's health seriously. The HPV vaccine will help protect her against:
- HPV
- Genital warts
- Abnormal pap tests
- Cervical cancer
- Other kinds of cancer, like cancer of the anus, vagina, vulva (area around the vagina) and possibly cancers of the throat

Info on HPV
- What is HPV?
- How do people get HPV?
- Do a lot of people get HPV?
- Does HPV have symptoms?
Other Concerns

Questions about the HPV Vaccine
It's not uncommon to have questions about the HPV vaccine. We've listed some common questions below. Tap a concern to read more.

- How common is cervical cancer?
- What is the risk of getting genital warts?
- Can the vaccine give you HPV?
- Will the vaccine cause reproductive problems?
- Will HPV cause problems with the immune system?

My Concerns

Your Questions About the HPV Vaccine
In your survey, you had some general questions about the HPV vaccine. We've listed each of those questions below. Tap a concern to read more.

- What is Ella's risk of getting HPV?
- Is my child too young for the vaccine?
- What are the side effects of the vaccine?
- Is it worth waiting to see if the vaccine is ok?
- Will the vaccine make my child think it is ok to have sex?
More On HPV

More on HPV
Tap to read more
- How many people have gotten the HPV vaccine?
- How does the HPV vaccine work?
- How long does the vaccine last?
- Do women still need Pap smears after getting the vaccine?
- Could HPV be passed to an unborn baby?
- Should pregnant women get the vaccines?

Personal Narrative Section (under “My Story”)

A Parent’s Story
Like every parent, I worry about making the right choices for my daughter, Jenny. It feels like every day, there’s a new issue to tackle or choice to make. It was like that five years ago when Jenny’s doctor recommended she get the HPV vaccine. I wasn’t really sure what to do. It didn’t seem like Jenny really needed the vaccine — she was only 13. I thought it might make her more likely to have sex and I was scared that the vaccine was so new, maybe it wasn’t as safe as people said — so Jenny didn’t get it.
I have never regretted a decision more.

When she turned 18, Jenny said she was ready for her first Pap test. I remember that she was anxious and I just kept telling her that everything would be fine. It wasn’t. The test showed “abnormal cells” on Jenny’s cervix. They ran the test again, with an HPV screen this time, and the results were the same. Jenny had HPV. Even worse, it was one of the kinds that can cause cancer. The doctor said often the body may fight the virus on its own, so Jenny needed Pap tests every six months to keep an eye on things.

My world turned upside down. I couldn’t even process the HPV part. I was mostly shocked that Jenny was sexually active. I always thought she would wait until she got married. But, I shouldn’t have been surprised — she and her boyfriend had been together for several years and were really serious about each other. I knew I had to get over my disappointment quickly — Jenny needed me. She was so afraid that she had cancer. She kept asking me “Mom, what if I have cancer?” I told her that I loved her and we would face whatever happened together.

I took her back for a check up six months later. The doctor told us that Jenny’s test was still abnormal. I could hardly breathe. The news got worse — Jenny would need a minor surgery, called a LEEP procedure, to cut out the cells. On top of that, she would need Pap tests every three months to make sure the cells didn’t come back.

The day of the surgery, Jenny’s eyes were wide with tears shining just in the corners. She held my hand, just like when she was little, as we walked into the clinic. During the procedure, the doctor numbed her cervix and used a tool to scrape away the cells. After it was over, I could see that Jenny was in pain, but trying to be strong.

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Now that you have read a bit about HPV infection and vaccination, how likely would you be to allow your adolescent to get a dose of the HPV vaccine today if the doctor recommended it?

- [ ] Very likely
- [ ] Somewhat likely
- [ ] Somewhat unlikely
- [ ] Very unlikely

Thank you. That's it! Please click CONTINUE.
eFigure 3. HPV Vaccine Decision Aid, Side 1

Making Decisions About HPV Vaccines

This worksheet is being provided by your doctor’s office for young adults (up to age 26) or parents of adolescents (9-18) who have not yet gotten vaccinated against human papillomavirus (also known as HPV).

HPV occurs in 80% of adults, but generally causes no health problems. However, in some people it causes cancers of the cervix, vagina, penis, and anus and also causes genital warts (a non-cancerous condition). In fact, the only way you can get cervical cancer and genital warts is from an HPV infection.

Getting vaccinated against HPV can decrease the chance of getting these diseases. The HPV vaccine is given as a series of 3 shots, ideally over a 6-12 month period. Many people have questions about the HPV vaccine even after talking to their doctor. Follow the three areas in this worksheet to weigh up the pros and cons of HPV vaccination for you or your family.
eFigure 3. HPV Vaccine Decision Aid, Side 2

2 Pros & Cons
Compare the pros and cons of getting vaccinated or not getting vaccinated. The graphs below show the chances of various events occurring over a person’s lifetime.

Out of 100 People...
- 80 will have pain at the injection site
- 33 will get a headache
- 2 will get a fever over 100°

Out of 10,000 People...
- 250 people will get Genital Warts
- 1 person will get Genital Warts
- 99 people will have an Abnormal Pap smear
- 1 person will have an Abnormal Pap smear
- 67 people will get HPV-Related Cancer
- 20 people will get HPV-Related Cancer

For more information about HPV infection and HPV vaccines please visit the following websites:
- Centers for Disease Control and Prevention: http://www.cdc.gov/hpv/vaccine.html
- American Cancer Society: http://www.cancer.org (search for HPV)

3 Next Steps
Look back over what you said were your health values, and the pros and cons of vaccinating versus not vaccinating. Weigh all the information together and decide on what is best for you or your family. Circle the choice below that is most in line with your decision. Then look at the action below your choice to see some next steps to take.

1. I have decided I want the vaccine and I’m ready to take action.
   - Call your doctor’s office to make an appointment to get the vaccine.

2. I have decided I will get the vaccine, just not right now.
   - Pick a date on your calendar when you will go through things again and decide if it is time to get the vaccine.

3. I want to talk to others first before making a decision.
   - Make an appointment with your provider to talk about the vaccine. If you want to talk to your family about this, put this conversation on your “to do” list.

4. I want to get more information first before making a decision.
   - See the websites on this page for reliable information about the vaccine, or make an appointment to talk about the vaccine with your medical provider.

5. I have decided I don’t want the vaccine.
   - Think about reconsidering your decision in a year or two. The vaccine can be given up to age 26.
**eFigure 4.** Practice-Specific HPV Vaccine Series Initiation Among 11-17 Year Olds at Baseline and Postintervention


Site "M" is represented by data for 11-12 years olds only. Baseline is September 1, 2012 thru August 31, 2013. These modifications were made as this site underwent changes to their EMR and requested data were not available.
**eFigure 5.** Practice-Specific HPV Vaccine Series Completion Among 11-17 Year Olds at Baseline and Postintervention


Site "M" is represented by data for 11-12 years olds only. Baseline is September 1, 2012 thru August 31, 2013. These modifications were made as this site underwent changes to their EMR and requested data were not available.
**eFigure 6.** Reduction in Missed Opportunities for HPV Vaccine Series Initiation, by Visit Types*

*Includes ages 11-17 and both genders*
Supplemental Methods

A full copy of the trial protocol is available from the authors upon request.

Analytic Cohorts:
Data were analyzed across three age cohorts: (1) 11-12 year olds, (2) 13-17 year olds, (3) 11-17 year olds. For inclusion in any cohort a patient was required to have had at least one clinic visit where they meet the cohort age criteria. Only visits where the child’s age was within the cohort age range were included in each cohort analyses. Age cohorts of 11-12 year olds and 13-17 year olds are not mutually exclusive. Demographics for each patient were retained from their most recent visit.

Variable Definitions:

Well visits were defined by the presence of either an ICD-9-CM code (V20.2, V70.0, V70.3, V70.5, V70.6, V70.8, V70.9) or CPT code (99383, 99384, 99385, 99393, 99394, 99395) for a well exam. For practices where codes were not provided, well visits were identified by visit type descriptions. For practices converting to ICD-10-CM coding during the study equivalent codes were determined from the Centers for Medicare & Medicaid Services General Equivalence Mappings (http://www.nber.org/data/icd9-icd-10-cm-and-pcs-crosswalk-general-equivalence-mapping.html, accessed 03/15/2016). All other visits were considered sick visits. As patients could be eligible for HPV vaccine at both a well encounter and a sick encounter, these groupings are not mutually exclusive.

Detailed Description of Intervention Components

HPV Fact Sheet Library: The Fact Sheet Library consisted of text, images, and graphics related to HPV infection and vaccination and a single page, double-sided template for creating the sheets. Practice providers and staff voted on the elements from the Library they wanted to incorporate in their Fact Sheet. The study team then created a draft of the Fact Sheet using the template. Through an iterative feedback process with the practice’s providers a final version of the Fact Sheet was created. These sheets were then printed in color and provided to the practice for use. Two examples of Fact Sheets created by study practices are provided in eFigure 1.

Tailored Website for Parents: The tailored website for parents, called “iVac HPV” was HPV specific and developed based on a prior version of the website that included information about all adolescent vaccines, and is depicted in eFigure 2. To use the website, parents first answered a short baseline survey embedded in the website that collected information about their attitudes, beliefs and experiences related to HPV infection, disease and vaccination. Upon completion, parents were automatically taken to educational information about HPV vaccination and infection that was customized for them based on the information they input into the baseline survey. Customization occurred on three levels: 1) the text throughout the multi-paged website reflected each parent’s main concerns and questions about HPV; 2) pictures placed throughout the website matched the parent’s self-reported race and gender; and 3) parents were asked to provide the first name of their child and this name was used throughout the text to personalize the information. Screen shots of the website are shown in Appendix Figure 2. Practices who chose to use the website did so in a variety of ways including having iPads or kiosks placed in the clinic’s waiting rooms, having the website available on computers in the exam rooms, or posting the website address on their clinic’s website and encouraging parents to look at it prior to their appointment.

Disease Images: The study team created binders that provided gender-specific photo representations of genital warts, penile cancer, vaginal cancer, vulvar cancer, cervical cancer, and oropharyngeal cancer. Practices that chose to use this intervention component kept the binder at a central location in the clinic and brought it into the patient rooms when they felt it was appropriate.
HPV Vaccine Decision Aid:  The HPV Vaccine Decision Aid was developed to provide parents with concrete information to inform decision-making about HPV vaccination if a conversation with the provider was not enough to help them make a decision. The Decision Aid was available as a 2-sided piece of paper that was provided to practices to use as they wished. It included information about the risks of vaccinating versus not vaccinating, and action steps for parents to take based on their current thoughts about the vaccine. The Decision Aid is provided in eFigure 3.

Communication Training:  The communication training consisted of three sessions. The first was a self-administered, 30 minute webinar that reviewed use of a presumptive communication style to open the HPV vaccine conversation and basic information about Motivational Interviewing (MI) strategies. The second session was a 1-hour, in-person training with practice providers that was led jointly by the study team and a professional MI trainer. This session briefly reviewed the specific language for providers to use to open the HPV vaccine conversation with a presumptive communication style and provided in-depth HPV-vaccine specific examples of how MI approaches could be used in the parent/provider interaction if the presumptive approach was met with parental vaccine hesitancy. The third session had a same focus as the second except but was significantly more participatory in that each provider modeled the communication approach for the group (with the study team serving as the “parent) and received immediate feedback from the MI trainer on what went well and what could be improved upon.

Implementation of Intervention Components

During the study planning meetings, intervention practices made decisions about which components of the intervention to use, and how to incorporate these into their clinic’s workflow. There was variability among the practices in these decisions, which are summarized as follows.

Fact Sheet: All intervention practices chose to use the fact sheet. Some practices provided this upon check in for all patients, some at check in for patients that the MA screened as being potentially HPV vaccine hesitant, and some provided the information sheet during the clinic visit, when parents had questions about the vaccines. One practice had the fact sheets laminated and posted in each exam room. One practice made the FS available on their website. One practice included the FS in the 10-11 year old annual visit packet.

iVac website: All practices elected to use the iVac website but there was high variability in its implementation. One practice chose to have a link to the website available on their office’s home page where parents routinely went to fill out pre-visit paperwork and questionnaires, Six practices had the website available on portable iPads or iPads in kiosks that were available to patients by the MA during a clinic visit if they had questions, One practice had a link to the website on each exam room computer that the provider could pull up for parents during a clinic visit if needed.

Decision Aid: All practices elected to use the Decision Aid. One practice’s MAs provided this to parents if they believed the parent to be HPV vaccine hesitant when checking in the patient (prior to the provider seeing the patient). The completed worksheet was hoped to facilitate the HPV vaccine conversation between parent and provider. Another practice stapled the Decision Aid to a Vaccine refusal form, which they had the parent sign when refusing the vaccine. After gaining the signature, the MA would tear off the DA and provide that to the parent to take home. The remaining practices had the Decision Aid available in the exam rooms to use during or at the end of the clinical visit, as needed.

Disease images: Only 6 practices elected to use the disease images library. One practice kept notebooks with the images in a centralized location that providers could use as needed. The others kept a packet of the images in each exam room, in a secure location, to be used during visits as needed. Disease images were laminated hard copies at all practices, except one practice choose to also have the images on the exam room computer desktops.
Communication training: Communication training was offered to all “providers” (MD, PA, NP) that could prescribe the vaccine in the intervention offices; it was required by medical providers (MD) wishing to receive MOC Part IV credits. If a provider was not able to attend an in-person training session, a video link to a previous training session at another practice was provided instead. However, providers were strongly encouraged to attend the sessions in person. Attestation of having viewed the introduction and background video and attendance at both in-person sessions (or viewing a make-up session) was required for receipt of MOC Part IV credit. Attendance at all 3 sessions was required for receipt of MOC Part IV credit.

Study Meetings
In the 6 months on-boarding period that occurred prior to the launch of the intervention, 2 hour long study planning and training meetings occurred at each of the intervention practices. The content of these meetings was as follows:

Meeting 1: The research team re-oriented practices to the study, administered a baseline survey regarding current communication techniques, asked participants to choose the intervention components they wished to use, and asked participants to “vote” on the elements from the Fact Sheet Library (provided in paper format) that they wanted to include in their practice’s customized HPV Fact Sheet.

Meeting 2: The research team presented draft versions of each Practices HPV Fact Sheet based on the results from the previous assessment, conducted process mapping with the practice to decide when and how each selected intervention component would be implemented at the practice.

Results
Increases in HPV vaccination initiation and completion, by practice, are depicted in eFigures 4 and 5, respectively. Thirteen of sixteen practices increased HPV vaccine series initiation over time. Series completion was lower over time in most practices.

Data on HPV vaccine series completion by clinic and patient factors are depicted in eTables 1 and 2 respectively. As with series initiation, improvements in intervention practices in series completion were more prominent in well child exams at private pediatric clinics. Data on HPV vaccine series initiation by race and ethnicity is depicted in eTable 3.

eFigure 6 depicts changes in missed opportunities for vaccination from baseline, comparing intervention and control practices. Reductions in missed opportunities were significantly greater among intervention than control practices for well visits, and slightly greater for sick visits.
eTable 1. HPV Vaccine Series Completion by Clinical Characteristics: Control/Intervention Difference in Difference Comparison of Baseline to Postimplementation Phase Periods

<table>
<thead>
<tr>
<th>Practice Variable</th>
<th>Study Period</th>
<th>Control</th>
<th>Intervention</th>
<th>I/C Difference in Difference*</th>
<th>I/C Difference in Difference*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Specialty</td>
<td></td>
<td></td>
<td></td>
<td>Unadjusted (Ratio of ORs)</td>
<td>Unadjusted (Ratio of ORs)</td>
</tr>
<tr>
<td>Family Medicine</td>
<td>Baseline</td>
<td>52</td>
<td>38.5%</td>
<td>1.41 (0.24-8.21)</td>
<td>0.73 (0.20-2.73)</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>47</td>
<td>46.8%</td>
<td>1.53 (0.25-9.41)</td>
<td>0.61 (0.15-2.47)</td>
</tr>
<tr>
<td>Pediatrics</td>
<td>Baseline</td>
<td>2,731</td>
<td>74.2%</td>
<td>0.64 (0.55-0.74)</td>
<td>0.91 (0.88-1.22)</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>2,700</td>
<td>68.5%</td>
<td>2,113 74.2% (0.56-0.75)</td>
<td>1.66 (1.33-2.06)</td>
</tr>
<tr>
<td>Practice Type</td>
<td></td>
<td></td>
<td></td>
<td>Unadjusted (Ratio of ORs)</td>
<td>Unadjusted (Ratio of ORs)</td>
</tr>
<tr>
<td>Public</td>
<td>Baseline</td>
<td>602</td>
<td>43.5%</td>
<td>0.73 (0.51-1.04)</td>
<td>0.75 (0.53-1.08)</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>498</td>
<td>37.1%</td>
<td>0.75 (0.52-0.74)</td>
<td>1.01 (0.78-1.40)</td>
</tr>
<tr>
<td>Private</td>
<td>Baseline</td>
<td>2,181</td>
<td>81.8%</td>
<td>0.63 (0.53-0.76)</td>
<td>1.05 (0.85-1.30)</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>2,249</td>
<td>75.0%</td>
<td>2,425 73.2% (0.55-0.74)</td>
<td>1.01 (0.82-1.26)</td>
</tr>
<tr>
<td>Encounter Type</td>
<td></td>
<td></td>
<td></td>
<td>Unadjusted (Ratio of ORs)</td>
<td>Unadjusted (Ratio of ORs)</td>
</tr>
<tr>
<td>Routine Check up</td>
<td>Baseline</td>
<td>1,181</td>
<td>64.8%</td>
<td>1.11 (0.89-1.39)</td>
<td>1.08 (0.89-1.39)</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>1,205</td>
<td>69.4%</td>
<td>1.12 (0.89-1.39)</td>
<td>1.27 (0.97-1.35)</td>
</tr>
<tr>
<td>Sick visits</td>
<td>Baseline</td>
<td>2,171</td>
<td>58.3%</td>
<td>0.59 (0.51-0.68)</td>
<td>1.575 58.3% (0.44-0.65)</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>2,110</td>
<td>48.3%</td>
<td>1.696 44.3% (0.91-1.25)</td>
<td>1.14 (0.09-1.28)</td>
</tr>
</tbody>
</table>

*Ratio of ORs from intervention (I) vs. control (C) groups describing the change from baseline to post implementation phase time points in the proportion of eligible patients completing the HPV vaccine series.

**Models adjusted for practice type (public/private), medical specialty (pediatrics/family medicine), patient age, patient insurance, and patient sex.

Intraclass correlation coefficients, order of model presentation = 0.039, 0.157, 0.142, 0.148, 0.253, 0.241.
**eTable 2. HPV Vaccine Series Completion by Patient Factors: Control/Intervention Difference in Difference Comparison of Baseline to Postimplementation Phase Periods**

| Patient Characteristic | Study Period | Control | | | Intervention | | | | | |
|------------------------|--------------|---------|---------|---------|----------------|---------|---------|---------|---------|----------------|---------|---------|---------|
|                        |              | N eligible for HPV Vaccine Dose | % of Eligible Who Received Needed HPV Vaccine Dose | Odds Ratio (95% CI), Baseline to Post Implementation Phase Unadjusted | Adjusted** | N eligible for HPV Vaccine Dose | % of Eligible Who Received Needed HPV Vaccine Dose | Odds Ratio (95% CI), Baseline to Post Implementation Phase Unadjusted | Adjusted** | I/C Difference in Difference* (Ratio of ORs) Unadjusted | I/C Difference in Difference* (Ratio of ORs) Adjusted** |
| **Age**                |              |                     |                     |                     |                 |                     |                     |                     |                 |                     |                     |
| 11-12 years            | Baseline     | 961                  | 76.8%               | 0.74                | (0.58-0.94)      | 0.74                | 665                  | 75.5%               | 0.96                | (0.74-1.25)      | 0.95                | (0.73-1.23)      | 1.30                | (0.91-1.85)      | 1.28                | (0.90-1.83)      |
|                        | Implementation | 1,042                | 74.8%               |                     |                 |                     | 886                  | 72.3%               |                     |                 |                     |                     |                     |                     |                     |
| 13-17 years            | Baseline     | 1,887                | 69.4%               | 0.63                | (0.53-0.75)      | 0.63                | 1,586                | 70.6%               | 1.06                | (0.89-1.27)      | 1.06                | (0.89-1.26)      | 1.68                | (1.32-2.14)      | 1.67                | (1.31-2.13)      |
|                        | Implementation | 1,767                | 61.7%               |                     |                 |                     | 1,679                | 70.0%               |                     |                 |                     |                     |                     |                     |                     |
| **Sex**                |              |                     |                     |                     |                 |                     |                     |                     |                     |                 |                     |                     |                     |                     |                     |
| Female                 | Baseline     | 1,310                | 71.5%               | 0.76                | (0.62-0.93)      | 0.76                | 1,036                | 73.5%               | 1.09                | (0.88-1.35)      | 1.04                | (0.84-1.29)      | 1.44                | (1.07-1.93)      | 1.38                | (1.02-1.86)      |
|                        | Implementation | 1,306                | 68.1%               |                     |                 |                     | 1,234                | 72.8%               |                     |                 |                     |                     |                     |                     |                     |
| Male                   | Baseline     | 1,473                | 75.4%               | 0.58                | (0.48-0.70)      | 0.57                | 1,170                | 73.6%               | 1.00                | (0.82-1.23)      | 0.97                | (0.79-1.19)      | 1.73                | (1.30-2.30)      | 1.71                | (1.29-2.27)      |
|                        | Implementation | 1,441                | 68.1%               |                     |                 |                     | 1,273                | 72.1%               |                     |                 |                     |                     |                     |                     |                     |
| **Insurance**          |              |                     |                     |                     |                 |                     |                     |                     |                     |                 |                     |                     |                     |                     |                     |
| Private                | Baseline     | 2,043                | 82.4%               | 0.63                | (0.53-0.74)      | 0.61                | 1,349                | 76.1%               | 1.12                | (0.92-1.37)      | 1.07                | (0.87-1.31)      | 1.79                | (1.38-2.33)      | 1.75                | (1.35-2.28)      |
|                        | Implementation | 2,104                | 75.4%               |                     |                 |                     | 1,529                | 75.2%               |                     |                 |                     |                     |                     |                     |                     |
| Public                 | Baseline     | 740                  | 49.2%               | 0.74                | (0.58-0.95)      | 0.75                | 857                  | 69.4%               | 0.97                | (0.77-1.21)      | 0.94                | (0.75-1.18)      | 1.31                | (0.94-1.83)      | 1.26                | (0.90-1.76)      |
|                        | Implementation | 643                  | 44.2%               |                     |                 |                     | 978                  | 68.1%               |                     |                 |                     |                     |                     |                     |                     |

*Ratio of ORs from intervention (I) vs. control (C) groups describing the change from baseline to post implementation phase time points in the proportion of eligible patients completing the HPV vaccine series.

**Models adjusted for practice type (public/private), medical specialty (pediatrics/family medicine), patient age, patient insurance, and patient sex.

Intraclass correlation coefficients, order of model presentation = 0.131, 0.158, 0.154, 0.152, 0.128, 0.123.
**eTable 3.** HPV Vaccine Series Initiation by Patient Factors: Control/Intervention Difference in Difference Comparison of Baseline to Postimplementation Phase Periods

<table>
<thead>
<tr>
<th>Patient Characteristic</th>
<th>Study Period</th>
<th>Control</th>
<th>Intervention</th>
<th>I/C Difference in Difference*(Ratio of ORs) Unadjusted</th>
<th>I/C Difference in Difference*(Ratio of ORs) Adjusted** Unadjusted</th>
<th>I/C Difference in Difference*(Ratio of ORs) Adjusted** Unadjusted</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>% of Eligible Who Received Needed HPV Vaccine Dose</td>
<td>Odds Ratio (95% CI), Baseline to Post Implementation Phase Unadjusted</td>
<td>% of Eligible Who Received Needed HPV Vaccine Dose</td>
<td>Odds Ratio (95% CI), Baseline to Post Implementation Phase Unadjusted</td>
<td>% of Eligible Who Received Needed HPV Vaccine Dose</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>Baseline</td>
<td>748</td>
<td>42.9%</td>
<td>1.39 (1.03-1.89)</td>
<td>1.38 (1.00-1.91)</td>
<td>1.09 (0.93-1.28)</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>633</td>
<td>50.7%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>Baseline</td>
<td>619</td>
<td>43.1%</td>
<td>1.42 (1.01-1.99)</td>
<td>1.42 (1.00-2.03)</td>
<td>1.25 (1.01-1.55)</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>522</td>
<td>51.7%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Black</td>
<td>Baseline</td>
<td>61</td>
<td>44.3%</td>
<td>1.21 (0.43-3.45)</td>
<td>1.10 (0.37-3.30)</td>
<td>1.02 (0.65-1.59)</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>53</td>
<td>49.1%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>Baseline</td>
<td>31</td>
<td>45.2%</td>
<td>0.99 (0.20-4.92)</td>
<td>0.97 (0.18-5.17)</td>
<td>0.75 (0.52-1.08)</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>20</td>
<td>45.0%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>Baseline</td>
<td>1692</td>
<td>24.7%</td>
<td>1.29 (1.11-1.51)</td>
<td>1.28 (1.09-1.49)</td>
<td>0.85 (0.73-0.99)</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>1597</td>
<td>29.7%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>Baseline</td>
<td>156</td>
<td>28.2%</td>
<td>1.18 (0.74-1.89)</td>
<td>1.02 (0.63-1.68)</td>
<td>0.82 (0.65-1.04)</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>177</td>
<td>31.6%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-Hispanic</td>
<td>Baseline</td>
<td>1324</td>
<td>25.2%</td>
<td>1.25 (1.05-1.49)</td>
<td>1.25 (1.05-1.49)</td>
<td>0.89 (0.73-1.10)</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>1217</td>
<td>29.6%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Ratio of ORs from intervention (I) vs. control (C) groups describing the change from baseline to post implementation phase time points in the proportion of eligible patients initiating the HPV vaccine series.

**Models adjusted for practice type (public/private), medical specialty (pediatrics/family medicine), patient age, patient insurance, and patient sex.

For Race, analysis data was limited to practices in which race was reported for at least 88% of the patients (n=6). "Unknown" race category was not modeled individually due to small sample size, n=403. For Ethnicity, analysis data was limited to practices in which ethnicity was reported for at least 80% of the patients (n=2).

Intraclass correlation coefficients, order of model presentation = 0.108, 0.134, NA, NA, NA, NA, NA.
**eTable 4. HPV Vaccine Series Completion by Limited Patient Factors: Control/Intervention Difference in Difference Comparison of Baseline to Postimplementation Phase Periods**

<table>
<thead>
<tr>
<th>Patient Characteristic</th>
<th>Study Period</th>
<th>Control</th>
<th>Intervention</th>
<th>I/C Difference in Difference* (Ratio of ORs)</th>
<th>I/C Difference in Difference** (Ratio of ORs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>N eligible for HPV Vaccine Dose</td>
<td>% of Eligible Who Received Needed HPV Vaccine Dose</td>
<td>Odds Ratio (95% CI), Baseline to Post Implementation Phase Unadjusted</td>
<td>% of Eligible Who Received Needed HPV Vaccine Dose</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N eligible for HPV Vaccine Dose</td>
<td>% of Eligible Who Received Needed HPV Vaccine Dose</td>
<td>Odds Ratio (95% CI), Baseline to Post Implementation Phase Unadjusted</td>
<td>Odds Ratio (95% CI), Baseline to Post Implementation Phase Unadjusted</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All</td>
<td>Baseline</td>
<td>266</td>
<td>45.1%</td>
<td>0.90</td>
<td>806</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>248</td>
<td>43.5%</td>
<td>0.91</td>
<td>913</td>
</tr>
<tr>
<td>White</td>
<td>Baseline</td>
<td>218</td>
<td>46.3%</td>
<td>0.83</td>
<td>430</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>206</td>
<td>43.2%</td>
<td>0.84</td>
<td>554</td>
</tr>
<tr>
<td>Black</td>
<td>Baseline</td>
<td>22</td>
<td>50.0%</td>
<td>1.44</td>
<td>113</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>22</td>
<td>59.1%</td>
<td>1.43</td>
<td>96</td>
</tr>
<tr>
<td>Other</td>
<td>Baseline</td>
<td>10</td>
<td>40.0%</td>
<td>0.30</td>
<td>210</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>6</td>
<td>16.7%</td>
<td>0.47</td>
<td>224</td>
</tr>
</tbody>
</table>

Ratio of ORs from intervention (I) vs. control (C) groups describing the change from baseline to post implementation phase time points in the proportion of eligible patients initiating the HPV vaccine series.

**Models adjusted for practice type (public/private), medical specialty (pediatrics/family medicine), patient age, patient insurance, and patient sex.

For Race, analysis data was limited to practices in which race was reported for at least 88% of the patients (n=6). "Unknown" race category was not modeled individually due to small sample size, n=122. For Ethnicity, analysis data was limited to practices in which ethnicity was reported for at least 80% of the patients (n=2).

Intraclass correlation coefficients, order of model presentation = 0.129, 0.116, 0.054, 0.326, NA, NA, NA.
eTable 5. Tdap and MCV4 Vaccination by Patient Factors: Control/Intervention Difference in Difference Comparison of Baseline to Postimplementation Phase Periods

<table>
<thead>
<tr>
<th>Patient Characteristic</th>
<th>Study Period</th>
<th>N eligible for Vaccine Dose</th>
<th>% of Eligible Who Received Needed Vaccine Dose</th>
<th>Odds Ratio (95% CI), Baseline to Post Implementation Phase</th>
<th>% of Eligible Who Received Needed Vaccine Dose</th>
<th>Odds Ratio (95% CI), Baseline to Post Implementation Phase</th>
<th>I/C Difference in Difference* (Ratio of ORs) Unadjusted</th>
<th>I/C Difference in Difference* (Ratio of ORs) Adjusted** Unadjusted</th>
<th>I/C Difference in Difference* (Ratio of ORs) Adjusted**</th>
</tr>
</thead>
<tbody>
<tr>
<td>TDAP</td>
<td>Baseline</td>
<td>4116</td>
<td>63.5%</td>
<td>0.82 (0.74-0.92)</td>
<td>3,949</td>
<td>57.1%</td>
<td>0.75 (0.67-0.83)</td>
<td>0.74 (0.65-0.84)</td>
<td>0.90 (0.78-1.05)</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>3931</td>
<td>60.1%</td>
<td>0.81 (0.71-0.92)</td>
<td>4,392</td>
<td>50.1%</td>
<td>0.74 (0.65-0.84)</td>
<td>0.74 (0.65-0.84)</td>
<td>0.90 (0.78-1.05)</td>
</tr>
<tr>
<td>MCV4</td>
<td>Baseline</td>
<td>4575</td>
<td>62.4%</td>
<td>0.99 (0.90-1.10)</td>
<td>4,707</td>
<td>53.5%</td>
<td>1.09 (1.00-1.20)</td>
<td>1.13 (1.02-1.25)</td>
<td>1.10 (0.96-1.26)</td>
</tr>
<tr>
<td></td>
<td>Implementation</td>
<td>4409</td>
<td>62.8%</td>
<td>0.99 (0.89-1.11)</td>
<td>5,406</td>
<td>55.6%</td>
<td>1.13 (1.02-1.25)</td>
<td>1.13 (1.02-1.25)</td>
<td>1.10 (0.96-1.26)</td>
</tr>
</tbody>
</table>

*Ratio of ORs from intervention (I) vs. control (C) groups describing the change from baseline to post implementation phase time points in the proportion of eligible patients receiving vaccine.

**Models adjusted for practice type (public/private), medical specialty (pediatrics/family medicine), patient age, patient insurance, and patient sex.

ICC = 0.130, 0.205 respectively.