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Increasing Human Papillomavirus Vaccine Initiation among Publically-Insured Florida Adolescents

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Abstract

Purpose—We evaluated the feasibility of a multi-level intervention to increase HPV vaccine initiation among adolescents.

Methods—We used a four-arm factorial quasi-experimental trial to assess feasibility and short-term, preliminary effectiveness of a health system-level, gender-specific postcard campaign and an in-clinic health information technology (HIT) system. Between August to November 2013, we tested the intervention among 11–17 year olds without prior HPV vaccine claims in Florida Medicaid or Children's Health Insurance Program encounters (2773 girls and 3350 boys) who attended or were assigned to primary care clinics in North Central Florida.

Results—At least one postcard was deliverable to 95% of parents. Most parents (91% boys' and 80% girls') who participated in the process evaluation survey (*n*=162) reported seeking additional information about the vaccine after receiving the postcard. Only 8% (57 of the 1062) of adolescents assigned to a HIT provider with an office visit during the study used the HIT system. When compared with arms not containing that component, HPV vaccine initiation increased with the postcard campaign [girls Odds Ratio (OR) = 1.6, 95% Confidence Interval (CI) = 1.1–2.3 and boys = not significant], the HIT system (girls OR = 1.5, 95% CI =1.0–2.3 and boys OR = 1.4, 95% CI=1.0–2.0), and the combined HIT and postcard intervention (girls OR = 2.4, 95% CI =1.4–4.3 and boys OR = 1.6, 95% CI=1.0–2.5).

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Conclusions—A system-level postcard campaign was feasible. Despite low recruitment to the inclinic HIT system, the intervention demonstrated short-term, preliminary effectiveness similar to prior HPV vaccine interventions.

Keywords

HPV vaccine; Florida; Medicaid and CHIP; intervention; health information technology; reminders

INTRODUCTION

As of 2013, in the United States, only 57% of girls and 35% of boys aged 13–17 years had initiated the HPV vaccine series (1). Furthermore, among girls, HPV vaccine coverage rates are increasing at half the rate of other recommended adolescent vaccines (tetanus, diphtheria, and acellular pertussis vaccine; and the meningococcal conjugate vaccine) and did not increase between 2011 and 2012 (2). Florida is among the four states with lowest HPV vaccine series initiation rates for girls (2). Interventions are needed to provide optimal protection for boys and girls and reach the Healthy People 2020 goals of 80% of 13–17 year old girls receiving all three doses (3).

Parents play a primary role in adolescents' initiation of the HPV vaccine series (4). Yet, parents' decisions are affected by multi-level influences including their own beliefs (e.g., vaccine safety and efficacy), their child's health care provider's recommendation, social influences, and their child's opinion (5–10). Assuming vaccination is similar to other behaviors (11), the largest probability of increasing HPV vaccine initiation is likely from interventions that target multiple levels of influence (e.g., parent, adolescent, provider). To date, however, few HPV vaccine interventions target more than one level of influence (12–14).

We developed a multi-level intervention, called Protect Me from HPV, with two components: (1) a system-level postcard campaign and (2) an in-clinic health information technology (HIT) reminder system. The postcard campaign was designed to prompt parents and adolescents to discuss the vaccine with their doctor. The HIT system was designed to prompt adolescents to consider the HPV vaccine and address two vaccination barriers identified by providers: time and discomfort discussing the vaccine with hesitant families (4, 15). By assessing vaccine interest, the HIT system differentiates adolescents who are likely to initiate vaccination without significant time from adolescents who require more intense discussions. Between August and November 2013, we assessed the feasibility and short-term, preliminary effectiveness of Protect Me from HPV among 11–17 year old Florida Medicaid and Children's Health Insurance Program (CHIP) beneficiaries visiting clinics in North Central Florida..

METHODS

Study population

We used identifiable Florida Medicaid and CHIP claims and encounter data to select 11–17 year old adolescents who met two criteria. First, adolescents could not have claims for the

HPV vaccine (current procedural terminology codes 90649 or 90650) prior to the sample draw (August 1, 2013). Second, to maximize the opportunity of adolescents visiting a provider in study's geographic area during the study period, we restricted our sample to adolescents who: (1) were enrolled in Medicaid or CHIP in June 2013; (2) had a residential zip code in North Central Florida defined as within Gainesville, Florida or a surrounding Primary Care Service Area (Chiefland, Citra, Cresent City, Cross City, Interlachen, Keystone Heights, Lake Butler, Lake City, Live Oak, Mayo, Ocala, Palatka, Starke, Steinhatchee, Williston)(16); and (3) had at least one regular office visit between July 1, 2011 and August 1, 2013. Regular office visits were defined by the Child and Adolescent Access to Primary Care Practitioners specification for office visits and preventive medicine (current procedural codes: 99201-99205, 99211-99215, 99241-99245, 99381-99385, 99391-99395, 99401-99404, 99411-99412, 99420, 99429) (17). We obtained permission for this use of the claims from the Florida Agency of Health Care Administration and the Institutional Review Board at the University of Florida approved this project.

Study design

We used a quasi-experimental factorial design to assign adolescents to one of four study arms: (1) postcard campaign, (2) in-clinic HIT system, (3) postcard campaign and in-clinic HIT system, and (4) usual care (Figure). Because adolescents and their families have a choice in their health provider and our budget limited the number of participating clinics, the HIT system was only offered to adolescents attending specific providers, hereafter, called HIT providers. For use of the in-clinic HIT system, we recruited all pediatric primary care providers (27 doctors, 3 nurse practitioners, and 39 medical residents) from six primary care clinics serving Medicaid and CHIP enrolled adolescents located in the Gainesville, Florida Hospital Service Area (HSA) (16). Five clinics are part of an academic health center (four general pediatrics and one family medicine) and one is a private general pediatric clinic. While included in the sampling and design, the adolescents attending the private clinic (n=221 patients) were excluded from the effectiveness analysis; we were unable to assess vaccine initiation for these adolescents since the clinic referred all Medicaid and CHIP adolescents to the health department for vaccination.

To identify adolescents most likely to visit the HIT providers, we selected all adolescents who had Medicaid or CHIP claims for a visit or panel assignments to a HIT provider between January 2012 and August 2013. For comparison, we identified adolescents without claims or panel assignments to HIT providers between January 2012 and August 2013. We did not identify the clinics or assess in-clinic care received for the comparison adolescents.

We further separated the HIT and comparison arms geographically to maximize baseline vaccine initiation equivalence. When using adolescent residential zip codes within Gainesville HSA, baseline vaccine initiation was higher for HIT than non-HIT providers (Girls: 41% HIT versus 26% non-HIT providers and Boys: 26% HIT and 15% non-HIT providers). More comparable baseline vaccination rates were found when comparing adolescents from HIT providers with residential zip codes within Gainesville HSA to adolescents not attending HIT providers and living outside of the Gainesville HSA: (Girls: 41% HIT versus 36% non-HIT providers and Boys: 26% HIT and 26% non-HIT providers).

Thus, we restricted HIT arms to adolescents within the Gainesville HSA and comparison arms to adolescents outside of the Gainesville HSA.

Among the identified adolescents within the HIT and the comparison arms, we randomly assigned half of boys and half of girls to receive the postcard campaign. We assigned boys and girls separately because postcards were gender-specific.

Intervention components

Postcard campaign—Following the learner verification framework (18, 19), we developed a gender-specific postcard campaign to address the gender diversity in vaccine series initiation and differential parental concerns (1, 8, 20). Behavioral experts developed and refined postcards using an iterative approach with focus groups of parents of Florida Medicaid and CHIP enrolled adolescents. The final postcards (2 for girls and 2 for boys) were 6 by 8 inch full-color cards with images of adolescents and parents and information in English and Spanish about vaccine benefits, costs, side-effects, and safety. All postcards urged parents to discuss vaccination with the adolescent's health care provider.

Prior to sending postcards via first class mail to parents of each selected adolescent, we updated addresses from Florida Medicaid and CHIP enrollment files with the National Change of Address Database. Families received two postcards specific to the gender of their selected child (1387 girls and 1764 boys). Postcards were sent at the study start (August 19, 2013) and two months later (October 7, 2013). Both postcards were undeliverable for 4.7% of families.

Among parents who received the postcard campaign, 200 parents of boys and 200 parents of girls were randomly sampled to assess postcard acceptability with a three-page survey. The survey included questions on postcard receipt recall, reactions, and impressions and was sent via courier with $5 cash and a hand-stamped return envelope one month after the final postcard mailing (November 1, 2013) and two months later to non-responders (January 28, 2014).

HIT system—Based on provider focus groups and an existing in-clinic HIT system assessing general health risks, we created a 4–6-question system (offered in English and Spanish on tablet computers) for adolescents to verify vaccination history and indicate interest in learning about the vaccine. Within the system, adolescents could choose to participate in a four-page follow-up survey sent via courier with $5 cash and a hand-stamped return envelope.

The HIT system summarizes adolescent responses for providers in real-time via color-coded screens. Green screens identified interested adolescents who agreed they were unvaccinated. Red screens identified adolescents who thought they had received at least one dose of the vaccine or were uninterested. Providers were asked to offer the vaccine to adolescents with green screens and follow usual care for adolescents with red screens. We made improvements based on an 8-person pilot.

Providers and front office staff were trained to use the HIT system during one-on-one meetings with study staff. Additionally, study staff guided clinic staff use of the HIT system with their first patient and routinely visited clinics to address questions.

The HIT system included a list of all adolescents identified as unvaccinated. Between August 14, 2013 and November 15, 2013, front office staff were asked to offer the HIT system to parents of adolescents included on the HIT system list who visited the clinic. Front office staff were asked to record parent refusals and inform providers of the participant's screen color. For each HIT participant, providers were asked to complete a 6-question survey embedded within the HIT system about their HPV-related actions during the adolescent's visit.

HPV vaccine series initiation

We considered vaccine initiation as the adolescent having at least one HPV vaccine claim during the study period (August 14, 2013 to November 15, 2013) reported by April 1, 2014 regardless of where the vaccine was received. Because claims can be submitted up to 90 days following the service date and there was a 12-day delay between the sample draw and the study start, 419 sampled adolescents had claims for the vaccine prior to the study start. We excluded these adolescents from the effectiveness analysis.

Statistical analysis

We estimated the frequency of process measures and used Fisher-exact tests to evaluate differences. We used survey logistic regression to assess the effect of the individual and combined intervention components on HPV vaccine initiation while adjusting for clustering within household. All analyses were conducted with SAS software version 9.3 (SAS Institute, Inc., Cary, NC). When possible, we stratified analyses by gender because we sampled boys and girls separately. In multivariable analyses, we adjusted for adolescent's race/ethnicity, age, and health program type (Medicaid or CHIP). We were unable to cluster analyses by clinic because we could not identify the clinics for the adolescents attending non-HIT providers; Florida Medicaid and CHIP Master Provider file does not group providers by clinic and frequently has outdated office locations. For logistic regression models, statistical significance was determined by 95% confidence intervals for Odds Ratios (ORs) that did not include the null value.

We performed three secondary analyses. First, because recruitment to the HIT system was low, the differences in HPV vaccine initiation between HIT and non-HIT assignees among adolescents who have a regular doctor visit during the study period was similar to baseline initiation rates for HIT and non-HIT groups. Thus, we evaluated the potential for selection bias by comparing vaccine initiation between HIT and non-HIT providers. Second, to estimate the potential of the HIT system to influence initiation rates, we estimated short-term, preliminary effectiveness of the HIT among adolescents who had a regular office visit during the study and, if assigned, used the HIT system. Third, to assess if HIT was effective within HIT clinics, we compared HPV vaccine initiation among users and non-users of HIT who had a regular office visit during the study.

RESULTS

Demographics

Adolescents were racially and ethnically diverse: 47% non-Hispanic white, 26% non-Hispanic black, 14% Hispanic, and 13% other racial/ethnic groups. Most (81%) were enrolled in Medicaid. The average age was 13.7 years (sd = 2.0).

Parents' Reaction to the Postcard Campaign

The postcard survey was completed by 162 of 400 (41%) randomly sampled parents. Responders were similar to the overall sample by race/ethnicity, program enrollment, and adolescent's age. Over half (61%) of the parents responding to the postcard survey remembered receiving at least one postcard. Among parents who remembered the postcards, general reactions were favorable (Table 1). Upon receiving the postcards, 21% of parents made an appointment to talk to their child's doctor about the vaccine and most parents (91% boys' and 80% girls) sought additional information in some way.

Parents' comprehension of postcard content varied across topics. Vaccine benefits were highlighted on both sides of the postcards and most parents (80% boys' and 82% girls') felt benefits were communicated. All of the postcards mentioned that the vaccine was free, but only 35% of boys' and 41% of girls' parents thought the postcards told about cost. While only one of the two postcards mentioned side effects, 58% of boys' and 63% of girls' parents recalled receiving safety information.

HIT system process and user reactions

Across all clinics and all visit types, during the three months of the study, 73 adolescents used the HIT system (8% of adolescents assigned to HIT providers who had a regular office visit). While real-time offer rates were not routinely collected, interviews with recruiters suggest most families were never offered participation in the HIT system. Few refusals were documented: 9 parents and 8 adolescents. Compared to the sample, HIT participants were less likely to be non-Hispanic white (25%) or Hispanic (9%) and more likely to be non-Hispanic black (38%) or from other racial/ethnic groups (29%) ($p<0.0001$).

Nearly all (93%) of HIT participants were enrolled in Medicaid. Nearly one-third (30%) of adolescents who used the HIT system did so during acute visits. Most (71%) adolescent agreed to receive the follow-up survey, among which 29 (40%) returned a completed survey. Providers completed visit-specific surveys for 90% of the HIT participants.

Among adolescents confirming they were unvaccinated (64%), half (53%) were interested in learning more about the vaccine (Table 2). On the day of the clinic visit, approximately two-thirds of unvaccinated and interested adolescents discussed the HPV vaccine with their provider, but only a third initiated the vaccine series. For adolescents who reported they were uninterested in the vaccine, providers (68%) were more likely than adolescents (38%) to report they had vaccine discussions and none of these adolescents initiated the vaccine.

About one-third (36%) of the adolescents identified from claims as unvaccinated reported they had initiated the HPV vaccine series. Without additional information, we cannot

reconcile the differences between the claims and the adolescents' report. For adolescents who reported they had already initiated the series, providers (80%) were more likely than adolescents (40%) to report vaccine discussions. Unlike uninterested adolescents, providers (57%) and adolescents (20%) reported vaccines were received during these visits.

HPV vaccine initiation

During the three-month study period, 5% (288 of 5663) of adolescents initiated the HPV vaccine series. The odds of HPV vaccine series initiation increased with the postcard campaign (60% among girls and not significantly among boys), with the HIT system (50% among girls and 40% among boys), and with the combined postcard campaign and HIT system (140% among girls and 60% among boys)(Table 3). Results were similar in analyses adjusted for race/ethnicity, age, and program type, but the estimated effect of the HIT system among girls was non-significant.

About half (41%) of the adolescents had a regular office visit during the study period. Among adolescent with office visits, vaccine initiation rates are similar between HIT and non-HIT provider groups [Girls OR = 1.2, 95% Confidence Interval (CI) = 0.8 to 1.7 and Boys OR = 1.0, 95% CI = 0.7 to 1.4]. Because very few of the adolescents assigned to HIT actually used the system, the similarities between HIT and non-HIT providers are reflective of provider baseline rates and not the HIT system effectiveness. Thus, the similar baseline rates suggest non-HIT providers are a reasonable comparison group.

To estimate the potential of the HIT system to improve vaccine initiation if recruitment could be improved, we considered only the adolescents who actually interacted with the system as HIT exposed. Compared to adolescents in the control group who had regular clinic visits, HPV vaccine initiation was three times higher among boys and girls who used the HIT system (Table 4). Among girls, the combined intervention demonstrated potential synergistic effects (OR = 5.9, 95% CI = 1.6 to 21.8). Even within HIT assigned adolescents, HIT users were three times more likely to initiate the vaccine than non-users (Girls OR = 3.3, 95% CI = 1.2 to 9.0 and Boys OR = 3.6, 95% CI = 1.7 to 7.5) further indicating that the observed HIT increase was likely due to the HIT system and not the difference between HIT and non-HIT providers.

DISCUSSION

A multi-level postcard and HIT system intervention was feasible and preliminary evidence suggests a two-fold increase in the three-month HPV vaccine series initiation rate among a low-income population of adolescents in North Central Florida. Compared to prior HPV vaccine interventions (12, 21, 22), over the short-term, our intervention was similarly effective as assigned. Although the intervention experienced difficulties with incorporating the HIT system into the clinic workflow, the effectiveness of the HIT system among users suggests if recruitment to the HIT system was improved the combination intervention is a promising strategy to improve HPV vaccine series initiation.

The postcard campaign was successful in reaching the homes of nearly all adolescents and prompted most parents who recalled receiving postcards to seek additional information. The

postcard campaign had a modest short-term, preliminary effectiveness on vaccine initiation, but appeared to work synergistically with the HIT system among girls. Furthermore, the true effects of the postcards may take longer than three months to realize since parents may wait for regular preventive care visits to discuss the vaccine with their child's doctor.

Protect Me from HPV demonstrated similar short-term, preliminary effectiveness in increasing HPV vaccine initiation among adolescents to prior interventions (21, 23–25). We found similar percentage point changes in incidence of vaccine initiation (3% to 4% compared to prior findings of 2% to 9%) (21, 23–25). Our relative increase in HPV vaccine initiation (ORs: 1.6 to 2.5) is also similar to prior interventions (Relative Risks: 1.0 to 2.5) (21, 23–25). Secondary analyses suggest that with improved recruitment to the HIT system the intervention may be more effective than prior interventions.

This study had three important strengths. First, we evaluated HPV vaccine receipt as our outcome and measured receipt with a medical database of Medicaid and CHIP claims that is not susceptible to self-report bias. Many prior HPV vaccine interventions aimed to change vaccine intentions that may not translate to vaccine receipt or used self-reported vaccination (12, 26–28). Second, our study used a large (2773 girls and 3530 boys) sample of low-income girl and boy adolescents within the age group recommended for universal vaccination (mean =13 years). Few other studies have considered HPV vaccine outcomes among young adolescents (21, 23, 24). Third, the Protect Me from HPV intervention has the potential to reduce the burden on individual clinics to improve vaccination. The feasibility and receptiveness of parents to postcards sent at the system-level suggest that the responsibility of sending vaccination reminders and educational material to families can be shifted from individual clinics to the health-systems. Furthermore, while we experienced difficulties incorporating the HIT system into the clinic workflow, the preliminary data suggest that provider time can be effectively triaged with the HIT system since only half of the unvaccinated teens were interested and providers did not convert any uninterested teens.

The study had three important limitations. First, we did not randomize assignment of the HIT system. Thus, it is possible that some of the effects of the HIT system could be attributed to differences between the HIT and non-HIT provider practices or patients rather than the HIT system itself. Our secondary analyses, however, suggest vaccination rates were similar between HIT and non-HIT providers and the HIT system was effective even among HIT providers. Second, like all single system records of vaccination (29), the Medicaid and CHIP records likely contain incomplete information as suggested by patient interactions with the HIT system. For example, adolescents who received the HPV vaccine at the Health Department may not have claims in Medicaid and CHIP. Unless claims submission procedures differ systematically between HIT and non-HIT providers, which we have no reason to suspect, the limitations of the claims data should have little influence on the effectiveness analysis. Identification of unvaccinated adolescents could be improved by incorporating medical records and vaccine registry data. Third, while common with recruitment to research by clinical staff (30, 31), recruitment to the HIT system was low. Efforts to improve recruitment could include better incorporation with workflow, recruiter incentives, increased training to elevate recruiters' confidence, and real-time feedback on

recruitment performance (32–34). Our population exposed to HIT is of similar size as intervention groups from several HPV vaccine studies (range 50–100) (6, 12, 13, 35, 36).

Our data suggest that a postcard campaign aimed at parents and an in-clinic HIT provider reminder system is feasible and may improve HPV vaccine series initiation among 11–17 year olds. Administering postcard campaigns at the system-level rather than the clinic level may relieve the pressure on individual providers while producing a similar increase in adolescent vaccination. Further study is required to incorporate the HIT system into a variety of clinic workflows over both the short- and long-term. Protect Me from HPV demonstrates the promise and challenges of using system-level resources and incorporating HIT systems in clinics to improve adolescent vaccination.

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IMPLICATIONS AND CONTRIBUTION

The United States, especially Florida, has low rates of HPV vaccine series initiation. A system-level postcard campaign reached 95% of low-income families. Despite challenges with recruitment to an in-clinic health information technology system, our intervention increased HPV vaccine series initiation incidence between 60–140%.

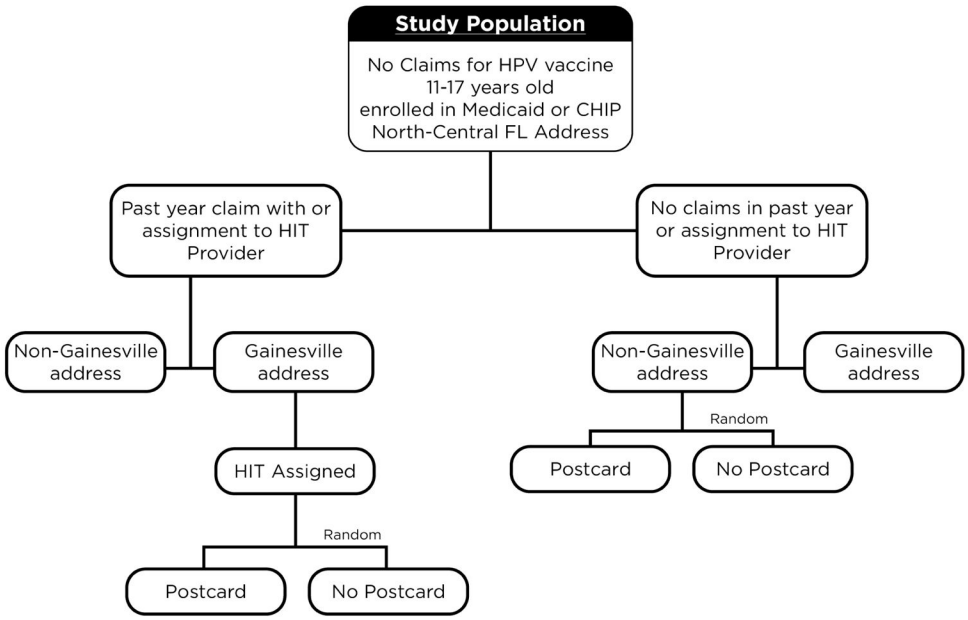

Figure.
Quasi-Experimental Study Design

Table 1

Reaction to Postcard Campaign among Parents who Remembered Receiving at Least One Postcard

	Girls (n=46) %	Boys (n=51) %	Fisher's exact test p-value
Reaction			
Made an appointment to talk to child's doctor	20%	23%	0.81
Sought information or spoke about the vaccine	80%	91%	0.14
Spoke to child	36%	31%	0.66
Spoke to doctor	27%	38%	0.49
Spoke to friends or family	14%	42%	<0.001
Sought info on the internet	9%	18%	0.37
Went to website provided	11%	11%	0.99
Agree they trusted postcard information	56%	62%	0.67
Comprehension agreement			
Told about vaccine benefits	82%	80%	0.99
Told about vaccine cost	41%	35%	0.64
Told about vaccine safety	63%	58%	0.66
Attraction			
Liked the pictures	63%	47%	0.19
Liked the colors	51%	44%	0.52
Liked receiving the postcards	47%	54%	0.99

Table 2

Provider and Adolescent Reactions to the HIT system by screen color

	Green Screen Unvaccinated and Interested	Red Screen Unvaccinated and Uninterested	Red Screen Received at least one vaccine
Total	25/73 (34%)	22/73 (30%)	26/73 (36%)
Reported vaccine discussions			
Provider	13/22 (68%)	13/20 (68%)	18/24 (81%)
Adolescent	7/11 (64%)	3/8 (38%)	4/10 (40%)
Reported vaccine receipt during visit			
Provider	6/22 (33%)	0/20 (0%)	12/24 (57%)
Adolescent	3/11 (33%)	0/8 (0%)	2/10 (20%)

Table 3

Intervention Components Increase HPV Vaccine Initiation Rate among Assigned Groups During Three-Month Study Period

	Control Group			Intervention Group				
	Number Assigned	Number Initiating	Initiation Rate	Number Assigned	Number Initiating	Initiation Rate	Crude OR (95% CI)	Adjusted OR (95% CI)
Postcards								
Girls	1236	44	3.6%	1234	68	5.5%	1.6 (1.1, 2.3)*	1.6 (1.1, 2.4)*
Boys	1588	85	5.4%	1605	91	5.7%	1.1 (0.8, 1.5)	1.1 (0.8, 1.5)
HIT								
Girls	1742	68	4.0%	728	44	6.0%	1.5 (1.0, 2.3)*	1.3 (0.9, 2.0)
Boys	2147	103	4.8%	1046	73	7.0%	1.4 (1.0, 2.0)*	1.4 (1.0, 2.0)*
Combined HIT and Postcards								
Girls	869	27	3.1%	361	27	7.5%	2.4 (1.4, 4.3)*	2.0 (1.1, 3.7)*
Boys	1067	50	4.7%	525	38	7.2%	1.6 (1.0, 2.5)*	1.6 (1.0, 2.5)

Adjusted for age, race/ethnicity, and program type.

*95% confidence interval indicates statistically significant differences between intervention arms.

Table 4

Among users of the HIT system, HIT demonstrated potential to increase vaccine initiation

	Control Group		Intervention Group			
	Number who had a regular clinic visit	Initiation Rate	Number Who Used the HIT System	Initiation Rate	Crude OR (95% CI)	Adjusted OR (95% CI)
HIT						
Girls	652	9.8%	21	28.6%	3.3 (1.2, 8.8)*	3.2 (1.3, 8.5)*
Boys	775	12.9%	37	32.4%	3.2 (1.5, 6.6)*	2.9 (1.3, 6.3)*
HIT and Postcards						
Girls	320	7.8%	11	36.4%	5.9 (1.6, 21.8)*	7.2 (1.6, 31.5)*
Boys	405	12.1%	22	27.3%	2.8 (1.0, 7.7)*	2.8 (1.0, 8.2)

Adjusted for age, race/ethnicity, and program type.

*95% confidence interval indicates statistically significant differences between intervention arms.