Completion of the Human Papillomavirus Vaccination Series Lags in Somali Adolescents

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Abstract

Objective—It is unknown whether the Somali population in the US is likely to participate in HPV vaccination. We aimed to determine whether Somali girls living in a US community are following the recommendations for HPV vaccination.

Materials and Methods—We conducted a study of HPV vaccination among Somali girls seen at Mayo Clinic, Rochester, Minnesota. Each Somali subject was matched by year of birth to white/non-Hispanic subjects in a 1:3 ratio. We abstracted information between August 1, 2006 and December 31, 2009 related to HPV vaccine series initiation and completion. Initiation and completion frequencies were compared between study groups using the Chi-squared test.

Results—A total of 251 Somali and 727 white/non-Hispanic girls were identified using the Rochester Epidemiology Project who met all inclusion criteria for final analysis. 114 Somali girls (45%) and 334 white/non-Hispanic girls (46%) initiated the series (odds ratio, 0.98; 95% CI, 0.73–1.31), but only 59 Somali girls (52%) completed the vaccination series, compared with 240 (72%) of the white/non-Hispanic girls (odds ratio, 0.42; 95% CI, 0.27–0.65).

Conclusions—We found Somali girls to be generally accepting of initiating the HPV vaccine series, but less likely to complete the series as compared to white non-Hispanic girls of the same age.

Keywords

Papillomavirus Vaccines; Uterine Cervical Neoplasms; Somalia; Emigrants and Immigrants; Sexually Transmitted Diseases

Introduction

Cervical cancer is the second most common cancer among women worldwide and the third leading cause of cancer related death (1), with 90% of new cases of cervical cancer occurring among women in developing countries (2–4). With the implementation of the

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Papanicolaou (Pap) test, cervical cancer incidence and mortality have decreased substantially in developed countries, with an age-adjusted incidence of 8.1 and mortality of 2.4 per 100,000 women per year in the United States (5). For some women who immigrate to the United States from developing countries, however, preventative measures are not always taken, leaving them at risk for cervical cancer (6).

More than 80,000 Somalis have immigrated to the United States in recent years, and this community now represents one of the largest African-born immigrant populations in the United States (7). According to estimates, Somalia has one of the highest rates of cervical cancer: the age-adjusted incidence is 20.3 and mortality is 15.2 per 100,000 women per year (8). In Somalia, regular Pap testing is extremely limited, and current evidence shows that Somali women who immigrate to developed countries where Pap testing is more common still have low rates of participation (6,9). Women who immigrate to the United States should also have access to HPV vaccination, another important preventative tool which should reduce the cervical cancer incidence even further. Somali children who immigrate to the United States participate in recommended childhood vaccine programs (10), including the hepatitis B virus vaccine (11). This implies openness to vaccines as a tool to prevent illness, including sexually transmitted illnesses, in this population. However, very little is known about HPV vaccine acceptance and participation in the Somali community. To address this question, we conducted a study comparing HPV vaccination series initiation and completion among Somali and white/non-Hispanic girls.

Methods

Study Population

This study was approved by the Mayo Clinic Institutional and Olmsted Medical Center Institutional Review Boards prior to initiation of the study. All potential study subjects were identified by using the Rochester Epidemiology Project (REP) infrastructure. The REP is a medical records-linkage system that includes medical records for residents living in Olmsted County, Minnesota and covers the past 45 years. These data are reliable when compared with the US Census; specifically, the REP captured 102.7% of the Olmsted County population in 2000 when compared with the US Census (12). The REP contains clinical data from Mayo Clinic in Rochester, Saint Marys Hospital, Rochester Methodist Hospital, Olmsted Medical Center, Olmsted Medical Center Hospital, Rochester Family Medicine Clinic, private practitioners, regional hospitals, and nursing homes (12). All girls who were aged 9 to 18 years and residents of Olmsted County, Minnesota, as of December 31, 2009, were identified from the REP as potential study subjects. After the initial screen for age and Olmsted County residency, potential subjects were excluded if they had no research authorization on record (Fig. 1).

Somali Group

From the initial group of possible subjects with research authorization, Somali girls were identified using the following criteria: girls with race identified as Somali in the REP, girls who had race identified as "black" or "other" in the REP and a primary language of Somali, and girls who were determined to have a Somali surname. Somali surnames were identified from a list of all girls' names from the REP by one of the authors (A.M.S.), a native of Somalia, who was blinded to any racial designation within the REP database. The medical records of the subjects identified as having a Somali surname were then reviewed, and subjects were included in the Somali cohort if the terms "Somali," "Somalian," or "Somalia" were listed as racial identification or place of origin within provider notes. Subjects were excluded if Mayo Clinic medical records were not available or if they had a primary

language other than English, Somali, or Arabic. Those without a primary language documented were designated as having English as their primary language.

White/non-Hispanic Group

From the initial search of the REP for appropriately aged girls with research authorization, we identified those who were designated as white/non-Hispanic (referred to hereafter as "white"). Subjects were excluded if Mayo Clinic records were not available or if they had a primary language other than English or had a need for a language interpreter indicated in the medical record. Those without a primary language documented were designated as having English as their primary language. From the remaining subjects, a group was randomly selected to provide a 3:1 ratio of white to Somali girls, matched by year of birth. After the group matching, those in both cohorts who had no documented medical visits during the study period were excluded from study analysis.

Data Abstraction

Data abstraction was performed according to an operations manual by 2 abstractors (C.N.P. and C.S.R.). All charts were reviewed by the first author and modified if changes were required. Patient demographics, recorded HPV vaccination, and provider visit types and dates were abstracted directly from the medical record. Provider notes were searched electronically for the terms *HPV vaccine*, *HPV vaccination*, *Gardasil (Whitehouse Station, NJ)* and *Cervarix (Research Triangle Park, NC)* to determine the frequency of discussion of HPV vaccination during medical visits. Data were stored in the Research Electronic Data Capture (REDCap).

HPV Vaccine Frequency

The study dates were August 1, 2006, the date the HPV vaccine became available at Mayo Clinic, through December 31, 2009. HPV vaccine initiation was defined as at least 1 dose of the HPV vaccine received within the study dates. HPV vaccine series completion was defined as receiving all 3 HPV vaccines within study dates. If HPV vaccination was documented in the clinical note to have been received at another institution during the study time frame, this vaccination was recorded as received.

Statistical Analysis

Descriptive analysis was carried out using a Chi-squared test with an alpha level of 0.05. Bivariate analysis was carried out using simple logistic regression to compare the odds of vaccine initiation and completion between groups. We calculated Odds Ratios (OR) and 95% confidence intervals for comparison of the Somali group versus the white group. JMP 9.0 software (SAS Institute, Inc. Cary, NC) was used for statistical analysis.

Results

Study Population

Using all methods of identification and after exclusions, 283 girls were identified as Somali and having available Mayo Clinic records. These subjects were age-matched to 849 white girls. However, 32 Somali girls and 122 white girls had no medical visits in the Mayo Clinic record during the study period and were therefore excluded from analysis. The remaining 251 Somali and 727 white girls were included for final study analysis, representing a ratio of 1:2.9.

Demographic information for the study population is shown in Table 1. Mean (SD) age was 13.3 (2.9) years in the Somali group vs. 13.2 (2.9) years for the white group (*P*=.66). The

two groups were significantly different in the percentage who spoke English as a primary language (*P*<.001) and the percentage who lacked health insurance (*P*<.001). Lack of health insurance was specifically defined as having no health insurance, private, subsidized or otherwise at time of data retrieval. There was no difference in documentation of a visit to a primary care provider during the study dates (*P*=.14). Access to health care in general also did not appear to be limited because there was no difference between groups with regard to having a provider interaction during the study dates (251 of 283 Somali girls [88.7%], 727 of 849 white girls [85.6%]; *P*=.26).

To ensure that both groups were still appropriately age-matched after the subjects without provider visits during the study period were removed from consideration, the distribution of age across cohorts was compared. The final included groups were stratified by age, and the ratio calculated for each age group (Fig. 2). The most disparate age group was 17 years, which had a 2.6:1 ratio of white girls to Somali girls after exclusions.

HPV Vaccine Initiation and Completion

Table 2 presents HPV vaccine initiation and completion among Somali and white groups. All those identified as having received the HPV vaccine in the medical record received the Gardasil vaccine. Overall, there was no difference in HPV vaccination initiation rates between Somali and white girls (45% vs. 46%; odds ratio [OR], 0.98, 95% CI, 0.73–1.31). However, in strata separated by age groups, Somali girls ages 9 to 12 years were more likely to have initiated HPV vaccination (OR, 1.85; 95% CI, 1.17–2.91), whereas Somali girls ages 16 to 18 years were less likely to have initiated HPV vaccination (OR, 0.35; 95% CI, 0.20–0.61).

Despite similar vaccine initiation rates between groups, Somali girls were less likely to complete the 3-shot series (Table 2). This was true for the entire group (vaccine completion) and for the subset of Somali girls who received the first shot in the series (conditional completion). Among those who initiated the vaccine series, 72% of white girls and 52% of Somali girls received all 3 doses during the study period (OR, 0.42; 95% CI, 0.27–0.65).

Not only did fewer Somali girls complete the series, but those who did complete the series did not do so in a timely manner. The recommended dosing schedule of the HPV vaccine is 60 days between doses 1 and 2 and 120 days between doses 2 and 3. Somali girls had longer intervals between doses 1 and 2 and between doses 2 and 3 than white girls (*P*<.001 for both) (Table 3). Accordingly, the time to complete the series was also longer for the Somali girls in our study population: a mean (SD) of 461 (204) days for Somali girls vs. 283 (145) days for white girls (*P*<.001).

Vaccine Compliance

To assess how well the subjects followed the recommended vaccine-dosing schedule, we determined whether a given dose was received within 10 days of the recommended interval (Table 3). Both groups of girls fell outside the recommended dosing schedule for the second dose: 37% of the white cohort and 26% of the Somali cohort received the second dose on schedule (OR, 0.63; 95% CI, 0.37–1.07). However, Somali girls were less likely to receive dose 3 on schedule (OR, 0.16; 95% CI, 0.05–0.54) and less likely to receive the entire HPV vaccine series on schedule (OR, 0.24; 95% CI, 0.07–0.81) compared with the white girls, although a minority of both groups remained on schedule for the third dose.

Provider Interactions

Evidence of discussion of the HPV vaccine at any provider visits during the study period was lacking for 41% of white girls and 46% of Somali girls (OR, 1.21; 95% CI, 0.91–1.62)

(Table 4). The remainder of each cohort had at least 1 encounter during which HPV vaccination was discussed. The only difference between cohorts was the percentage that had 3 such interactions: 24% of white girls vs. 15% of Somali girls (OR, 0.56; 95% CI, 0.38–0.82). Successful provider interactions were defined as interactions between patients and providers specific to HPV vaccination that resulted in HPV vaccine initiation. The rates of successful provider interactions did not differ significantly between the groups (Table 4).

Language and Interpreter Utilization

Within the Somali girls alone, there was no difference in vaccine initiation or completion with regard to the primary language spoken or the need for a language interpreter (Table 5). Among those who spoke English, 53% initiated and 25% completed the series, compared with 42% and 23%, respectively, of those who spoke Somali or Arabic. Among those who didn't did not need a language interpreter, 49% initiated and 27% completed the series, compared with 42% and 20%, respectively, of those who needed a language interpreter.

Discussion

Among the Somali group, nearly half initiated the HPV vaccine series (45%) and of those that initiated the vaccine series, more than half (52%) completed the series. This is better than many of the national statistics for the HPV vaccine, with initiation rates ranging from 25% to 49% and completion rates of 33% or less (13–21). These findings imply that the HPV vaccine is generally well accepted and received among the Somali population in our region. Although our results are encouraging, we also identified a significant disparity in vaccine completion and compliance within the Somali group. This is disconcerting because girls may not be deriving maximum benefit if all 3 shots are not administered. The difference in completion rates found in this study is consistent with previous findings in the literature indicating disparities in HPV vaccination completion rates among minority females, specifically black females in the United States (16,17,22–24).

There are several potential causes for the differences identified in this study, including access to the health care system and language barriers. Language seemed not to be a factor because HPV vaccine initiation and completion rates were the same among Somali girls who spoke English as their primary language and those who did not, or among those who required a language interpreter to interact with their provider. Only girls who accessed the health care system at least once were included in the analysis, and we did not find a difference in the number of provider visits in which HPV vaccination was discussed. However, we do not have information regarding the total number of and time between provider visits or type of provider seen (e.g. primary care vs. specialist) within each group, which could affect completion rates. The Department of Pediatrics at Mayo Clinic, Rochester, has a follow-up mechanism in place for those patients who miss appointments. If a child misses an appointment, their parent/legal guardian is contacted by phone within 10 days of the missed visit as a reminder and to schedule another appointment. While this protocol would apply to every patient, if there was a difference in the reliability of contact information on file between study groups, follow-up may have been more limited, resulting in lower completion rates. This needs further investigation.

Importantly, educational and cultural barriers may also exist and may be related to the differences in vaccine completion and compliance identified in this study. Identifying any barriers related to vaccine completion and compliance in this population may provide further insight into improving vaccine utilization in other populations.

Overall, compliance was not good across the entire study population. Currently, it is unknown whether partial series completion or if receiving the 3 doses outside the

recommended dosing schedule decreases overall effectiveness of the vaccine. Therefore, it is essential that providers become more proactive at reminding patients to return for each dose as recommended and continue to educate patients on the importance of receiving all 3 doses (25). There was no difference between groups in documentation of a visit to a primary care provider during the study dates (P=.14); this was assessed because primary care providers are more likely to monitor and administer preventive services such as vaccinations (26,27).

Our study has both strengths and limitations. We were able to define the entire population of girls aged 9 to 18 years in Olmsted County, Minnesota, but were limited to only including those with a Mayo Clinic medical record and research authorization in our study. However, only 9.6% of the total population identified in Olmsted County was lost due to lack of Mayo Clinic medical record availability (9.9% of white girls and 5.3% of Somali girls, calculated from Fig. 2, which suggests that this limitation is unlikely to have markedly affected our study findings.

Among those included in our study population, we were further limited to analyzing only those seen at Mayo Clinic during the study dates. Analysis of all those initially identified in the study population did not indicate any difference in HPV vaccination initiation between groups; however, again Somali girls were less likely to complete the HPV vaccine series than were the white girls. Since these results are consistent with our overall findings, it suggests this limitation did not substantially affect our study.

Another potential limitation of our study is use of the Mayo Clinic electronic medical record to verify HPV vaccine immunizations. It is possible that some of our study population received the HPV vaccine elsewhere, which was not recorded in their Mayo Clinic medical record. To minimize this limitation, we reviewed provider notes specific to HPV vaccination in addition to reviewing the immunization record. Those reported as receiving the HPV vaccinations elsewhere were recorded as having received the vaccine. In addition, those that had written documentation of HPV vaccination provided in the immunization record but no record of having received it at Mayo Clinic (suggesting they had received the vaccine elsewhere) were included as having received the vaccine. Of those in our study population, 9.7% were found to have received the HPV vaccine elsewhere. Since we were able to include these vaccinations in our study findings by including both the Mayo Clinic immunization record and provider notes, we believe this to be a minor limitation to our study findings.

Lastly, our study is subject to incidence-prevalence bias. Because we designed our study to include subjects who were Olmsted County residents at the study index date (December 31, 2009), there is a possibility that subjects may have moved into or out of Olmsted County during the study time frame, during which time they may have received the HPV vaccine, either before or after they encountered a Mayo Clinic provider, and therefore were not captured. However, our findings are likely more conservative than they would be if we only included those who were Olmsted County residents during the entire study period, and therefore this limitation is unlikely to significantly affect our overall findings.

The Findings of this study enable focused educational efforts within our community and stresses the need for similar analysis so resources are appropriately allocated, specifically, aimed at improving vaccine completion. Further studies need to be conducted to determine why Somali girls are less likely than their white counterparts to complete the series and, among those who do complete the series, are less likely to do so in accordance with the recommended dosing schedule. Identifying the potential causes of these disparities can be used to establish appropriate interventions that may improve vaccine completion and compliance among Somali girls.

Acknowledgments

Abbreviations

HPV	human papillomavirus
OR	odds ratio
Pap	Papanicolaou
REP	Rochester Epidemiology Project

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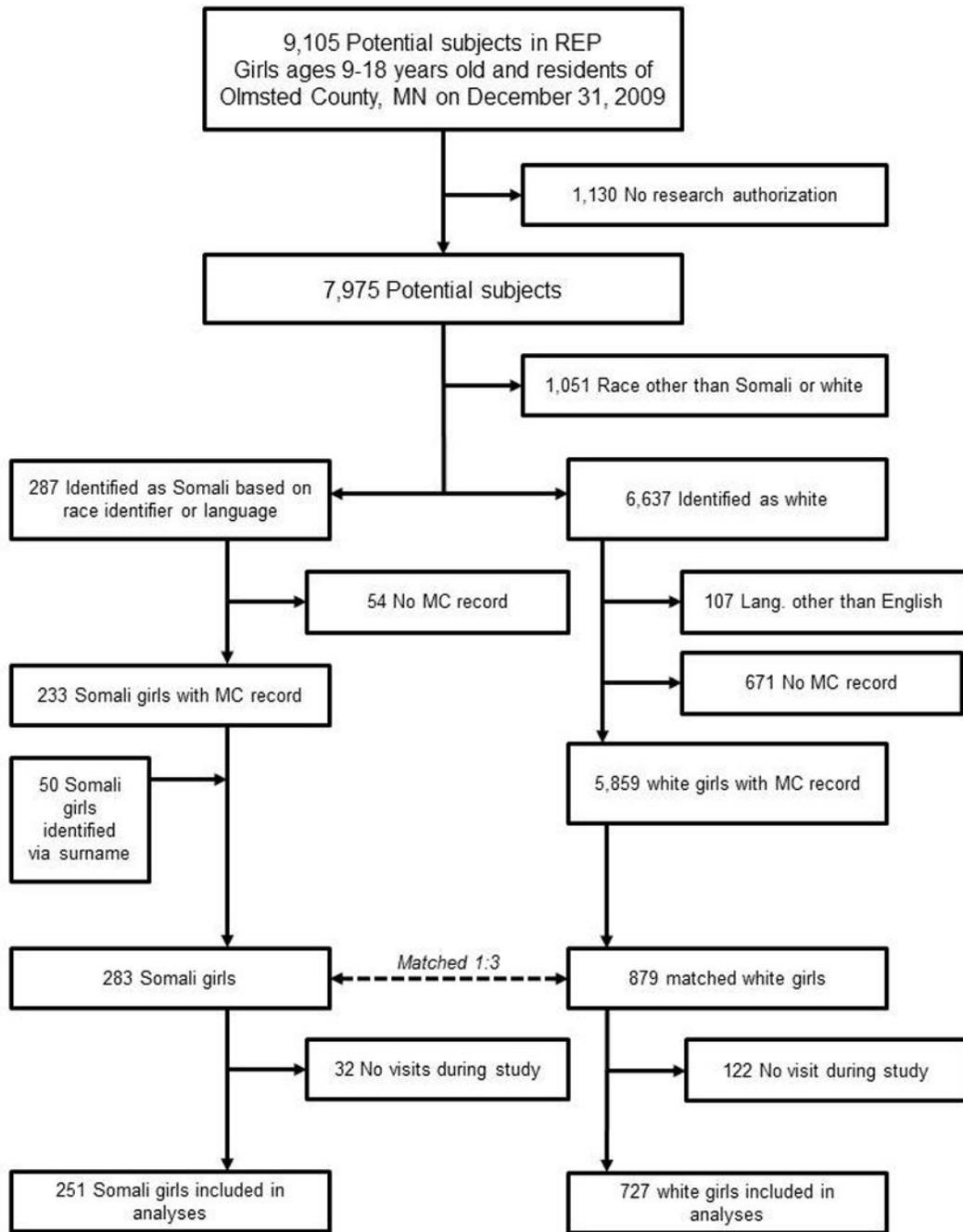
Fig. 1.
Identification and Selection of Study Subjects. MC indicates Mayo Clinic; REP, Rochester Epidemiology Project.
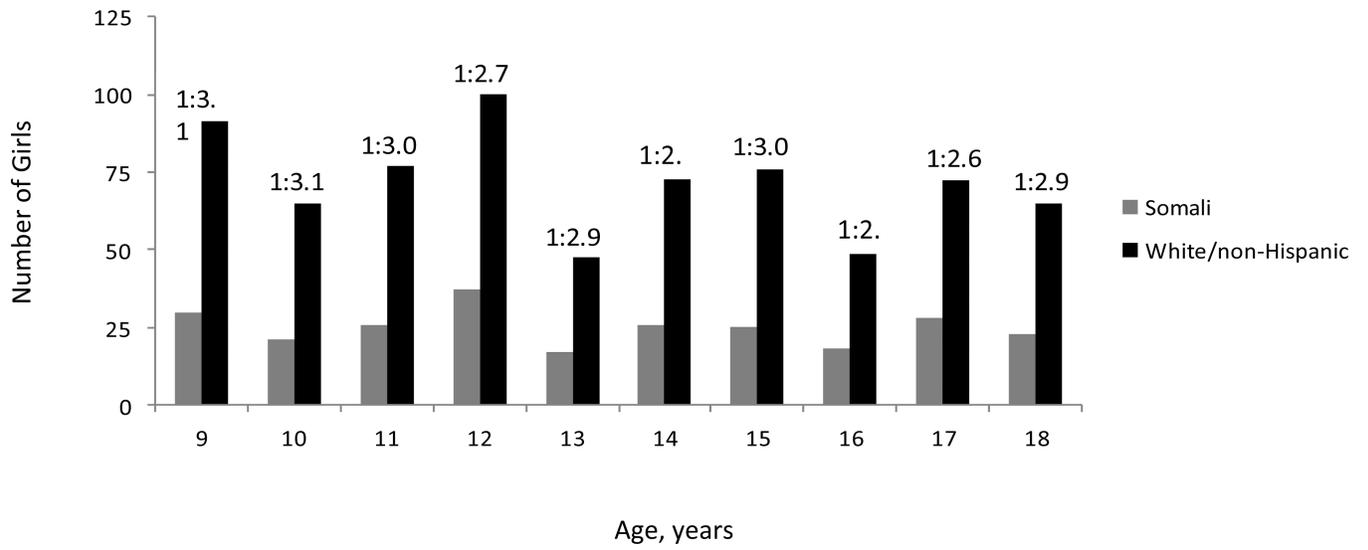
Fig. 2.
Distribution of Age across Cohorts. Numbers above bars indicate ratio of Somali to white/non-Hispanic girls in each age group.

Table 1

Subject Demographics

| Characteristic | Subject Group[a] | | P Value |
	White/non-Hispanic (n=727)	Somali (n=251)	
Language			<.001
English	727 (100)	76 (30.3)	
Somali or Arabic	0 (0)	175 (69.7)	
Insurance Coverage			<.001
Insured	708 (97.4)	234 (93.2)	
Uninsured	19 (2.6)	17 (6.8)	
Primary Care Visit Within Study Dates (i.e. Pediatrics, Family Medicine or Internal Medicine)[b]	649 (89.3)	223 (88.8)	.14

[a]Values are No. of subjects (%).

[b]Among girls with a provider visit during the study period.

Table 2

HPV Vaccine Initiation and Completion

Variable	Subject Group[a]		OR (95% CI)[b]
	White/non-Hispanic	Somali	
Vaccine Initiation			
All[c]	334/727 (45.9)	114/251 (45.4)	0.98 (0.73–1.31)
Age group, y[d]			
9–12	83/337 (24.6)	43/114 (37.7)	1.85 (1.17–2.91)
13–15	122/199 (61.3)	42/68 (61.8)	1.02 (0.58–1.80)
16–18	129/191 (67.5)	29/69 (42.0)	0.35 (0.20–0.61)
All including no provider visit[e]	334/849 (39.3)	115/283 (40.6)	1.06 (0.80–1.39)
Vaccine Completion			
All[c]	240/727 (33.0)	59/251 (23.5)	0.62 (0.45–0.87)
Age group, y[d]			
9–12	49/337 (14.5)	19/114 (16.7)	1.18 (0.66–2.10)
13–15	91/199 (45.7)	24/68 (35.3)	0.65 (0.37–1.14)
16–18	100/191 (52.4)	16/69 (23.2)	0.27 (0.15–0.51)
All including no provider visit[e]	240/849 (28.3)	59/283 (20.9)	0.67 (0.48–0.92)
Conditional Completion[f]			
All[c]	240/334 (71.9)	59/114 (51.8)	0.42 (0.27–0.65)
Age group, y[d]			
9–12	49/83 (59.0)	19/43 (44.2)	0.55 (0.26–1.56)
13–15	91/122 (74.6)	24/42 (57.1)	0.45 (0.22–0.95)
16–18	100/129 (77.5)	16/29 (55.2)	0.36 (0.15–0.83)

Abbreviations: HPV, human papillomavirus; OR, odds ratio.

[a] Values are No. of subjects in group/No. of possible subjects (%).

[b] The white group is the referent group in each case (OR, 1.00).

[c] Girls with a provider visit during the study period.

[d] Age as of December 31, 2009.

[e] All girls identified as white/non-Hispanic or Somali with a Mayo Clinic record available.

[f] Among those who initiated the vaccine series only.

Table 3

HPV Vaccine Compliance

Variable	Subject Group[a]		P value	OR (95% CI)[b]
	White/non-Hispanic	Somali		
Received first dose	334	114		
Received second dose	298	89		
Time between doses, days	125 (133)	212 (163)	<.001	
Within recommended schedule[c]	106 (35.6)	23 (25.8)		0.63 (0.37–1.07)
Received third dose	240	59		
Time between doses, days	170 (87)	261 (154)	<.001	
Within recommended schedule[c]	59 (24.6)	3 (5.1)		0.16 (0.50–0.54)
Completed series	240	59		
Time from first to last dose, days	283 (145)	461 (204)	<.001	
According to recommended schedule[c]	45 (18.8)	3 (5.1)		0.23 (0.07–0.78)

Abbreviations: HPV, human papillomavirus; OR, odds ratio.

[a]Values are No. of subjects, No. of subjects (%), or mean (SD).

[b]The white group is the referent group in each case (OR, 1.00).

[c]Second dose to be received within 2 months of the first dose; third dose to be received 4 months after the second dose. Subjects meeting these criteria received each dose no earlier than recommended and no more than 10 days after the recommended time frame.

Table 4

Provider Interactions

No. of Discussions[a]	Subject Group[b]		OR (95% CI)[c]
	White/non-Hispanic	Somali	
Provider Interaction[d]	727	251	
0	299 (41.1)	115 (45.8)	1.21 (0.91–1.62)
1	100 (13.8)	44 (17.5)	1.33 (0.90–1.96)
2	101 (13.9)	40 (15.9)	1.17 (0.79–1.75)
3	176 (24.2)	38 (15.1)	0.56 (0.38–0.82)
4	51 (7.0)	14 (5.6)	0.78 (0.43–1.44)
Successful Provider Interaction[e]			
0	299 (41.1)	115 (45.8)	1.21 (0.91–1.62)
1	257 (35.4)	87 (34.7)	0.97 (0.72–1.31)
2	52 (7.2)	11 (4.4)	0.59 (0.31–1.16)
3	13 (1.8)	3 (1.2)	0.66 (0.19–2.35)
4	0 (0)	1 (0.4)	---

Abbreviations: HPV, human papillomavirus; OR, odds ratio.

[a] Specific discussions with the provider about the HPV vaccine.

[b] Values are No. of subjects or No. of subjects (%).

[c] The white group is the referent group in each case (OR, 1.00).

[d] Provider visit during the study period.

[e] Provider interaction, with HPV vaccination discussed and resulting in an HPV vaccine dose received during the study period.

Table 5

Effect of Language on HPV Vaccination Status in Somali Girls Only (n=251)

Variable	Primary Language[a]		OR (95% CI)[b]
	English (n=76)	Somali or Arabic (n=175)	
Vaccine Initiation	40 (52.6)	74 (42.3)	0.66 (0.38–1.13)
Vaccine Completion	19 (25.0)	40 (22.9)	0.89 (0.47–1.67)
	Interpreter Needed[a]		
	No (n=130)	Yes (n=121)	OR (95% CI)[c]
Vaccine Initiation	63 (48.5)	51 (42.2)	0.77 (0.47–1.28)
Vaccine Completion	35 (26.9)	24 (19.8)	0.67 (0.37–1.21)

Abbreviations: HPV, human papillomavirus; OR, odds ratio.

[a]Values are No. of subjects (%).

[b]The English-speaking group is the referent group (OR, 1.00).

[c]The no-interpreter-needed group is the referent group (OR, 1.00).