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Temporal Patterns of Human Papillomavirus Vaccine Safety Concerns from NIS-Teen, 2008-2012.

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Master of Public Health

Epidemiology

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Temporal Patterns of Human Papillomavirus Vaccine Safety Concerns from NIS- Teen, 2008-2012.

By

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2013

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An abstract of
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Abstract

Temporal Patterns of Human Papillomavirus Vaccine Safety Concerns from NIS-Teen, 2008-2012.

By Jessica Wurster

Background: The HPV vaccine is the first vaccine targeted to prevent cervical cancer, but it is sub-optimally used. We sought to test the hypothesis that parental safety concerns leading to non-vaccination were proportionally higher among HPV vaccine non-recipients compared to tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) vaccine and meningococcal conjugate (MCV4) vaccine non-recipients.

Methods: We analyzed the CDC National Immunization Survey-Teen (NIS-Teen) public use data files for years 2008 through 2012. The proportion of parents who reported safety concerns as the main reason for not vaccinating was compared between HPV and MCV4, and HPV and Tdap vaccines using a chi square test for each year. For year 2012, reasons for not vaccinating adolescents for HPV were evaluated between three groups: 1) those who received Tdap and MCV4 vaccines, but not HPV, 2) those who received Tdap or MCV4 but not HPV and 3) those who had not received Tdap, MCV4, and HPV. We used a log binomial regression to evaluate changes in the frequency of citing safety concerns relative to the level in 2008.

Results: Parental safety concerns as a reason for non-vaccination were higher for HPV vaccine non-recipients compared to both MCV4 and Tdap non-recipients across all years 2008 to 2012. Among parents of adolescents who received zero HPV vaccines and were not up to date for Tdap, the proportion of parents citing safety concerns as the main reason for non-vaccination was significantly higher for the HPV vaccine compared to MCV4 for all years and Tdap in all years except for 2008 ($p=0.1165$). There was a significant difference among parents who indicated safety concerns as the primary reason for not vaccinating their adolescent for HPV between those who have received Tdap and MCV4, but not HPV (12.4%) to those who had not received Tdap, MCV4 nor HPV (7.6%, $p<0.0001$).

Conclusions: Significantly higher safety concerns among the HPV vaccine compared to MCV4 and Tdap indicate that education about the documented safety of the HPV vaccine is needed by both parents and health care providers to combat the fear of safety concerns.

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Introduction

Human papillomavirus (HPV) is the most common sexually transmitted infection in the United States, and if these infections are persistent, they can cause cervical cancer [1]. The HPV vaccine is the first vaccine targeted to prevent cervical cancer, yet HPV vaccination rates remain low [2]. The Advisory Committee on Immunization Practices (ACIP) formally recommended the HPV vaccine in June 2006 for adolescent girls while the tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis (Tdap) vaccine and meningococcal conjugate (MCV4) vaccines were recommended in June 2005 and February 2005 respectively for routine vaccination of all adolescents [3]. Although these vaccines were introduced within 17 months of each other, HPV vaccine coverage lags substantially behind Tdap and MCV4. In 2013, adolescent vaccine coverage was 86.0% for Tdap, 77.8% for MCV4 and 37.6% for completion of the HPV vaccine series among adolescent girls [2].

The reasons for non-vaccination must be investigated to better understand the barriers to HPV vaccination and to facilitate development of evidence-based interventions to address HPV vaccination barriers. Concerns about vaccine safety have been reported as a major reason for non-vaccination in several studies [4-7]. Other common parental concerns include limited knowledge about the vaccine, lack of a recommendation from a health care professional, financial concerns, and age of the adolescent at vaccination [7]. The CDC reports that safety concerns were identified as the main reason for not vaccinating for HPV by 13.1% of parents who did not intend to vaccinate their daughters in the next 12 months [8].

To date, few studies have examined patterns of safety concerns as the reason for non-vaccination for the HPV vaccine relative to safety concerns about MCV4 and Tdap vaccines [9]. Additionally, longitudinal trends of safety concerns in HPV vaccination have not been

extensively investigated. Understanding longitudinal trends in safety concerns and other parental reasons for non-vaccination can assist public health officials in targeting resources and programs to improve vaccine uptake. In this study, we sought to test the hypothesis that parental safety concerns leading to non-vaccination were proportionally higher among non-recipients of the HPV vaccine non-recipients compared to Tdap and MCV4 vaccine non-recipients. We also investigated reasons for not vaccinating adolescents for HPV among adolescents who have already received MCV4 and Tdap vaccines, but not HPV.

Methods

Study Population and Data Source

We analyzed the CDC National Immunization Survey-Teen (NIS-Teen) public use data files for years 2008 through 2012 [10]. The NIS-Teen annual survey aims to produce timely vaccination coverage estimates of adolescents aged 13 to 17 years living in the United States [11]. The survey includes two phases: 1) the household survey and 2) provider verified data. The household survey identified participants in all 50 states through a random-digit-dialed sample of landline and cellular telephone numbers. Parents were interviewed regarding vaccination history of their adolescent [11]. If the adolescent's parent granted permission to contact the adolescent's health care provider, a questionnaire was mailed to providers to obtain vaccination history [11]. Because we focused exclusively on parent-cited safety concerns and because estimates were similar between household and provider-verified data with regard to the prevalence of safety concerns, we utilized the household survey-level data exclusively for this analysis.

Our main outcome variable was parental safety concerns leading to non-vaccination for HPV. For years 2010 to 2012, parents were asked how likely it is the adolescent will receive HPV vaccinations in the next twelve months. For these years, we limited our analysis to data for adolescents with no household survey reported HPV vaccine receipt, and whose parents indicated "Not Too Likely", "Not At All Likely", and those "Not Sure/Don't Know" whether the adolescent will receive HPV shots in the next 12 months. For years 2008 and 2009, frequencies for safety concerns and other reasons for not vaccinating for HPV were limited to adolescents who have received zero HPV vaccines according to the household survey data, as vaccination intention was not assessed in those survey years. For years 2008 to 2012, frequencies for the MCV4 and Tdap safety concerns for not vaccinating were limited to adolescents who were not up to date for that respective vaccine according to the household survey data.

Comparison of Safety Concerns between MCV4, Tdap, and HPV Vaccines

The proportion of parents who reported safety concerns as the main reason for not vaccinating was compared between HPV and MCV4, and HPV and Tdap vaccines using a chi square test for each year 2008 through 2012.

Because this comparison was conducted among (a) those who had received zero HPV vaccines and those who were not up to date for MCV4 and (b) the those who had received zero HPV vaccines and those who were not up to date for Tdap, the sample sizes and proportions citing HPV safety concerns differed across analytic comparisons.

Comparison of Non-Vaccination Reasons for HPV

For year 2012, reasons for not vaccinating adolescents for HPV were evaluated between three groups: 1) those who received Tdap and MCV4 vaccines, but not HPV, 2) those who received Tdap or MCV4 but not HPV and 3) those who had not received Tdap, MCV4, and HPV. This analysis was limited to adolescents who had received zero HPV vaccines and those "Not Too Likely", "Not At All Likely", and those "Not Sure/Don't Know" whether the adolescent will receive HPV shots in the next 12 months.

Changes in Safety Concerns

We used a log binomial regression to evaluate changes in the frequency of citing safety concerns relative to the level in 2008 and adjusted for mother's education, poverty status, and race/ethnicity. The survey year (2008-2012) was the predictor variable and parental safety concerns as the primary reason for not vaccinating for HPV were used as the outcome variable.

Statistical Analysis

All analyses were conducted using SAS (version 9.4, SAS Institute Inc, Cary, NC), at a significance level of $\alpha=0.05$. Because this analysis utilized existing, previously collected, and publicly available data, Emory University Institutional Review Board exemption was granted.

Results

Study Population Characteristics

Parental safety concerns as a reason for non-vaccination were higher for non-recipients of HPV vaccine compared to both MCV4 and Tdap non-recipients across all years 2008 to 2012 (Table 1). The prevalence of safety concerns as the primary reason for not receiving HPV vaccine increased from 5.2% of parents in 2008 to 9.7% of parents in 2012. Safety concerns were cited as the main reason for non-vaccination with MCV4 by 0.5% of parents in 2008 to 1.3% of parents in 2012, and for non-vaccination with Tdap by 0.7% of parents in 2008 to 1.6% of parents in 2012.

While common, safety concerns were not the primary reason for lack of HPV vaccination. In 2012, the major reasons parents cited for their adolescents not receiving the HPV vaccine in the next 12 months were the vaccine was not needed or not necessary (23.1%), the vaccine was not recommended (19.4%), lack of knowledge about the vaccine (16.2%), the adolescent was not sexually active (10.1%), and safety concerns about the vaccine (9.7%). These reasons were consistently ranked by parents as the top five reasons why their adolescent will not receive the HPV vaccine across all years 2008 to 2012 (Table 1).

Comparison of Safety Concerns between MCV4, Tdap, and HPV Vaccines

Table 2 shows the differences in safety concerns between MCV4, Tdap, and HPV vaccines. Among parents of adolescents who received zero HPV vaccines and were not up to date for Tdap, the proportion of parents citing safety concerns as the main reason for non-vaccination was higher for the HPV vaccine compared to Tdap and MCV4 in all years. In all years, HPV safety concerns were cited at least 2.8 times as high as the rate of safety concerns for Tdap and 4.3 times as high as the rate of MCV4 safety concerns.

Comparison of Non-Vaccination Reasons for HPV

We compared non-vaccination reasons for HPV among those who had received Tdap and/or MCV4 but not HPV compared to those who had not received Tdap, MCV4, and HPV in 2012 (Table 3). Safety concerns varied among the three groups. There was a significant difference among parents who indicated safety concerns as the primary reason for not vaccinating their adolescent for HPV between those who have received Tdap and MCV4, but not HPV (12.4%) to those who had not received Tdap, MCV4 nor HPV (7.6%, $p<0.0001$). Comparatively, among those who had received either Tdap or MCV4, but not HPV, 9.1% of parents reported safety concerns as the reason for not vaccinating for HPV.

In 2012, among adolescents who had received MCV4 and Tdap, but not HPV, 17.2% of parents indicated that HPV was not recommended compared to 19.2% of parents whose adolescents had not received MCV4, Tdap, and HPV. Among those who had received either MCV4 or Tdap, but not HPV, 17.8% indicated that HPV was not recommended.

Changes in Safety Concerns

A log binomial regression was used to evaluate changes in the frequency of citing safety concerns relative to the level in 2008 (Table 4). In reference to 2008, 2009 resulted in a 58% (95% CI: 1.38, 1.81) increase in safety concerns after controlling for mother's education, poverty status, and race/ethnicity. The greatest change in safety concerns in reference to 2008 was 2010 with an 84% increase (95% CI: 1.63, 2.08) after controlling for mother's education, poverty status, and race/ethnicity. 2011 (75%, 95% CI: 1.55, 1.97) and 2012 (54%, 95% CI: 1.36, 1.74) also had elevated safety concerns compared to 2008 but were less extreme compared to 2010.

Discussion

Since 2008, the proportion of adolescents not vaccinated against HPV has decreased, yet the proportion of parents who indicate safety concerns the main reason for non-vaccination of HPV has increased. Significantly higher safety concerns among the HPV vaccine compared to MCV4 and Tdap indicate that both parents and health care providers require education to combat the fear of safety concerns for the HPV vaccine. The safety of the HPV vaccine has been extensively studied. A 2011 study from the Vaccine Safety Datalink monitored over 600,000 doses of the HPV vaccine administered over three years and found that girls who received the HPV vaccine were not at increased risk to experience severe adverse outcomes compared to girls who have not received the HPV vaccine [12]. Similar results were found in the Kaiser Permanente study, which evaluated over 340,000 doses of the HPV vaccine, and the Sweden and Denmark cohort study that evaluated over 690,000 doses of HPV vaccine [13, 14]. These studies indicate parents need further education and outreach to lessen misconceptions about the HPV vaccine in particular. Additionally, health care providers should explore supplementary ways to disseminate necessary information about the vaccine. This study also suggests more interventions are necessary to address the large disparities in HPV coverage and further explore the reasons for non-vaccination.

It is interesting to note that among adolescents who had received MCV4 and Tdap but not HPV, 19.6% of parents believed the HPV vaccine was not needed (Table 3). Because these adolescents had received MCV4 and Tdap, their parents must have had some understanding and acceptance of the benefits of vaccination so it is alarming they do not feel the same for the HPV vaccine. This finding also indicates that additional education should be targeted to parents to communicate the rationale to vaccinate for HPV specifically. Additionally, among adolescents who had received both MCV4 and Tdap, but not HPV, 17.2% of parents indicated that HPV was not recommended. This indicates a high proportion of adolescents who are receiving MCV4 and

Tdap with missed opportunities to receive the HPV vaccine because their physician did not recommend it to them. Further education and training for pediatricians about the HPV vaccine and how to talk to parents about this vaccine may be necessary to increase HPV vaccination coverage and reduce misconceptions.

Physicians should be acutely aware of this disparity and initiate conversations with patients about the importance of the HPV vaccine. A 2011 study investigated the sources parents trust the most for vaccine safety information and found that the majority (76%) of parents trusted their child's physician [15]. Several additional studies have shown HPV vaccine uptake is significantly higher among patients who have physicians who initiate conversations about the HPV vaccine [16, 17]. In a 2014 study investigating physician vaccination recommendation styles, the authors found that most physicians discuss the HPV vaccine in detail with their patients rather than routinely recommend the vaccine similar to other adolescent vaccines [18]. Physicians who routinely recommend the vaccine had a 94% same day vaccination rate compared to physicians who discussed the HPV vaccine in detail who had a 38% same day vaccination rate [18]. Physicians should be cognizant of the importance of their role in discussing vaccines and openly share research regarding vaccine safety.

Although issue to consider when thinking about low HPV vaccination is how to approach parents about vaccine hesitancy. In a 2014 randomized trial addressing vaccination with the measles mumps rubella (MMR) vaccine, Nyhan et al. found that of four different educational interventions, none of them increased parental intent to vaccinate their child [19]. Interventions to improve HPV vaccination should be grounded in appropriate behavioral theory to ensure that efforts to educate parents and healthcare providers about HPV vaccination do not backfire.

Similar concerns about HPV vaccine safety have been found abroad, and in several countries, safety concerns have also been increasing [20]. In Greece, safety concerns increased dramatically and were the major reason for vaccine refusal in 2010 [20]. In British Columbia, safety concerns were cited as the main reason not to vaccinate for HPV by 30% of parents who did not intend to have their daughter vaccinated [20]. In a Swedish study investigating parental acceptance of the HPV vaccine, most seemed accepting of the vaccine, but several parents indicated they were worried about unknown side effects [21]. An Italian study also found that the major barrier to vaccination was fear of adverse events reported by 80% of families [22]. As safety concerns increase both internationally and domestically, the media or anti-vaccination groups could influence parents and their decisions about vaccinating their adolescents for HPV. It is vital that accurate information about the vaccine is disseminated to prevent misunderstandings about the vaccine.

In 2008 and 2009, HPV vaccines received negative national media attention which could have influenced the increase in safety concerns we found. A study published in 2009 reviewed the Vaccine Adverse Event Reporting System (VAERS) for the HPV vaccine and found that most of the adverse events were not serious [23]. However, the study gained attention due to its report of 32 VAERS-reported deaths that caused some people to question the safety of the vaccine without taking into consideration the limitations of the VAERS [23]. Other negative media reports have gained attention intermittently since 2010 which may help explain why HPV safety concerns have remained elevated since 2008 [24-25]. Concerns about HPV vaccine safety have recently been publicized in a highly visible article in The Toronto Star which questioned the safety of HPV vaccine without adequately presenting related epidemiologic studies documenting the safety profile of the HPV vaccine [25]. The newspaper later pulled the story from its website after Canadian public health advocates highlighted the safety of HPV vaccine [25-26].]. The media

must recognize its influential role in parental decision making, and strive for accurate, timely news stories to inform the public without encouraging inaccurate conclusions.

The long term implications of safety concerns for HPV are alarming. Increased safety concerns may be responsible for the stagnating HPV vaccination rates nationwide and result in many preventable cases of cervical cancer. In 2013, it was estimated that if all missed opportunities for HPV vaccination were eliminated in 2012, coverage for greater at least 1 dose of the HPV vaccine could have been as high as 92.6% [8]. Additionally, the fear of safety concerns about the HPV vaccine could also impact other vaccines resulting in decreasing coverage rates.

This study has several limitations. The NIS-Teen data for years 2013 and 2014 were not available at the time of analysis; therefore, analysis was limited to years 2008 to 2012. While many researchers utilizing the NIS-Teen survey use provider verified data, our analysis used the household survey data. Because our main outcome variable was parental reasons for non-vaccination, which would not be verified by physicians, we believe that it was more appropriate to use the household survey data rather than the provider verified data. Additionally, there were no major differences found in proportions of non-vaccination reasons and demographics when compared between provider verified data and household survey data. Another limitation is that the NIS-Teen survey did not ask parents about specific safety concerns such as adverse events and long term effects so we are limited in our interpretations of these findings with regard to specific safety concerns. Further research is needed to better understand the specific reasons parents indicate safety concerns as the main reason for non-vaccination of the HPV vaccine.

Conclusions

This study highlights the need for further education about the HPV vaccine targeted to both parents and physicians. Physicians must communicate the importance of this vaccine, consistently recommend the vaccine, and become more comfortable discussing the vaccine with their patients and the patients' parents. Additionally, parents must fully understand the importance of HPV vaccination. In the US, Tdap and MCV4 have much higher coverage rates than HPV. Because these two vaccines are recommended for administration at the same age as HPV vaccine, it is possible that HPV vaccination coverage could reach the levels observed for Tdap and MCV4. However, education, training, and other interventions must be implemented for both parents and physicians to address parental concerns and increase coverage rates.

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Table 1. Characteristics of the study population from the National Immunization Survey-Teen, 2008-2012.

Characteristic	2008 %	2009 %	2010 %	2011 %	2012 %
Demographics					
Mother's Education					
Less than 12 years	10.0	10.0	9.5	9.5	9.8
12 years	21.6	20.8	20.9	20.3	19.9
More than 12 years, non-college grad	30.5	29.2	8.8	27.6	7.9
College graduate	37.9	40.1	40.8	42.6	42.4
Poverty Status					
Above poverty>$75K	40.8	42.8	42.4	43.4	43.9
Above Poverty<=$75K	43.2	43.6	42.7	41.3	39.4
Below Poverty	12.1	13.6	14.8	15.4	16.8
Missing					
Race/Ethnicity					
Hispanic	12.2	13.5	13.7	14.3	14.2
Non-Hispanic White Only	68.5	66.5	65.9	64.8	64.0
Non-Hispanic Black Only	12.0	12.6	12.4	12.4	12.6
Non-Hispanic Other + Multiple Race	7.2	7.3	8.0	8.5	9.3
Safety Concerns					
Main reason teen will not receive HPV shots: Safety Concerns*	5.2	9.0	10.4	10.8	9.7
Main reason teen will not receive Meningitis Booster shots: Safety Concerns**	0.5	0.4	0.9	0.6	1.3
Main reason teen will not receive Tetanus booster shots: Safety Concerns**	0.7	0.6	0.7	0.5	1.6
HPV: Main reason teen will not receive HPV shots in next 12 months*					
Not needed or not necessary	17.7	18.3	23.4	25.1	23.1
Not recommended	12.0	9.8	15.9	16.9	19.4
Lack of knowledge	18.0	18.8	13.9	13.7	16.2
Not sexually active	19.1	18.1	15.6	16.3	10.1
Family/parental decision	3.0	5.3	2.3	2.7	3.9
Not appropriate age	8.7	7.2	4.6	5.4	3.9
Child is male^	N/A	N/A	9.5	7.3	3.0
Not a school requirement	0.4	0.4	0.6	0.8	2.6
Costs	2.3	2.6	1.4	1.9	1.7
More info/new vaccine	4.9	5.7	1.6	2.0	1.7
Child Fearful	1.0	0.9	0.7	0.9	1.2
No Doctor or Doctor's visit scheduled	0.7	0.5	0.8	1.4	1.0
Child should make decision	1.2	2.0	0.9	0.9	0.9
Don't believe in immunizations	0.7	0.9	0.6	0.8	0.9
Handicapped/special needs/illness	0.7	1.1	0.5	0.6	0.6
Religion/orthodox	0.7	0.7	0.3	0.4	0.6
Increased sexual activity concern	0.1	0.2	0.2	0.1	0.5
Other reason	3.7	1.2	1.8	1.3	0.4
Already up to date	0.3	0.5	0.1	0.0	0.2
Effectiveness Concern	0.7	0.7	0.2	0.3	0.2

Already sexually active	0.2	0.0	0.0	0.0	0.0
College Shot	0.0	0.1	0.1	0.0	0.0
No OB/GYN	0.2	0.1	0.0	0.0	0.0
Not available	0.1	0.1	0.2	0.2	0.0
Time	0.1	0.1	0.0	0.0	0.0

*For years 2010 to 2012, frequencies limited to teens who have received 0 HPV vaccines and those not too likely, not at all likely, and not sure teen will receive HPV shots in the next 12 months. For years 2008-2009, frequencies limited to teens who have received 0 HPV vaccines.
**Of those who are not up to date on that shot

^Not asked in 2008 and 2009.

Table 2. Safety concerns of MCV4, Tdap, and HPV vaccines from the National Immunization Survey-Teen, 2008-2012.

	2008		**2009**		**2010**		**2011**		**2012**	
	%	p-value	%	p-value	%	p-value	%	p-value	%	p-value
HPV*	5.2		9.8		10.9		10.8		9.0	
MCV4**	0.9	<0.0001	1.2	<0.0001	1.3	<0.0001	1.0	<0.0001	2.1	<0.0001
HPV*	5.1		9.6		11.0		10.8		8.2	
Tdap**	1.8	0.1165	1.6	<0.0001	1.3	<0.0001	1.1	<0.0001	2.9	<0.0001

*For years 2010 to 2012, frequencies limited to teens who have received 0 HPV vaccines and those not too likely, not at all likely, and not sure teen will receive HPV shots in the next 12 months. For years 2008-2009, frequencies limited to teens who have received 0 HPV vaccines.
**Of those who are not up to date on that shot

Table 3*. Comparison of non-vaccination reasons for HPV among adolescents who have already received Tdap and/or MCV4 vaccines, but not HPV compared to adolescents who have not received MCV4, Tdap, and HPV from the National Immunization Survey-Teen, 2012.

	Meningitis+, Tdap+, HPV- n=3,522 N (%)	**Meningitis-, Tdap-, HPV- N=1,497 N (%)**	**Meningitis +/-, Tdap +/-, HPV- N=4,458 N (%)**
Not needed or not necessary	689 (19.6)	421 (28.1)	1096 (24.6)
Not recommended	606 (17.2)	287 (19.2)	793 (17.8)
Lack of knowledge	585 (16.6)	198(13.2)	627 (14.1)
Safety Concerns	437 (12.4)	114 (7.6)	404 (9.1)
Not sexually active	355 (10.1)	123 (8.2)	445 (10.0)
Child is male	146 (4.2)	25 (1.7)	122 (2.7)
Not appropriate age	142 (4.0)	43 (2.9)	174 (3.9)
Family/parental decision	127 (3.6)	48 (3.2)	188 (4.2)
More info/new vaccine	79 (2.2)	8 (0.5)	80 (1.8))
Not a school requirement	63 (1.8)	53 (3.5)	121 (2.7)
Costs	54 (1.5)	29 (1.9)	73 (1.6)
Child Fearful	39 (1.1)	19 (1.3)	61 (1.4)
No Doctor or Doctor's visit scheduled	35 (1.0)	14 (0.9)	38 (0.9)
Child should make decision	30 (0.9)	8 (0.5)	41 (0.9)
Don't believe in immunizations	24 (0.7)	35 (2.3)	35 (0.8)
Increased sexual activity concern	22 (0.6)	7 (0.5)	19 (0.4)
Religion/orthodox	15 (0.4)	13 (0.9)	32 (0.7)
Other reason	14 (0.4)	7 (0.5)	16 (0.4)
Handicapped/special needs/illness	13 (0.4)	19 (1.3)	30 (0.7)
Already up to date	10 (0.3)	2 (0.1)	9 (0.2)
Effectiveness Concern	8 (0.2)	0 (0.0)	14 (0.3)
Time	8 (0.2)	1 (0.1)	1 (0.0)
College Shot	3 (0.1)	0 (0)	2 (0.0)
Already sexually active	1 (0.0)	1 (0.1)	1 (0.0)
No OB/GYN	0 (0.0)	0 (0.0)	0 (0.0)
Not available	0 (0.0)	2 (0.1)	6 (0.1)

*For 2012, analysis limited to teens who have not received the HPV vaccine and those who are not too likely, not at all likely, and not sure teen will receive HPV shots in the next 12 months.

Table 4*. Changes in safety concerns of the HPV vaccine from the National Immunization Survey-Teen, 2008-2012.

Year	Relative Risk	95% Confidence Interval
2008	ref.	ref.
2009	58%	1.38, 1.81
2010	84%	1.63, 2.08
2011	75%	1.55, 1.97
2012	54%	1.36, 1.74

*For years 2010 to 2012, frequencies limited to teens who have received 0 HPV vaccines and those not too likely, not at all likely, and not sure teen will receive HPV shots in the next 12 months. For years 2008-2009, frequencies limited to teens who have received 0 HPV vaccines.