

Awareness Is Not Enough: The Need to Increase Meningococcal Vaccine Uptake

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Abstract

Objective. Adolescent meningococcal vaccine uptake remains low. We examined vaccine awareness among parents of adolescents and uptake. **Methods.** Parents of adolescents aged 11 to 17 years ($n = 1281$) participated in a statewide survey. Logistic regression with weighted data provided population-based estimates. **Results.** In all, 65% had heard of meningococcal vaccine; parents more likely to report awareness had adolescents aged 16 to 17 years, in private school, or with health insurance. In total, 44% of aware parents reported vaccination; vaccinated teens were more likely to be black (odds ratio [OR] = 2.17), had a preventive checkup within 12 months (OR = 3.03), or resided with another child ≤ 18 years (OR = 1.83). Many parents of unvaccinated adolescents (38.5%) did not plan to vaccinate them within 12 months. The most common reasons for not vaccinating were providers not recommending it and believing adolescents did not need it. **Conclusion.** Many parents aware of meningococcal vaccine did not vaccinate their adolescents. Interventions that include increasing provider recommendation and annual visits may increase uptake.

Keywords

adolescent, immunization, meningococcal infections, meningococcal vaccines, vaccinations

Introduction

Meningococcal disease continues to cause significant morbidity and mortality in the United States in spite of decreasing rates. Meningococcal disease, particularly septicemia, can be a serious, rapidly progressive infection that leaves little time for diagnosis and management.¹ Early meningococcal disease can present with symptoms similar to common viral illnesses, making diagnosis difficult.² Twenty percent of survivors in all age-groups suffer severe sequelae, which include limb loss and scarring from gangrene, stroke, or central nervous system disorders such as seizures, motor nerve deficits, and cognitive dysfunction. Other sequelae include visual impairment, hearing loss, educational difficulties, and developmental delays.^{1,2}

The serious consequences of this disease may be avoided, because meningococcal conjugate vaccines have high efficacy.³ Meningococcal conjugate vaccines can provide direct immunity to those who receive them and may provide herd immunity to those not receiving them, primarily through the reduction of nasopharyngeal

carriage of the bacteria. As rates of meningococcal disease beyond infancy rise in early adolescence and peak between ages of 16 and 18 years, the vaccine is especially important for young adolescents prior to disease exposure.^{4,5}

In 2005, the Advisory Committee for Immunization Practices (ACIP) recommended routine meningococcal vaccination for adolescents aged 11 to 12 years.³ The meningococcal conjugate vaccine alongside the tetanus, diphtheria, and acellular pertussis vaccine (Tdap) became the foundation for what would become known as the adolescent vaccine platform. The ACIP expanded the platform to include: quadrivalent human papillomavirus

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vaccine (HPV4) in 2006 (for females); and subsequently bivalent human papilloma vaccine (HPV2), and HPV4 for boys.⁴

According to the goals set by Healthy People 2010, uptake of a vaccine should reach 90% within 5 years of the vaccine recommendation. However, by 2009, only 54% of a nationally representative sample of adolescents aged 13 to 17 years had received a dose of a meningococcal vaccine.⁶ Studies have examined correlates of meningococcal vaccine uptake though none have looked at correlates of uptake and awareness.⁷ Although provider recommendation and contact have been shown to be important for uptake, it is unclear what role awareness of the disease and the vaccine has on vaccination. Many studies have looked at the relationship between awareness, acceptance, and uptake of the HPV4 vaccine and found divergent cohort-dependent trends, particularly regarding the sexual nature of transmission.⁸⁻¹⁰ However, meningococcal disease is not sexually transmitted and the relationship between awareness and uptake of the meningococcal vaccine could be markedly different from that of HPV4. Understanding the prevalence and effect of meningococcal vaccine awareness is critical for evaluating public health education and outreach. Thus, the primary purpose of this study was to identify correlates of uptake of meningococcal vaccine as well as vaccine awareness among parents of adolescents in North Carolina. We also describe reasons for nonvaccination among the parents who are aware of the vaccine.

Materials and Methods

Study Design

For this study, we used data from the 2008 North Carolina Behavioral Risk Factor Surveillance System (BRFSS) and 2008 Child Health Assessment and Monitoring Program (CHAMP) surveys. BRFSS is an annual, population-based telephone survey that examines health-related behaviors among noninstitutionalized adults 18 years and older in the United States. In North Carolina, the State Center for Health Statistics Survey Center used random digit dialing to recruit participants for BRFSS. Interviewers used a computer-assisted telephone interviewing system to conduct all interviews.

The State Center for Health Statistics also annually conducts the CHAMP survey to assess the health of children younger than 18 years in North Carolina. Interviewers asked adults during their BRFSS interview if they had any children younger than 18 years currently

living in their household. For those with a child living in their home, interviewers collected information about the child's date of birth, gender, and whether the respondent would complete the CHAMP survey. When adults reported having more than one child younger than 18 years, the computerized interviewing system randomly selected one to be the index child. Interviewers placed follow-up calls about 2 weeks later to complete CHAMP surveys with respondents who agreed to participate. CHAMP surveys were conducted with the individual identified as being the most knowledgeable about the child's health (usually the BRFSS respondent). In 80% of households, the same respondent completed both CHAMP and BRFSS surveys. We linked data from the CHAMP and BRFSS surveys using anonymous unique identifiers. The institutional review board at the University of North Carolina determined that this study did not require approval.

The 2008 BRFSS survey in North Carolina had a response rate of 61%. Among eligible BRFSS households, 84.7% (3865/4565) agreed to also participate in the CHAMP survey, of which 77.3% ($n = 2987$) actually completed a survey. All caregivers with children aged 11 to 17 years ($n = 1305$) received items regarding meningococcal vaccine during their CHAMP surveys. We report data on 1281 of these caregivers, excluding 24 who were not sure if they had ever heard of meningococcal vaccine. We refer to caregivers as "parents" for the remainder of this report, as 92% (1180/1281) reported being a parent of the child.

Measures

Surveys are available online for the 2008 BRFSS (<http://www.schs.state.nc.us/SCHS/brfss/pdf/BRFSSQ08.pdf>) and 2008 CHAMP (<http://www.epi.state.nc.us/SCHS/champ/pdf/CHAMPQ08.pdf>). The CHAMP survey section on meningococcal vaccine began by providing parents with a brief informative statement: "Meningitis is an infection around the brain. A vaccine is now available that protects against some types of meningitis. This is sometimes called the meningitis shot, meningococcal shot, or Menactra. I will call this the 'meningitis vaccine.'" The survey then assessed whether parents had ever heard of meningococcal vaccine before the interview. Among parents who were aware of the vaccine, the survey assessed meningococcal vaccine uptake using the item "Has [CHILD] had the meningitis vaccine?"

For parents who had heard of meningococcal vaccine but had unvaccinated children, interviewers asked the main reason why their children had not been vaccinated. If needed, interviewers provided participants

with several potential reasons. Interviewers then asked these parents about their intentions to vaccinate in the next year using the item: "How likely are you to get the meningitis vaccine for your child in the next 12 months?" Response options for this item (coded 1-4) were "definitely won't," "probably won't," "probably will," and "definitely will." We recoded volunteered responses of "don't know" or "not sure" to the midpoint of the scale.

The CHAMP survey assessed children's age, gender, race, Hispanic ethnicity, school type, and health care coverage. Interviewers also collected data on whether children had regular health care providers or had received preventive checkups in the last 12 months, how often parents thought children should be seen by health care providers for regular checkups, parents' interests in hearing more about teen health issues, and highest education level completed by anyone in the household.

During the BRFSS survey, parents provided information regarding demographics, influenza vaccination (either shot or spray) for themselves in the past year, and whether they had ever received pneumococcal vaccine. Using county of residence, we determined geographic region within North Carolina (Eastern, Piedmont [central], or Western). We also classified households as either "urban" (in a Metropolitan Statistical Area) or "rural" (outside a Metropolitan Statistical Area).

Data Analysis

Analyses examined 2 main outcomes: parents' awareness of meningococcal vaccine and meningococcal vaccine uptake among their children aged 11 to 17 years. For each outcome, we used logistic regression models to first identify bivariate correlates. We then entered statistically significant bivariate correlates ($P < .05$) into a multivariate logistic regression model. Analyses applied sampling weights to account for the complex sampling design. We present unweighted frequencies but present weighted percentages to reflect statewide population estimates. Statistical tests were 2-tailed with a critical α of .05. All analyses were conducted using Intercooled Stata Version 10.1 (College Station, TX).

Results

Participant Characteristics

Children's mean age was 14.1 years ($SD = 2.1$; Table 1). Most parents indicated their children were non-Hispanic white (63.0%) or non-Hispanic African American (23.0%), with fewer indicating their children were

Hispanic (8.8%) or of another race or ethnicity (5.2%). A majority of parents reported their children had some form of health care coverage (92.8%), had a regular health care provider (83.3%), and had received a preventive checkup within the past year (78.1%).

Parents tended to be aged 40 years or older (70.8%), female (66.5%), married or member of an unmarried couple (74.0%), and employed (71.0%). Most households contained a person with at least some college education (75.6%) and were located in an urban area (70.2%). About half (49.6%) of households had an income of \$50 000 or more.

Awareness of Meningococcal Vaccine

In total, 65.0% of parents had heard of meningococcal vaccine prior to the survey (Table 1). Parents were more likely, in bivariate analyses, to have heard of the vaccine if their children were aged 16 to 17 years (compared with those aged 11-12 years), went to private school (compared with those who went to public school), had some form of health care coverage, had a regular health care provider, or had received a preventive checkup within the past year (all $P < .05$). Awareness was also higher in bivariate analyses among parents who were married or member of an unmarried couple, received flu vaccine in the past year for themselves, reported someone in the household had at least some college education, or resided in the Eastern region of North Carolina (compared with those who resided in the Western region; all P s $< .05$). Parents were less likely to have heard of meningococcal vaccine if their children were Hispanic (compared with non-Hispanic whites) or if their annual household income was less than \$50 000 or not reported (all P s $< .05$).

In multivariate analyses, awareness of meningococcal vaccine was higher among parents whose children were aged 16 to 17 years (compared with those aged 11-12 years; odds ratio [OR] = 1.82, 95% confidence interval [CI] = 1.21-2.74), went to private school (compared with those who went to public school; OR = 1.95, 95% CI = 1.09-3.50), or had some form of health care coverage (OR = 1.90, 95% CI = 1.04-3.45). Parents were also more likely to be aware if they resided in the Eastern region of North Carolina, compared with those who resided in the Western region (OR = 1.73, 95% CI = 1.10-2.71). Vaccine awareness was lower among parents who reported their children were Hispanic (compared with non-Hispanic whites; OR = 0.50, 95% CI = 0.28-0.89) or did not report an annual household income (compared with those whose reported income was \$50 000 or more; OR = 0.55, 95% CI = 0.30-0.99).

Table 1. Parents' Awareness of Meningococcal Vaccine Prior to Survey (n = 1281).^a

	Total, n (Weighted %)	Heard of Vaccine, n (Weighted %)	Bivariate OR (95% CI)	Multivariate OR (95% CI)
Total	1281 (100.0)	830 (65.0)	—	—
<i>Child characteristics</i>				
<i>Age (years)</i>				
11-12	313 (27.4)	199 (58.1)	Ref.	Ref.
13-15	546 (41.3)	339 (65.2)	1.35 (0.94-1.95)	1.44 (0.98-2.11)
16-17	422 (31.3)	292 (70.7)	1.74 (1.17-2.57)*	1.82 (1.21-2.74)*
<i>Gender</i>				
Female	621 (49.3)	380 (62.3)	Ref.	—
Male	660 (50.8)	450 (67.5)	1.26 (0.94-1.69)	—
<i>Race/Ethnicity</i>				
Non-Hispanic white	883 (63.0)	595 (68.1)	Ref.	Ref.
Non-Hispanic African American	203 (23.0)	130 (66.5)	0.93 (0.63-1.37)	0.99 (0.63-1.56)
Hispanic	97 (8.8)	43 (38.7)	0.30 (0.18-0.50)**	0.50 (0.28-0.89)*
Other	98 (5.2)	62 (64.1)	0.83 (0.48-1.45)	0.92 (0.51-1.67)
<i>School type^b</i>				
Public	1132 (88.2)	721 (63.2)	Ref.	Ref.
Private	105 (9.2)	81 (80.1)	2.35 (1.34-4.12)*	1.95 (1.09-3.50)*
Home schooled	33 (2.6)	23 (72.1)	1.51 (0.61-3.74)	1.97 (0.71-5.44)
<i>Health insurance</i>				
No/Don't know (n = 2)	95 (7.3)	41 (37.4)	Ref.	Ref.
Yes	1186 (92.8)	789 (67.1)	3.42 (2.00-5.85)**	1.90 (1.04-3.45)*
<i>Regular health care provider</i>				
No/Don't know (n = 6)	226 (16.7)	123 (51.4)	Ref.	Ref.
Yes	1055 (83.3)	707 (67.6)	1.97 (1.36-2.86)**	1.37 (0.92-2.04)
<i>Preventive checkup in past 12 months</i>				
No/Don't know (n = 10)	311 (21.9)	172 (55.8)	Ref.	Ref.
Yes	970 (78.1)	658 (67.5)	1.65 (1.18-2.30)*	1.38 (0.96-1.99)
<i>Parent characteristics</i>				
<i>Age (years)^c</i>				
<39	307 (29.2)	192 (59.6)	Ref.	—
40-49	606 (47.9)	395 (67.2)	1.39 (0.97-1.99)	—
≥50	368 (22.9)	243 (67.1)	1.38 (0.93-2.06)	—
<i>Gender^c</i>				
Female	844 (66.5)	551 (64.3)	Ref.	—
Male	437 (33.5)	279 (66.3)	1.09 (0.80-1.49)	—
<i>Marital status^c</i>				
Never married/Divorced/Widowed/ Separated	353 (26.0)	203 (59.1)	Ref.	Ref.
Married/Member of unmarried couple	928 (74.0)	627 (67.0)	1.40 (1.02-1.94)*	1.09 (0.75-1.60)
<i>Employment status^c</i>				
Other	351 (29.0)	220 (62.9)	Ref.	—
Employed for wages/Self-employed	930 (71.0)	610 (65.8)	1.14 (0.82-1.57)	—
<i>Wants to hear more about teen health issues</i>				
No/Don't know (n = 8)	343 (28.7)	240 (70.2)	Ref.	—
Yes	938 (71.3)	590 (62.8)	0.72 (0.51-1.01)	—
<i>Frequency children should be seen by doctor</i>				
Less frequent than once a year/Don't know (n = 13)	118 (8.0)	73 (63.4)	Ref.	—
At least once a year	1163 (92.0)	757 (65.1)	1.08 (0.67-1.73)	—
<i>Flu vaccine in the past year (shot or spray)^c</i>				
No/Don't know (n = 5)	816 (65.7)	499 (62.0)	Ref.	Ref.
Yes	465 (34.3)	331 (70.5)	1.47 (1.07-2.02)*	1.28 (0.91-1.78)

(continued)

Table 1. (continued)

	Total, n (Weighted %)	Heard of Vaccine, n (Weighted %)	Bivariate OR (95% CI)	Multivariate OR (95% CI)
Pneumococcal vaccine ever ^c				
No	1039 (81.2)	673 (65.0)	0.82 (0.50-1.33)	—
Don't know	98 (7.7)	61 (57.7)	0.60 (0.30-1.21)	—
Yes	144 (11.2)	96 (69.4)	Ref.	—
<i>Household characteristics</i>				
Highest education level in household				
High school or less/Don't know (n = 1)	315 (24.4)	151 (50.6)	Ref.	Ref.
Some college or more	966 (75.6)	679 (69.6)	2.24 (1.60-3.13)**	1.28 (0.86-1.91)
Annual household income ^c				
<\$50 000	541 (41.4)	316 (57.8)	0.51 (0.37-0.70)**	0.69 (0.47-1.02)
≥\$50 000	630 (49.6)	450 (72.9)	Ref.	Ref.
Not reported	110 (9.0)	64 (54.3)	0.44 (0.26-0.75)*	0.55 (0.30-0.99)*
Number of children younger than 18 years in household ^c				
1	641 (30.7)	419 (68.8)	Ref.	—
≥2	640 (69.3)	411 (63.3)	0.78 (0.59-1.03)	—
Geographic region ^c				
Eastern	429 (29.2)	293 (69.8)	1.62 (1.07-2.46)*	1.73 (1.10-2.71)*
Piedmont	645 (58.3)	420 (63.9)	1.24 (0.84-1.83)	1.15 (0.75-1.76)
Western	207 (12.5)	117 (58.7)	Ref.	Ref.
Urbanicity ^{c,d}				
Rural	408 (29.8)	239 (61.5)	Ref.	—
Urban	873 (70.2)	591 (66.4)	1.24 (0.91-1.69)	—

Abbreviations: OR, odds ratio; CI, confidence interval; Ref., referent group.

^aThe multivariate model did not include variables with dashes (—). The multivariate model excluded 11 people who did not provide data regarding school type (n = 1270).

^bDoes not include parents who indicated they did not know their child's school type or that their child was not in school (n = 11).

^cData collected during Behavioral Risk Factor Surveillance System survey. All other data collected during Child Health Assessment and Monitoring Program survey.

^dUrban defined as within a metropolitan statistical area (MSA) and rural defined as outside an MSA.

*P < .05. **P < .001.

Meningococcal Vaccination

Among parents who were aware of meningococcal vaccine and provided their children's vaccination status (n = 703), 44% (280) reported that their children had received meningococcal vaccine (Table 2). Vaccination was more common among children who were non-Hispanic African American (compared with non-Hispanic whites) or those who had received a preventive checkup within the past year (both *P*s < .05 in bivariate analyses). Parents were also more likely to report that their children had received meningococcal vaccine if they were aged 49 years or younger, thought children should be seen by a doctor at least once a year, or had at least 2 children younger than 18 years in their household (all *P*s < .05).

In multivariate analyses, children were more likely to have received meningococcal vaccine if they were

non-Hispanic African American (compared with non-Hispanic whites; OR = 2.17, 95% CI = 1.29-3.65) or who had received a preventive checkup within the past year (OR = 3.03, 95% CI = 1.72-5.33). Parents were more likely to report their children had received meningococcal vaccine if their household had at least 2 children younger than 18 years (OR = 1.83, 95% CI = 1.22-2.75).

Reasons for Not Vaccinating and Intentions to Vaccinate

Among parents who were aware of meningococcal vaccine but had not yet vaccinated their children (n = 423), the most commonly reported reasons for not vaccinating was health care providers not mentioning or recommending the vaccine (24.7%) and believing that their

Table 2. Meningococcal Vaccination Among Children Whose Parents Were Aware of Meningococcal Vaccine Prior to the Survey (n = 703).^a

	Total, n (Weighted %)	Vaccinated, n (Weighted %)	Bivariate OR (95% CI)	Multivariate OR (95% CI)
Total	703 (100.0)	280 (44.1)	—	—
<i>Child characteristics</i>				
<i>Age (years)</i>				
11-12	173 (25.3)	62 (37.3)	Ref.	—
13-15	280 (40.3)	116 (47.1)	1.50 (0.92-2.46)	—
16-17	250 (34.4)	102 (45.6)	1.41 (0.85-2.35)	—
<i>Gender</i>				
Female	325 (46.9)	133 (44.2)	Ref.	—
Male	378 (53.1)	147 (44.0)	0.99 (0.67-1.46)	—
<i>Race/Ethnicity</i>				
Non-Hispanic white	510 (66.2)	185 (38.3)	Ref.	Ref.
Non-Hispanic African American	105 (23.3)	53 (57.6)	2.19 (1.32-3.63)*	2.17 (1.29-3.65)*
Hispanic	33 (5.1)	16 (51.7)	1.72 (0.74-4.01)	1.60 (0.69-3.73)
Other	55 (5.5)	26 (49.6)	1.58 (0.74-3.39)	1.75 (0.76-3.99)
<i>School type^b</i>				
Public	610 (86.4)	243 (45.0)	Ref.	—
Private	70 (11.1)	31 (42.0)	0.89 (0.48-1.63)	—
Home schooled	19 (2.5)	5 (34.9)	0.65 (0.18-2.39)	—
<i>Health insurance</i>				
No/Don't know (n = 0)	29 (3.6)	9 (33.7)	Ref.	—
Yes	674 (96.4)	271 (44.5)	1.58 (0.59-4.24)	—
<i>Regular health care provider</i>				
No/Don't know (n = 3)	104 (13.3)	36 (34.0)	Ref.	—
Yes	599 (86.7)	244 (45.7)	1.63 (0.93-2.86)	—
<i>Preventive checkup in past 12 months</i>				
No/Don't know (n = 4)	152 (19.7)	31 (23.1)	Ref.	Ref.
Yes	551 (80.3)	249 (49.3)	3.23 (1.86-5.62)**	3.03 (1.72-5.33)**
<i>Parent characteristics</i>				
<i>Age (years)^c</i>				
<39	156 (25.0)	69 (46.6)	1.87 (1.10-3.18)*	1.24 (0.69-2.22)
40-49	341 (51.6)	147 (48.5)	2.01 (1.27-3.18)*	1.53 (0.94-2.48)
≥50	206 (23.4)	64 (31.9)	Ref.	Ref.
<i>Gender^c</i>				
Female	472 (66.6)	188 (43.7)	Ref.	—
Male	231 (33.4)	92 (44.9)	1.05 (0.69-1.58)	—
<i>Marital status^c</i>				
Never married/Divorced/Widowed/ Separated	156 (22.4)	66 (46.5)	Ref.	—
Married/Member of unmarried couple	547 (77.6)	214 (43.4)	0.89 (0.56-1.39)	—
<i>Employment status^c</i>				
Other	182 (27.1)	68 (47.5)	Ref.	—
Employed for wages/Self-employed	521 (72.9)	212 (42.8)	0.83 (0.54-1.28)	—
<i>Wants to hear more about teen health issues</i>				
No/Don't know (n = 6)	206 (30.4)	80 (44.3)	Ref.	—
Yes	497 (69.6)	200 (44.0)	0.99 (0.65-1.50)	—
<i>Frequency children should be seen by doctor</i>				
Less frequent than once a year/Don't know (n = 6)	62 (7.7)	19 (27.8)	Ref.	Ref.

(continued)

Table 2. (continued)

	Total, n (Weighted %)	Vaccinated, n (Weighted %)	Bivariate OR (95% CI)	Multivariate OR (95% CI)
At least once a year	641 (92.3)	261 (45.5)	2.16 (1.12-4.16)*	1.49 (0.75-2.97)
Flu vaccine in the past year (shot or spray) ^c				
No/Don't know (n = 1)	419 (62.1)	164 (41.5)	Ref.	—
Yes	284 (37.9)	116 (48.3)	1.31 (0.89-1.94)	—
Pneumococcal vaccine ever ^c				
No	575 (81.4)	225 (42.3)	Ref.	—
Don't know	80 (11.8)	32 (49.3)	1.84 (0.87-3.92)	—
Yes	48 (6.8)	23 (57.4)	1.33 (0.72-2.44)	—
<i>Household characteristics</i>				
Highest education level in household				
High school or less/Don't know (n = 1)	119 (18.4)	49 (49.9)	Ref.	—
Some college or more	584 (81.6)	231 (42.8)	0.75 (0.45-1.24)	—
Annual household income ^c				
<\$50 000	253 (34.9)	96 (45.1)	1.09 (0.72-1.65)	—
≥\$50 000	397 (57.7)	160 (42.9)	Ref.	—
Not reported	53 (7.4)	24 (48.7)	1.26 (0.62-2.56)	—
Number of children younger than 18 years in household ^c				
1	354 (31.8)	121 (32.9)	Ref.	Ref.
≥2	349 (68.2)	159 (49.3)	1.99 (1.39-2.85)**	1.83 (1.22-2.75)*
Geographic region ^c				
Eastern	246 (31.6)	96 (44.9)	1.61 (0.84-3.07)	—
Piedmont	354 (56.7)	157 (45.9)	1.67 (0.90-3.11)	—
Western	103 (11.8)	27 (33.6)	Ref.	—
Urbanity ^{c,d}				
Rural	200 (28.4)	70 (39.5)	Ref.	—
Urban	503 (71.6)	210 (46.0)	1.31 (0.85-2.00)	—

Abbreviations: OR, odds ratio; CI, confidence interval; Ref., referent group.

^aThe multivariate model did not include variables with dashes (—).

^bDoes not include parents who indicated they did not know their child's school type or that their child was not in school (n = 4).

^cData collected during Behavioral Risk Factor Surveillance System survey. All other data collected during Child Health Assessment and Monitoring Program survey.

^dUrban defined as within a metropolitan statistical area (MSA) and rural defined as outside an MSA.

*P < .05. **P < .001.

child did not need meningococcal vaccine (13.6%). Other frequently reported reasons included believing their child was too young or wanting to wait until their child was older (10.1%), concerns about vaccine safety (9.0%), and reporting the child had not been to a doctor recently (7.6%). Other reasons were reported by less than 5.0% of parents. A majority of parents of unvaccinated children indicated they definitely will (20.8%) or probably will (32.5%) get their children the meningococcal vaccine in the next year, whereas a substantial proportion (38.5%) indicated that they definitely won't or probably won't (9.5% and 29.0%, respectively). The remaining 8.2% were unsure about their likelihood to vaccinate their children in the next year.

Discussion

Most parents were aware of meningococcal vaccine. Among parents who were aware of the vaccine, less than half (44%) had children who had received the vaccine. Awareness of meningococcal vaccine was almost twice as likely among parents of children who were older (age 16-17 years), went to private school, or had some form of health insurance coverage. However, groups with higher awareness of the vaccine did not have higher meningococcal vaccine uptake. Non-Hispanic African Americans compared with non-Hispanic whites had 2 times higher odds of receiving the meningococcal vaccine despite the fact

that non-Hispanic whites reported greater awareness of the meningococcal vaccine. Other studies have found racial disparities in uptake of adolescent vaccines.^{11,12} In a national study, African American girls aged 13 to 17 years were less likely to have completed the 3-dose HPV vaccine series than white girls, though both groups were equally likely to have initiated the vaccine series.⁶ In that study, Hispanics reported lower awareness of the vaccine than non-Hispanic whites but not lower than non-Hispanic African Americans. Among parents aware of the vaccine, identifying as Hispanic was not associated with an increased likelihood to vaccinate. The negative relationship between Hispanic ethnicity and meningococcal vaccine awareness suggests the need for culturally specific public health campaigns for Hispanics in North Carolina.

Our study demonstrated that access to health care with a reported preventive checkup in the past 12 months correlated to parents' awareness of meningococcal vaccine and the vaccination of their adolescents. Parents who reported some form of health care insurance, a regular health care provider, or a preventive checkup in the past 12 months, were more likely to be aware of the meningococcal conjugate vaccine than those who did not. The largest odds ratio for vaccination was the child having had a preventive checkup within the past year. Adolescents who had a recent preventive visit had a 3 times higher odds of being vaccinated than those children who had not. A study by Lu et al⁶ also found that a child's access to health care correlated with uptake of meningococcal vaccine. Thus, this study supports the importance of annual health visits as a mechanism of increasing meningococcal conjugate vaccine uptake. Professional organizations (including the American Academy of Pediatrics, and Society for Adolescent Health and Medicine) should further emphasize annual adolescent preventive health visits as an important strategy to increase the uptake of adolescent vaccinations.^{13,14}

Just as regular provider contact can increase vaccine uptake, parents cited lack of provider recommendation as the most common reason for *not* getting their children meningitis vaccine. In our study, among parents who are aware of meningococcal vaccine, the most frequently reported reason for having an unvaccinated child was a physician not mentioning or not recommending vaccination. This may reflect lack of awareness of recent changes in ACIP-approved adolescent vaccine recommendations among providers.¹⁵ It may also reflect practical issues that prevent some clinicians from making vaccines available to their patients, such as inconsistent or inadequate

reimbursement by insurers, variations in vaccine availability, or the many competing demands to provide preventive services during doctor visits. In several studies, such barriers were associated with lower provision of HPV vaccine by physicians.^{16,17} The second most common reason parents in our study cited for not getting their adolescents the meningococcal vaccine was the belief that their adolescents did not need it. Most parents gauge what their adolescents need based on physicians' and health providers' recommendations, and physician recommendation has been demonstrated to be one of the greatest influences on parents' decision to immunize.^{11,12} Physicians' personal support for vaccines or a particular vaccine has been shown to be the strongest predictor of their patients being vaccinated.¹⁸ These beliefs may be related to the nature of the vaccine-preventable disease or the physician preference for how to use valuable health care visits, especially when vaccines are available at other locations.¹⁹⁻²¹ Physician communication with parents about the importance and safety of vaccines is particularly important given the small but increasing number of parents voicing anti-vaccination sentiments.²² Other influences on vaccination include insurance coverage for vaccines, perceived effectiveness and harms of the vaccine, and perceived susceptibility to the vaccine preventable disease.^{23,24}

A strength of this study is that these data come from a statewide representative survey.²⁵ Thus, our study can provide useful insights into meningococcal vaccination that may be especially relevant to states that have characteristics in common with North Carolina. There are some limitations to the use of parent-report for measurement of adolescent vaccination. We found slightly higher rates of meningococcal vaccination than the 2008 National Immunization Survey-Teen (NIS-Teen) data (30.7%), which is verified with medical records.⁴ The difference in statewide rates could be a function of different sampling methods. Because our study did not verify with medical records, parents could have overreported vaccination either due to social desirability bias or being mistaken. However, parental report has been shown to be 76% to 96% reliable when estimating child vaccination rates.²⁶ This difference was greatest among African American parents; National Immunization Survey-Teen found that nationwide 25.5% of African American parents reported vaccinating their children as opposed to 57.6% in this statewide study. Also, the study's cross-sectional design prevents us from making inferences about causal association among variables. An additional limitation is that only households with landlines can be in BRFSS and CHAMP. Nevertheless, this statewide representative sample provides useful insights

into the factors associated with vaccine awareness and uptake.

Conclusions

Many parents were aware of meningococcal vaccine, but awareness alone was not enough to ensure vaccination. Increasing the number of adolescents who have a regular health care provider, annual preventive visits, provider recommendations to vaccinate, and health care insurance may be important strategies to increase uptake of meningococcal vaccine. Future research should examine how to better translate parental vaccination awareness into adolescent vaccination, and the reasons that white parents are less likely to vaccinate their adolescents despite higher awareness of the vaccine as well as racial and often socioeconomic privilege.

Determining strategies to improve meningococcal vaccine uptake is critically important as the ACIP recently recommended in 2010 a booster dose of meningococcal vaccine at age 16 years because of waning vaccine immunity.²⁷ Unfortunately, there is even lower awareness of this meningococcal booster recommendation among providers and patients than the routine vaccination recommendation at age 11 and 12 years; thus adequate uptake of this booster dose may also be a challenge.

Declaration of Conflicting Interests

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