The Vaccination Confidence Scale: A brief measure of parents' vaccination beliefs

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ABSTRACT

Purpose: The success of national immunization programs depends on the public's confidence in vaccines. We sought to develop a scale for measuring confidence about adolescent vaccination in diverse populations of parents.

Methods: Data came from 9623 parents who completed the 2010 National Immunization Survey-Teen, an annual, population-based telephone survey. Parents reported on a 13- to 17-year-old child in their households. We used exploratory and confirmatory factor analysis to identify latent constructs underlying parents' responses to 8 vaccination belief survey items (response scale 0–10) conceptualized using the Health Belief Model. We assessed the scale's psychometric properties overall and across demographic subgroups.

Results: Parents' confidence about adolescent vaccination was generally high. Analyses provided support for three factors assessing benefits of vaccination (mean = 8.5), harms of vaccination (mean = 3.3), and trust in healthcare providers (mean = 9.0). The model showed good fit both overall (comparative fit index = 0.97) and across demographic subgroups, although internal consistency was variable for the three factors. We found lower confidence among several potentially vulnerable subpopulations, including mothers with lower levels of education and parents whose children were of Hispanic ethnicity (both $p < 0.05$).

Conclusions: Our brief, three-factor scale offers an efficient way to measure confidence in adolescent vaccination across demographic subgroups. Given evidence of lower confidence by educational attainment and race/ethnicity, program planners should consider factors such as health literacy and cultural competence when designing interventions to promote adolescent vaccination to ensure these programs are fully accessible.

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1. Introduction

Parents' confidence in vaccines is critical to the success of national immunization programs. Unfortunately, in the case of adolescent vaccines, recent research suggests that many parents are not convinced that the benefits of vaccination outweigh the costs. For example, over 30% of parents in the U.S. report having refused or delayed human papillomavirus (HPV) vaccine for their adolescent daughters; their reasons include doubts about safety, effectiveness, and whether the vaccine is needed [1]. Parents who have not gotten their children tetanus, diphtheria, and acellular pertussis (Tdap) or meningococcal vaccines also commonly report believing these vaccines are not necessary [2]. Increasing parents' confidence in the value of adolescent vaccination is important for addressing parental refusal and delay, especially since adolescent vaccines have yet to attain the high coverage achieved for many early childhood vaccines [3].

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Better measures of vaccination confidence could facilitate research and interventions aimed at addressing hesitancy toward adolescent vaccines. Although scales have been developed for specific vaccines [4] or for parents of younger children [5], the field currently lacks a composite measure capable of characterizing adolescent vaccination beliefs more holistically. Because research indicates that vaccine hesitancy varies by demographic characteristics [1,5–8], a scale that could perform reliably across diverse populations would be especially valuable.

To address this need, we developed the Vaccination Confidence Scale using data from a national, population-based sample of parents of adolescent children. To test the suitability of our scale for use in diverse populations, we assessed the scale's properties by demographic factors including race/ethnicity, maternal educational attainment, and household income. Finally, we used the scale to assess subgroup differences in vaccination confidence.

2. Methods

2.1. Participants and data source

We used existing data from the 2010 National Immunization Survey (NIS)–Teen, an annual, population-based survey sponsored by the Centers for Disease Control and Prevention [9]. Data collection included a telephone survey of respondents contacted through random digit dialing. Eligible respondents were parents or guardians who provided information about a randomly selected 13- to 17-year-old child in their household. For the sake of simplicity, we refer to these participants hereafter as "parents."

The household response rate for the 2010 NIS–Teen, excluding the U.S. Virgin Islands, was 58%, and resulted in an overall sample of 32,429 parents from all 50 states and select localities, including the District of Columbia. Data for this study came from a subset of 11,754 parents who completed the "Parental Attitudes Module," a special addendum administered in 2010 for two of the four quarters during which NIS–Teen data were collected. We excluded parents who did not provide responses to key variables (n = 1282), who took the survey in a language other than English (n = 607), or who were dropped due to weighting procedures (n = 242). Our final analytic sample consisted of 9623 parents.

The National Center for Health Statistics (NCHS) Research Ethics Review Board approved data collection for NIS–Teen. Analysis of deidentified data from the survey is exempt from the federal regulations for the protection of human research participants. Analysis of restricted data through the NCHS Research Data Center was approved by the NCHS Ethics Review Board. The University of North Carolina Institutional Review Board ruled this study exempt from further review.

2.2. Measures

The Parental Attitudes Module assessed 11 beliefs about the vaccination of teenagers using an 11-point response scale that ranged from 0 ("strongly disagree") to 10 ("strongly agree"). Items were conceptualized using the Health Belief Model, a theory of health behavior that researchers have successfully used to identify attitudes related to vaccination in early childhood and adolescence [7,10]. Topics included perceived benefits of vaccination such as disease prevention and perceived barriers to vaccination such as side effects (Fig. 1). Given the extent to which prior research emphasizes the importance of trust in vaccination decisions [5,7,11–13], we included two items from the Parental Attitudes Module that assessed parents' relationship with healthcare providers, including one general item that was not specific to vaccination. Because items in the Parental Attitudes Module are restricted variables that are

Table 1
Sample characteristics (n = 9623).

	n	(%)
Child characteristics		
Age		
13	1887	19.85
14	1918	19.71
15	1957	19.77
16	2014	21.49
17	1847	19.18
Sex		
Male	5003	50.97
Female	4620	49.03
Race/ethnicity		
Non-Hispanic white	6892	65.93
Non-Hispanic black	1116	15.94
Hispanic	837	11.18
Other	778	6.96
Vaccines for Children eligibility		
Yes	2000	23.52
No	5636	55.13
Not reported	1987	21.35
Parent characteristics		
Relationship to child		
Mother/female guardian	7561	77.55
Father/male guardian	1605	16.66
Grandparent or other	457	5.79
Mother's age		
≤34 years	653	7.27
35–44 years	3876	43.22
≥45 years	5094	49.51
Mother's education		
12 years or less	2552	34.44
Some college, no degree	2909	26.89
College degree or more	4162	38.68
Household characteristics		
Region		
Northeast	1895	18.54
Midwest	2080	22.91
South	3562	37.76
West	2086	20.78
Annual income[a]		
Below poverty	1093	14.39
Above poverty, ≤$75,000	3884	39.59
>$75,000	4272	42.17
Not reported	374	3.86
MSA status		
Urban	3674	34.31
Suburban	3672	47.85
Rural	2277	17.84

Note: we report raw frequencies and weighted percentages. Percentages may not total 100 due to rounding.
[a] Poverty level based on 2009 U.S. Census poverty thresholds.

not included in the 2010 NIS–Teen public-use dataset, we accessed these data through the NCHS Research Data Center.

The 2010 NIS–Teen also assessed demographic characteristics including the child's age, sex, and race/ethnicity (Table 1). The survey assessed variables used to determine whether the child was eligible for the Vaccines for Children (VFC) Program, which provides free vaccines to populations with limited ability to pay, including uninsured and Medicaid-eligible youth [14]. Respondents indicated their own relationship to the child as well as the age and educational attainment of the child's mother. Household characteristics included annual income and geographic location. We classified households as urban, suburban, or rural based on metropolitan statistical areas [15].

2.3. Statistical analysis

We used factor analysis to identify the latent constructs underlying parents' responses to the 11 items on vaccination beliefs in