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Changes in childhood immunization decisions in the United States: Results from 2012 & 2014 National Parental Surveys

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ABSTRACT

Objective: Understanding the current status of parents' vaccine decision making is crucial to inform public policy. We sought to assess changes in vaccine decisions among parents of young children.
Methods: We conducted a web-based national poll of parents of children <7 years in 2012 and 2014. Participants reported vaccine decisions for their youngest child. We calculated survey-weighted population estimates of overall immunizations decisions, and delay/refusal rates for specific vaccines.
Results: In 2012, 89.2% (95% CI, 87.3–90.8%) reported accepting or planning to accept all recommended non-influenza childhood vaccines, 5.5% (4.5–6.6%) reported intentionally delaying one or more, and 5.4% (4.1–6.9%) reported refusing one or more vaccines. In 2014, the acceptance, delay, and refusal rates were 90.8% (89.3–92.1%), 5.6% (4.6–6.9%), and 3.6% (2.8–4.5%), respectively. Between 2012 and 2014, intentional vaccine refusal decreased slightly among parents of older children (2–6 years) but not younger children (0–1 years). The proportion of parents working to catch up on all vaccines increased while those refusing some but not all vaccines decreased. The South experienced a significant increase in estimated acceptance (90.1–94.1%) and a significant decrease in intentional ongoing refusal (5.0–2.1%). Vaccine delay increased in the Northeast (3.2–8.8%).
Conclusions: Nationally, acceptance and ongoing intentional delay of recommended non-influenza childhood vaccines were stable. These findings suggest that more effort is warranted to counter persistent vaccine hesitancy, particularly at the local level. Longitudinal monitoring of immunization attitudes is also warranted to evaluate temporal shifts over time and geographically.

1. Introduction

Childhood vaccination coverage in the United States (U.S.) has been consistently high in recent years, yet there is growing public health concern on stabilizing vaccine hesitancy [1–4] in the wake of recent high-profile outbreaks of measles, pertussis, and other vaccine preventable diseases (VPDs). These decisions to delay or refuse recommended vaccines impact not only the child for whom the immunizations are recommended, but also others in the community who are unable to vaccinate (e.g., those with contraindications). [5–8].

Estimates of vaccine delay vary widely (13–22%) [9–11], as do reasons for delay, which are often based on vaccines' perceived risk/benefit [9,12]. Some parents may intentionally space vaccine doses over longer timeframes than recommended, or delay the entire vaccination schedule until a child is older, due to safety or efficacy concerns [11,13]. Alternatively, some may intend to accept vaccines but circumstantially delay due to acute illness or vaccine shortage [11]. Refusal estimates and definitions also vary; complete refusal of all vaccines is rare (estimated <1% nationally) [14], while selective refusal of one or more is more common (6–16%) [9,10,15,16]. Reasons given for refusal are linked to perceived risk or lack of necessity of specific vaccines [17–19].

The ongoing burden of VPDs is a reminder of the continued importance of vaccination and consequences arising from a loss of confidence [20,21]. Previous studies using National Immunization Survey data of immunization coverage among U.S. children

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ages 19–35 months have examined parental behavior related to vaccine refusal; the NIS has distinct methodological attributes (e.g. immunization confirmation by healthcare providers, large sample sizes, geographic granularity, assessment of vaccine combinations) [22–24]. Yet, few national samples exist that offer more recently collected data at two or more time points, and that offer measurement specificity to capture parental behavior toward immunizations across a decisional spectrum and in relation to specific vaccines. Thus, we conducted this study to gain thorough understanding of the recent status of childhood immunization decisions and to offer timely detection of shifts in vaccine hesitancy.

2. Methods

2.1. Study design and sample

The survey utilized quality standards implemented by the Federal government (e.g., CDC-sponsored National Immunization Survey (NIS)), including survey pilot testing via cognitive interviews with parents of young children. From January to March 2012 and June to July 2014, a probability-based sampling strategy was used to recruit from KnowledgePanel, a survey panel selected to be nationally representative of the U.S. population [25]. Panel members were recruited using address-based sampling and random digit dialing [26]. Members were offered Internet access if they did not have it before joining the panel. This methodology allows KnowledgePanel to closely mirror the US population [27].

Our sampling frame included English-speaking, non-institutionalized parents/guardians ages $\geqslant$18 living in the U.S. with children <7 years. Participants were selected from potentially eligible active KnowledgePanel members, using probabilities weighted to account for panel recruitment design, demographic differences between the panel and current U.S. population, and non-coverage bias. Selected participants were invited via email to take the online survey. Participants received a $5 cash-equivalent incentive.

Our overall response rate was 52.7% (2603/4933) and 52.4% (2518/4803) in 2012 and 2014, respectively. Survey iterations had discrete populations. Following survey administration, ranking was applied to construct study-specific post-stratification weights that allowed analyses to adjust for non-response, sampling design, and sampling and non-sampling differences between the sample and US population of parents of children <7 [28]. The ranking procedure iteratively updated the base KnowledgePanel sample design weights to fit the marginal distribution of several key demographics of parents of children <7, as determined by the full KnowledgePanel (2012) and by the 2012 3-year American Community Survey estimates (2014) [29]. The sample was aligned to the US population on age and gender, race/Hispanic ethnicity, education, household income (2014 only), census region, and metropolitan residence. The FHI360 and Westat Institutional Review Boards approved each survey. Subsequently, the Emory University IRB also reviewed the study.

2.2. Measurement

Surveys examined behaviors of parents of children <7 towards childhood immunization, as this age group is primarily affected by school entry immunization policies and are included in the CDC recommended immunization schedule for infants and children [30,31]. Sociodemographic characteristics were derived from existing panel data and were not included on surveys. Child age was determined from the age category of the youngest child in the household (i.e., 0–1, 2–5, 6–12 years). In 2014, 116 parents verified having a child <7 years but did not have any children <12 years reported in their panel data, which we addressed using two models: (1) treating child's age as missing and (2) considering them as having a child age 0–1 (as they were likely new parents whose panel information had not yet been updated at time of survey).

To assess vaccination decisions, we asked respondents if their youngest child received all vaccinations at their most recent medical appointment. Parents were asked about vaccines including Hepatitis B (HepB), Rotavirus (RV), Diphtheria, Tetanus, Pertussis (DTaP), *Haemophilus influenzae* type b (Hib), Pneumococcal (PCV), Inactive Poliovirus (IPV), Influenza (Flu), Measles, Mumps, Rubella (MMR), Varicella (chickenpox), and Hepatitis A (Hep A); the survey did not include combination administration (e.g., DTaP-Hib-IPV).

Response options included: (1) received all vaccinations at recommended time, (2) had not, but actively working on catching up, (3) delayed one or more but not all, (4) delayed all, (5) refused one or more but not all, (6) refused some and delayed some, and (7) refused all. Delays due to sickness or vaccine stock issues were not included as actual delays; we recoded those as actively working on catching up on all vaccines (n = 7 in 2012; n = 12 in 2014). Respondents who reported delaying or refusing at least one vaccine (not actively working to catch up) were then asked to indicate if they chose to delay or refuse 10 recommended childhood vaccines: HepB, RV, DTaP, Hib, PCV, IPV, influenza, MMR, chickenpox, and HepA. Respondents could also indicate if they were unsure of delay and/or refusal of each vaccine. Specific refusal and delay responses did not include parents who experienced circumstantial delay (e.g., due to acute illness or vaccine shortage) or those actively working to catch up on all vaccinations.

Because of differences in perception and attitudes towards influenza vaccination compared to other single-series childhood vaccines, this analysis focuses on delay and refusal of vaccines to protect against 1 or more of 13 diseases against which all young children are recommended to be vaccinated, excluding influenza [32]. The initial decision options were combined with specific vaccine decisions to determine parents' non-influenza vaccine decision categories on the vaccine decision-making continuum. These categories were then aggregated into "acceptors" or highly-accepting parents (including parents who accepted all recommended non-influenza vaccines, those actively working to catch up, and those indicating delay or refusal of only influenza vaccination, but acceptance of all other recommended vaccines), "delayers" (or hesitant parents), and "refusers" (including parents who indicated refusal or possible refusal, but unsure, of at least one non-influenza vaccine).

2.3. Statistical analysis

Population estimates of U.S. vaccination decisions in 2012 and 2014 were constructed using survey post-stratification weights. Bivariate survey-weighted chi-square analyses between vaccination decisions and survey year determined changes in vaccination decisions over time. Additionally, U.S. decision rates were estimated for parents of children age 0–1 and of children age 2–6. Opportunities for delay or refusal are greater in the first two years of life. By stratifying by age, we were able to account for the number of doses normally due during this time period. We also assessed changes in childhood immunization decisions according to U.S. census region definitional parameters (West, Midwest, South, Northeast) [29,33]. Population estimates were also constructed for intentional and ongoing delay and refusal of each specific childhood vaccination, using only participants sure of delay or refusal. Estimates were also constructed for the proportion of parents unsure of delay or refusal of each vaccine.

We performed analyses using SPSS version 22.0 and SPSS Complex Sample Module (IBM SPSS Inc., Chicago, IL, USA). Statistical significance was assessed at $\alpha = 0.05$ and point estimates were at 95% confidence.

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