

Influenza Vaccinations of Young Children Increased With Media Coverage in 2003

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ABSTRACT

OBJECTIVE. We sought to evaluate the impact of intense influenza media coverage during the 2003–2004 influenza season on the influenza vaccination status of children 6 to 59 months of age.

METHODS. Children 6 to 59 months of age who presented to a large, academic pediatric continuity clinic or affiliated acute care clinic in the summer of 2004 were enrolled. A parental survey ascertained the influenza vaccination status of the child and family members during the 2003–2004 influenza season and factors that influenced their vaccination status. For children vaccinated in the clinic or health department, influenza vaccination dates were confirmed in a computerized medical chart or state immunization registry.

RESULTS. Of 256 enrolled children, 98 (38%) parents reported that their child had received the 2003–2004 influenza vaccine, and 64 (65%) had confirmed influenza vaccination dates. Unlike the previous influenza season in which confirmed influenza vaccination dates from a similar study population were distributed more evenly from October through December, most children (75%) with confirmed vaccination dates received the vaccine after the media coverage in mid-November. Influenza vaccinations per week increased dramatically after the media coverage began (2.4 vs 8.6 per week; *t* test: $P < .001$). In late November and December 2003, the influenza-related media coverage, which focused primarily on an early, severe influenza season, increased dramatically and explained 85% of the variation in influenza vaccinations. Multivariate analysis showed that recalling a physician recommendation (odds ratio [OR]: 6.8; 95% confidence interval [CI]: 2.3–19.7), having a family member who had received the influenza vaccine (OR: 9.5; 95% CI: 4.3–21.3), having a continuity clinic visit between October and January (OR: 4.5; 95% CI: 2.0–10.1), and having a high-risk medical condition (OR: 2.9; 95% CI: 1.1–7.8) strongly predicted the influenza vaccination status in the children.

CONCLUSION. Media coverage in conjunction with explicit physician recommendation for children and their contacts are key factors that are associated with influenza vaccination rates in children.

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Key Words

influenza vaccine, immunization, children, physician recommendation, news media

Abbreviations

OR—odds ratio
CI—confidence interval

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INFLUENZA VIRUS INFECTS ~15% to 20% of children each year and causes many pediatric hospitalizations and outpatient visits annually.^{1,2} Although influenza vaccine has been recommended for decades for high-risk children,³ influenza vaccine remains underutilized among high-risk children.⁴⁻⁷ For the 2002–2003 and 2003–2004 influenza seasons, the Advisory Committee on Immunization Practices added a new recommendation by encouraging influenza vaccine, when feasible, for all children aged 6 to 23 months.^{8,9} We showed previously that influenza vaccinations for healthy children 6 to 23 months of age increased from 1% to 17% concurrently with the 2002–2003 recommendation.¹⁰ The 2003–2004 influenza season was remarkable for substantial media coverage of an early, severe influenza season that began in mid-November.¹¹ The purpose of this study was to evaluate the impact of influenza media coverage on the vaccination status of children 6 to 59 months of age.

METHODS

Study Population

All children 6 to 59 months of age who received primary care in a large, university-affiliated pediatric residents' continuity clinic and whose parent/guardian spoke English were eligible. Healthy children 24 to 59 months of age, a population for whom the encouraged influenza vaccine recommendation did not directly apply, were included to help determine if any increase in influenza vaccinations was specific to the recommendations or was a more general effect. A trained interviewer systematically approached parents of young children who presented to the clinic from May 10 through July 21, 2004, and administered the survey. If multiple eligible children presented at the same time, the parent of the child who signed into the clinic most recently was approached. If multiple children in 1 family presented to the clinic, only the youngest eligible child was enrolled. The Vanderbilt University Institutional Review Board approved this study.

Questionnaire

After obtaining written, informed consent, a trained interviewer administered the questionnaire. The questionnaire, as previously reported, obtained demographic information, medical history, and the 2003–2004 influenza vaccination status of the child, parental reasons for the child's influenza vaccination status, and family influenza vaccination status for that season.¹⁰

A child was considered vaccinated if a parent reported that his or her child received at least 1 dose of influenza vaccine after September 1, 2003.¹⁰ To verify this report, all parents of vaccinated children were asked when the influenza vaccine was administered. A family member

was considered vaccinated if a member of the household excluding the enrolled child was reported to have received the 2003–2004 influenza vaccine.¹⁰ Influenza vaccine arrived at the medical center on September 25, 2003, and was available for administration within 1 week.

Demographic information and medical history of the child were obtained by parental report. Race was characterized as white, black, or Hispanic/other. When a parent identified the child as biracial, the child was classified in the nonwhite group. The 6- to 23-month and 24- to 59-month age groups were determined by the age of the child on December 31, 2003.¹⁰ Parents were asked if their child had a high-risk medical condition as listed in the *2003 Red Book*.^{10,12}

To identify factors that influenced the influenza vaccination status of children, all parents were asked if a physician recommended the vaccine for their child. On the basis of pilot studies and our previous work, we generated a list of the most commonly stated reasons that parents cite for vaccinating or not vaccinating their child.¹⁰ The choice "other" was available to all parents; all comments and other reasons were recorded verbatim. We have found these responses to be internally consistent, have face validity to pediatricians and parents, and high interrater reliability ($\kappa = 0.85$; SE: 0.05). Parents of vaccinated and unvaccinated children could cite multiple reasons for their decision. For unvaccinated children the choices included lack of knowledge, concern about adverse effects, availability of vaccine, lack of a physician recommendation, inconvenience, and other. For vaccinated children the choices included protection of a family member, good experience with the vaccine, previous influenza infection, information from the media or a friend, physician recommendation, and other.

Medical Chart

Using a computerized medical chart, the number of continuity clinic and acute care visits for each patient from October 1, 2003, to January 31, 2004, were recorded. For children who were vaccinated in the clinic or health department, influenza vaccination dates were confirmed in the computerized medical chart or Tennessee State Immunization Registry. For children already enrolled after the previous 2002–2003 influenza season, we reconfirmed the influenza vaccination dates in the same databases. All data were entered without personal identifiers.

Media Coverage

To quantitate the media coverage about influenza infection or influenza vaccine, the total number of placements involving medical center personnel by week with the title including "influenza" or "flu" is compiled by the Office of Medical Center News and Public Affairs by using 4 standard media sources: LexisNexis, Custom-

Scoop, Google News, and NewsPowerOnLine. Internal review has revealed that this methodology captures 90% to 95% of all local health news and 80% of local and national influenza-related news. The placements include all media stories from national and local newspapers, wire service stories, radio, national network and cable television, local television, national magazines, and Internet news outlets. We evaluated all influenza-related media placements from October through December 2002 and in 2003 for comparison. This methodology had face validity to media experts, influenza experts, and pediatricians and good interrater reliability when we evaluated 3 randomly selected weeks ($\kappa = 0.75$; SE: 0.08).

Statistical Analysis

All data were double entered into Access 2002 (Microsoft, Redwood, WA) to verify the accuracy of data entry. The primary outcome, influenza vaccination status in 2003–2004, and all variables except for race were coded as dichotomous variables. Demographic information and the proportion of vaccinated children by high-risk condition, age group, family-member vaccination status, and continuity clinic visit between October and January were evaluated by using 2-sided, χ^2 , or Fisher's exact tests. Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated by using univariate and

multivariate logistic regression to determine which factors identified a priori predicted a child's influenza vaccination status. We evaluated the model for interactions between age group and physician recommendation, high-risk condition and age group, high-risk condition and physician recommendation, and family member being vaccinated and high-risk condition. The only statistically significant interaction was between age group and physician recommendation, which was included in the final model. For children with confirmed influenza vaccination dates in 2002 and in 2003, we performed a Pearson's correlation between the total number of media placements per week on influenza vaccines, influenza infection, or vaccine shortage and the number of influenza vaccinations per week. Results were reported as r^2 , which was the variation in influenza vaccinations explained by the media placements by topic. All statistical analyses were performed by using Stata 8.1 (Stata Corp, College Station, TX).

RESULTS

Of 293 parents approached, 277 (95%) children were enrolled, and 256 (92%) were 6 to 59 months of age on December 31, 2003, and comprised the study population (Table 1). Ninety-eight (38%) parents reported that their child had received the 2003–2004 influenza vaccine. In multivariate analysis, several factors predicted that a

TABLE 1 Characteristics of Enrolled Children With Proportion Vaccinated and the Univariate and Multivariate Odds Ratios and 95% Confidence Intervals for Influenza Vaccination Status in 2003–2004

	N Vaccinated/ N Total (%)	Univariate OR (95% CI)	Adjusted OR (95% CI) With Interaction
Gender			
Female	53/133 (40)	Reference	Reference
Male	45/123 (37)	0.9 (0.5–1.4)	0.8 (0.4–1.8)
Race			
White	23/77 (30)	Reference	Reference
Black	54/140 (39)	1.5 (0.8–2.7)	1.8 (0.7–4.5)
Hispanic/other	21/39 (54)	2.7 (1.2–6.1) ^a	2.9 (0.9–9.5)
Age, mo			
6–23	40/97 (41)	Reference	Reference
24–59	58/159 (36)	0.8 (0.5–1.4)	0.7 (0.2–1.9)
High risk			
No	69/205 (34)	Reference	Reference
Yes	29/51 (57)	2.7 (1.5–5.2) ^a	2.9 (1.1–7.8) ^a
Physician recommendation			
No	27/164 (16)	Reference	Reference
Yes	71/92 (77)	17.2 (9.1–32.5) ^a	6.8 (2.3–19.7) ^a
Family member vaccinated			
No	33/154 (21)	Reference	Reference
Yes	65/102 (64)	6.4 (3.7–11.3) ^a	9.5 (4.3–21.3) ^a
Fall continuity appointment			
No	30/135 (22)	Reference	Reference
Yes	68/121 (56)	4.5 (2.6–7.7) ^a	4.5 (2.0–10.1) ^a
Interaction (age × recommendation)	—	4.1 (1.1–14.7) ^a	4.7 (1.1–21.2) ^a

^a Statistically significant predictor of influenza vaccination.

child would receive the 2003–2004 influenza vaccine while accounting for gender, race, age group, high-risk medical conditions, and an interaction between age group and physician recommendation. These factors were recalling a physician recommendation (OR: 6.8; 95% CI: 2.3–19.7), having a family member who had received the influenza vaccine (OR: 9.5; 95% CI: 4.3–21.3), having a continuity clinic visit between October and January (OR: 4.5; 95% CI: 2.0–10.1), and having a high-risk medical condition (OR: 2.9; 95% CI: 1.1–7.8). For children with a vaccinated family member, 75% had a vaccinated adult or parent living in the home, 50% had a vaccinated sibling, and 25% had both a vaccinated adult and sibling. Of children 6 to 23 months of age with and without high-risk medical conditions, 41% were vaccinated; more children 24 to 59 months of age with high-risk medical conditions were vaccinated (66% vs 29%; $P < .001$) than those without high-risk medical conditions.

The total number of media placements about influenza vaccine, influenza infection, and vaccine shortage are shown by year in Figs 1 and 2. In both years, local newspaper and television accounted for the majority (812 [67%]) of all media placements, whereas the top 100 national newspapers in circulation accounted for 17% (211) of placements. The remaining placements included Internet news (57 [5%]), national television (53 [4%]), radio (34 [3%]), wire service (29 [2%]), and national magazines (25 [2%]). Although the distribution of media outlets was similar during both time periods, the volume and the content of media placements differed. The number of media placements before mid-November was slightly higher in 2002 than in 2003, whereas the number of placements was significantly higher after mid-November in 2003 than in 2002 ($P <$

.001). As compared with 2002, when 99% of all media placements focused on influenza vaccine, the content of the media coverage before and after mid-November 2003 differed. Before mid-November 2003, all of the media placements focused on influenza vaccine, whereas afterward, 90% of the placements focused on the early, severe influenza season or serious influenza infections including deaths in children. Most of the remaining placements (71% of which were local) addressed the shortage of influenza vaccine in December resulting from greater demand than expected. On November 17, 2003, the Centers for Disease Control and Prevention released a statement that early evidence indicated that the 2003–2004 influenza season could be severe.¹¹ Pediatric influenza deaths hit the national news on November 27, 2003.¹³

Of 98 vaccinated children, 64 (65%) had confirmed influenza vaccination dates between October 1 and December 23, 2003. As shown in Fig 1, we found an average of 2.4 influenza vaccinations per week before (weeks 1–7) and 8.6 vaccinations per week after (weeks 8–12) the media coverage began in mid-November ($P < .001$). Using a similar population during the same months in 2002 (Fig 2), there were a similar number of vaccinations during the 2 time periods: 2.4 and 2.0 vaccinations per week, respectively. Unlike the 2002–2003 influenza season in which influenza vaccine was distributed more evenly from October through December, 48 (75%) children with confirmed vaccination dates received the influenza vaccine after the media coverage.

To determine if media coverage explained the variation in pediatric influenza vaccinations, we performed a correlation of the number of media placements by topic to the number of vaccinations by week. In 2003, the media placements about influenza vaccine and influenza

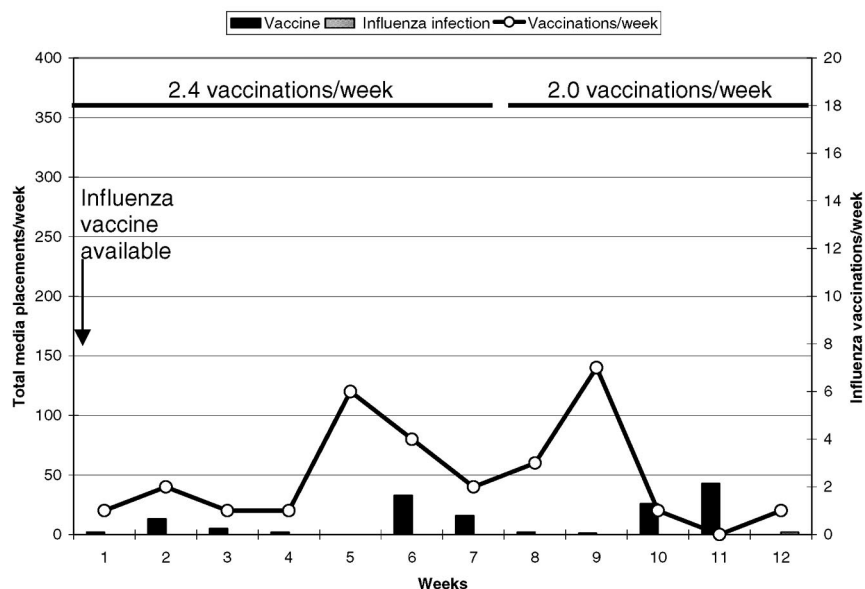


FIGURE 1
Number of influenza vaccinations and influenza-related media placements by topic per week between October and December 2002.

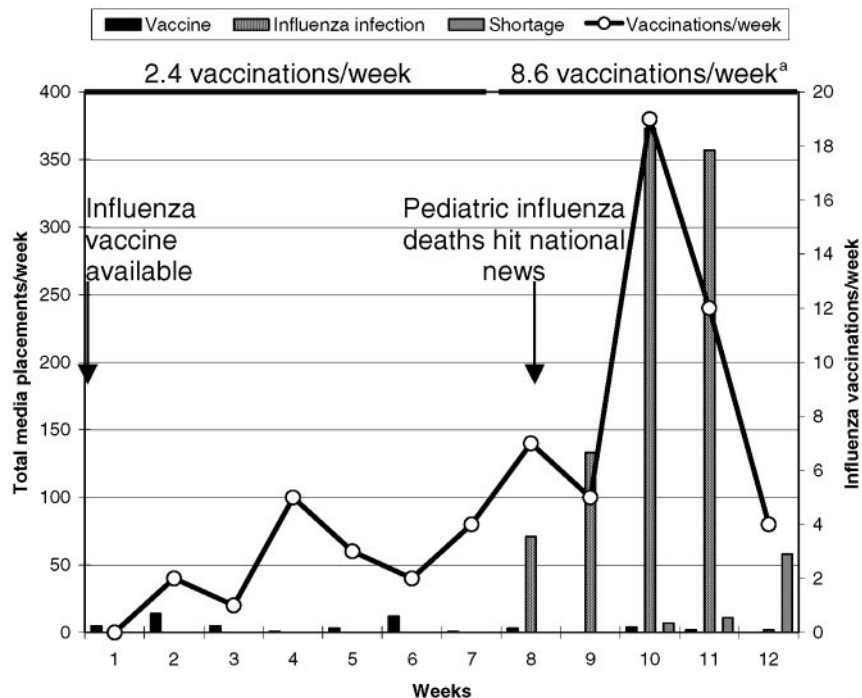


FIGURE 2
 Number of influenza vaccinations and influenza-related media placements by topic per week between October and December 2003. * $P < .001$.

infection explained 7% and 85% of the variation in influenza vaccinations by week, respectively (Fig 1). It is interesting to note that the decline in influenza vaccinations per week in December coincided with the media placements about influenza vaccine shortages, which were experienced locally. In contrast, influenza vaccine stories in 2002 explained 25% of the variation in influenza vaccinations by week, and only 2 articles focused on influenza infections (Fig 2).

Some parents (17%) of vaccinated children cited >1 reason that contributed to that vaccination status. The most common reasons were physician recommendation (60%), media coverage or recommendation of a friend (26%), and desire to avoid influenza illness in their child (21%). Only 10% of the parents reported that past experience with influenza, positive experience with influenza vaccine, or desire to protect a family member were contributing reasons.

Some parents (19%) of unvaccinated children cited >1 reason that contributed to their decision not to vaccinate. The reasons included lack of perceived need (39%), lack of knowledge about influenza vaccine for children (27%), concern about adverse effects (22%), lack of physician recommendation (20%), and difficulty in obtaining influenza vaccine (11%), with several children having influenza disease before they could be vaccinated. The reasons were similar for children 6 to 23 months of age or those with a high-risk medical condition (targeted population) and for healthy children 24 to 59 months of age.

DISCUSSION

This study demonstrates that media coverage, particularly media placements about a severe influenza season and infection, was associated with increased influenza vaccinations in children aged 6 to 59 months for the 2003–2004 season. Pediatric influenza vaccination rates in 2003–2004 were proceeding similarly to 2002–2003 until the onset of intense influenza media coverage, at which time the number of influenza vaccinations per week increased more than threefold. This change in rates was associated with increased parental knowledge about pediatric influenza vaccine.¹⁰ We reported previously that 50% of parents of unvaccinated children and 43% of all enrolled children reported lack of knowledge about vaccination from 2001–2003. In contrast, we found in 2003–2004 that 27% of parents of unvaccinated children and 16% of all enrolled children reported lack of knowledge about vaccination.

Similar proportions (41%) of children 6 to 23 months of age were vaccinated regardless of high-risk medical condition. In contrast, children 24 to 59 months old with a high-risk medical condition (66%) were more than twice as likely to receive the influenza vaccine compared with those without high-risk medical conditions (29%). Although it is unclear why the proportions differed for children who were 6 to 23 months of age and for high-risk children who were 24 to 59 months of age, older children may have had more experience with influenza infections or more opportunities for physician recommendations.

There are several potential limitations to this study.

To minimize selection bias when multiple eligible children presented to the clinic, we approached the eligible child who most recently checked in at the clinic and enrolled 95% of them. To minimize interviewer bias, the interviewer was trained to administer and record responses to a standardized questionnaire and record all comments verbatim. Misclassification is possible for influenza vaccination status for the child and family members that was determined by parental report. However, misclassification seems less likely, because self-reported influenza vaccination status has been validated in adults.¹⁴ Many, but not all, influenza vaccinations were confirmed by chart review or in the state immunization registry. In this predominantly Medicaid practice (90%), income and parental education levels were not collected. Another limitation was that the study was conducted at 1 academic center. Because the number and content of media placements changed dramatically after mid-November, we cannot differentiate the impact of volume of coverage from content. Furthermore, it is possible that the media coverage was associated with more parents seeking influenza vaccine, with physicians recommending influenza vaccine more frequently, with parents being more receptive to influenza vaccine recommendations by physicians, or any combination of these factors. Although we cannot distinguish among these possibilities, the impact of the media on influenza vaccination rates is important and complements the data presented by Kempe et al¹⁵ from private practice clinics in Denver, Colorado.

Similar to previous studies, physician recommendation and having a vaccinated family member strongly predicted influenza vaccination in children.^{10,16} Unlike our previous study, children with high-risk medical conditions and those with an October–January continuity clinic visit had an increased likelihood of influenza vaccination. Recalling a physician recommendation, having a vaccinated family member, and having a continuity clinic visit from October through January were stronger predictors of a child's influenza vaccination status than having a high-risk medical condition. Despite this increase in influenza vaccinations during a year with substantial media attention, we, like Jones et al,¹⁷ found that many persons had a medical encounter with a missed opportunity.

These data suggest that media coverage in conjunction with explicit physician recommendation for children and their contacts are key factors that may help physicians improve influenza vaccination rates in children. Scheduling continuity clinic visits between October and January and vaccinating at all visits, not just well-child visits, may be beneficial also.

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