

Influenza Among Healthy Young Children: Changes in Parental Attitudes and Predictors of Immunization During the 2003 to 2004 Influenza Season

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ABSTRACT

BACKGROUND. In Colorado, the 2003 to 2004 influenza season was unusually early and severe and received substantial media attention.

OBJECTIVES. Among parents of healthy young children, to determine how parental knowledge and attitudes regarding influenza infection and immunization changed during the 2003 to 2004 influenza season and to identify factors predictive of influenza immunization.

METHODS. The study was conducted in 5 metropolitan Denver pediatric practices. A total of 839 healthy children age 6 to 21 months and their parents were randomly selected for participation. Parents were surveyed by telephone before (August 18 to October 7, 2003) and after (March 31 to June 10, 2004) the influenza season.

RESULTS. Among 828 eligible parents, 472 (57%) completed the preseason survey; 316 (67%) of these parents subsequently completed the postseason survey. All analyses were performed for the 316 subjects who completed both preseason and postseason surveys. Compared with their attitudes before the influenza season, 48% of parents interviewed after the season viewed their child as more susceptible to influenza, 58% viewed influenza infections as more severe, and 66% perceived fewer risks associated with influenza vaccine. Ninety-five percent of parents reported hearing in the media about Colorado's influenza outbreak, and having heard about the outbreak in the media was associated with viewing influenza infections as more severe. A total of 258 parents (82%) immunized their child against influenza. In multivariate analyses, positive predictors of immunization included a physician recommendation for immunization and a preseason to post-season increase in the perception that immunization was the social norm. Negative predictors of immunization included high perceived barriers to immunization, less parental education, and preseason intention not to immunize.

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The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the Centers for Disease Control and Prevention or the Association of American Medical Colleges.

Key Words

influenza, immunization, parental attitudes, media

Abbreviation

ACIP—Advisory Committee on Immunization Practices

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CONCLUSIONS. Parent attitudes about influenza infection and immunization changed substantially during the 2003 to 2004 influenza season, with changes favoring increased parental acceptance of influenza vaccination for young children. During an intensively publicized influenza outbreak, a physician recommendation of vaccination was an important predictor of influenza immunization.

THE INFLUENZA VIRUSES cause an average of 36 000 deaths¹ and 134 000 hospitalizations² every year in the United States. Although deaths resulting from influenza occur primarily among adults ≥ 65 years of age,¹ healthy children < 2 years of age have a substantially increased rate of influenza-related hospitalizations,^{3–5} and influenza infections can cause death among otherwise healthy children.⁶ Prevention efforts aimed at reducing the burden of influenza have relied primarily on annual influenza vaccination of populations at increased risk of hospitalization or death resulting from influenza, such as elderly subjects and individuals with certain chronic conditions.⁷ Because of more recently published data documenting high rates of influenza-associated hospitalization among young children,^{3,4} the Advisory Committee on Immunization Practices (ACIP) encouraged influenza immunization of healthy 6- to 23-month-old children during the 2002 to 2003 and 2003 to 2004 influenza seasons.^{8,9} For the 2004 to 2005 season, the ACIP strengthened this policy by fully recommending influenza immunization for all 6- to 23-month-old children,⁷ a strategy also endorsed by the American Academy of Pediatrics¹⁰ and the American Academy of Family Physicians.¹¹

Recent ACIP influenza recommendations also highlighted the importance of educating parents about the “impact of influenza and the potential benefits and risks of vaccinating young children.”^{8,9} The development of educational messages is hampered, however, by a scarcity of published data examining parental attitudes about influenza, particularly among parents of young children. Parental attitudes about influenza and predictors of immunization were investigated among children 6 months to 18 years of age who were hospitalized during influenza season,¹² as well as children 6 to 59 months of age seen in a university-affiliated primary care clinic.¹³ In the only study of parental attitudes focused exclusively on parents of 6- to 23-month-old children, a range of parental attitudes about influenza were examined but whether these attitudes were predictive of vaccination was not assessed.¹⁴ Each of these studies was cross-sectional and therefore was not designed to assess changes in parental attitudes over time.^{12–14}

The 2003 to 2004 influenza season presented a unique opportunity to investigate the potentially changeable nature of parental attitudes about influenza. The

2003 to 2004 influenza season was atypical in several respects; influenza activity began and peaked earlier than usual,^{15,16} might have been associated with increased pediatric mortality rates,^{6,17} and produced a great deal of media attention.^{18–21} This study was conducted to determine how parental knowledge and attitudes regarding influenza infection and immunization changed during the 2003 to 2004 influenza season. In addition, the study was designed to identify the factors, including sociodemographic characteristics, changes in parental attitudes, perceived barriers to vaccination, and exposure to influenza-related media stories, that were predictive of influenza immunization.

METHODS

Study Setting and Population

This study was conducted in 5 private pediatric practices in metropolitan Denver, Colorado, from August 2003 to June 2004. These practices shared a computerized billing system and participated in a regional immunization registry.^{22,23} An estimated 81% of patients within the study practices were privately insured, 15% were publicly insured, and 3% were uninsured.²⁴ All practices participated in the federal Vaccines for Children program.²⁵ Before the 2003 to 2004 influenza season, providers in study practices had decided to encourage influenza immunization for healthy 6- to 23-month-old children, in accordance with existing ACIP recommendations.⁹

The survey-eligible population consisted of parents of all children who were between 6 and 21 months of age as of October 1, 2003, with a record in both the billing and registry databases and with a visit to a study practice in the preceding 18 months. Parents of children with chronic medical conditions, identified with a previously established set of diagnostic codes, were excluded.²⁶ Non-English-speaking parents and parents who had transferred their child's care to another clinic were also excluded. Study practices requested that children 22 to 23 months of age as of October 1, 2003, not be included in this investigation, because of concern that insurers would not provide reimbursement for vaccination of children who were > 23 months of age on the day they received influenza vaccine. This was of particular concern to study practices because influenza vaccination was encouraged but not fully recommended by the ACIP at the time.⁹ After all survey-eligible families were identified, a random sample was selected, with sampling proportional to the size of the study practices.

This investigation was part of a larger, randomized, controlled trial of recall for influenza immunization among healthy young children.²⁴ Through random selection, recall letters were sent to approximately one half of surveyed families. These letters, sent after the pre-season survey described below, included a statement that healthy young children “are at increased risk of

complications from the flu" but did not contain other educational messages. This study was reviewed by the human subjects review boards at the University of Colorado at Denver and Health Sciences Center and the Centers for Disease Control and Prevention and was approved as exempt research; written informed consent was not required.

Survey Administration and Content

Parents were surveyed before (August 18 to October 7, 2003) and after (March 31 to June 10, 2004) the influenza season. Interviewers asked to speak with "the person who usually takes the child to doctor's appointments" and, if that individual was unavailable, the survey was rescheduled for another time. Because the study was designed to assess changes in parental knowledge and attitudes over time, only parents who had completed the preseason survey were eligible for the postseason survey. All surveys were conducted by trained interviewers with computer-assisted, telephone interviewing technology.²⁷ We attempted to find an alternate contact number whenever a telephone number was not in service, and up to 20 attempts were made to contact subjects.

The survey content was based primarily on the Health Belief Model, which theorizes that parents' vaccination decisions are based on the following beliefs: perceived susceptibility of their child to influenza, perceived severity of influenza, perceived risks of vaccination, perceived benefits of vaccination, and perceived barriers to vaccination.²⁸ In addition, we questioned parents about whether they thought influenza immunization of children was generally the norm among their social network. The phrasing of several questions was adapted from previously published surveys regarding hepatitis B vaccine,²⁹ varicella vaccine,³⁰ and pneumococcal conjugate vaccine.³¹ The survey did not contain any recommendation that parents immunize their children. To minimize any confusion with the newly licensed intranasal influenza vaccine,³² it was stated explicitly in the survey introduction that the survey pertained to "flu shots."

In the postseason survey, knowledge and attitude questions presented in the preseason survey were repeated. In addition, parents were asked whether their child was immunized and whether any barriers to vaccination were encountered. Finally, because of the extensive media coverage of the 2003 to 2004 influenza season,¹⁸⁻²¹ we asked respondents whether they had heard in the media about the influenza outbreak, pediatric deaths, and issues related to influenza vaccination.

Outcome Measures

This investigation had 2 main study outcomes, ie, (1) changes in parental knowledge and attitudes regarding influenza infection and immunization, determined by

comparing preseason and postseason survey responses, and (2) receipt of influenza vaccine. A child was considered vaccinated if ≥ 1 influenza vaccination was documented between September 1, 2003, and February 29, 2004, in the billing or immunization registry databases or if the child's parent reported vaccination in the post-season survey.

Analytic Methods

Parental knowledge and attitudes were compared between preseason and postseason surveys with McNemar's test for paired data, with 4-point Likert scales collapsed into dichotomous variables. For each major conceptual domain of the survey (susceptibility, severity, benefits, risks, barriers, and social norms), we also developed composite scales. For example, all questions regarding the severity of influenza infections were grouped together in a "severity" scale. The validity of item groupings within scales was tested with Cronbach's α , with individual survey items being removed from composite scales if inclusion of the items reduced Cronbach's α substantially.³³ For each respondent, preseason scales were then compared with postseason scales, with the change in scales being calculated for each survey domain.

Predictors of immunization were determined with the change scales described above, as well as additional data from both the preseason (demographic features and intention to immunize) and postseason (media exposure, barriers to immunization, parental vaccination, and physician recommendation) surveys. Factors significant at $P < .20$ in bivariate analyses were tested in multivariate logistic regression models; factors were retained in the final regression model if the P value was $< .05$ after controlling for other predictors of immunization. Because of the potential impact of recall letters on parental attitudes and influenza immunization, we controlled for receipt of recall letters in multivariate analyses. All statistical analyses were performed with SAS software (SAS 8.0; SAS Institute, Cary, NC).

RESULTS

Survey Responses and Demographic Characteristics of Respondents

Among 5193 healthy 6- to 21-month-old children in the study practices, 839 (16%) were selected randomly for this study. Eleven parents were ineligible for the survey because they did not speak English, they were < 18 years of age, or the selected child was no longer in their care. Of the remaining 828 survey-eligible subjects, 472 (57%) completed a preseason survey. Among subjects with a completed preseason survey, 316 (67%) subsequently completed a postseason survey. Parents who completed both preseason and postseason surveys were similar to those who did not complete both surveys with

respect to the age of their child (14.4 months for respondents and 14.5 months for nonrespondents; $P = .78$). Parents who completed both surveys were more likely to have private insurance for their child than were those who did not complete both surveys (91% vs 77%; $P < .01$). On the basis of immunization registry and billing data, survey respondents were more likely to have vaccinated their child against influenza than were nonrespondents (77% vs 52%; $P < .001$). No other information was available on survey nonrespondents.

The 316 parents with completed preseason and post-season surveys constituted the study population for all remaining analyses. Table 1 presents the demographic characteristics of survey respondents. Most parents had at least some college education, and 22% identified their child as being from a racial/ethnic minority group.

Changes in Knowledge and Attitudes

Parents' responses to a variety of influenza-related questions from before versus after the 2003 to 2004 influenza season are presented in Table 2. Nearly all significant changes in parental knowledge and attitudes were in a direction that, on the basis of the Health Belief Model,²⁸ would be predicted to enhance parental acceptance of

influenza vaccination. Only 1 question, regarding the benefits of vaccination, yielded inconsistent results; 59% of respondents before the influenza season thought that influenza vaccine "prevents children from catching the flu," compared with 49% after the season ($P < .01$).

As can be seen in Fig 1, substantial changes in parental attitudes were also evident when survey questions regarding similar concepts were grouped into composite scales. Cronbach's α for composite scales ranged from 0.46 to 0.69 before the season and from 0.45 to 0.66 after the season. The most substantial changes in parental attitudes during the 2003 to 2004 influenza season were an increase in the perceived severity of influenza, an increase in the perception that influenza vaccination is the social norm, and a decrease in the perceived risks of influenza vaccination.

Media Impact

In response to questions about exposure to influenza-related media stories, 95% of parents reported having heard about Colorado's influenza outbreak, 91% had heard that children in Colorado had died as a result of influenza, 90% had heard that young children "should get a flu shot," 94% had heard about local vaccine shortages, and 78% had heard that the vaccine strains were not a perfect match for the strains of influenza circulating locally. Reported media exposure was associated significantly with changes in parental influenza-related attitudes in the following areas: having heard about Colorado's influenza outbreak was associated with an increase in perceived severity of influenza ($P = .01$); having heard that children had died as a result of influenza was associated with a decrease in perceived risks of vaccination ($P = .05$); having heard about vaccine shortages was associated with an increase in perceived severity of influenza ($P = .01$) and an increase in perceived social norms of vaccination ($P = .03$); and having heard that young children should be immunized was associated with a decrease in perceived risks of vaccination ($P < .01$), an increase in perceived social norms ($P = .04$), and an increase in perceived susceptibility of their child to influenza ($P = .03$).

Perceived Barriers

In the postseason survey, we questioned all parents, regardless of whether their child had been immunized or not, about perceived barriers to vaccination. Twenty-three percent of parents thought that their child's doctor had inadequate vaccine supplies, 19% reported that their child being sick interfered with vaccination, and 15% reported that they did not know whether influenza vaccination was recommended for their child. Fewer parents reported barriers related to office systems; 12% thought that waiting times for vaccination were long, 10% reported that appointments were difficult to make, and 9% thought that office hours for vaccination were

TABLE 1 Demographic Characteristics of Survey Respondents and Their Respective Child

	Proportion of Sample, % (n = 316)
Parent/guardian age	
<30 y	29
30–39 y	63
≥40 y	8
Relationship to child	
Mother	83
Father	16
Other guardian	1
Parent/guardian education	
High school graduate or less	9
Some college	23
College graduate or more	67
Annual household income	
<\$50 000	28
\$50 000 to <\$100 000	42
\$100 000 or more	30
Child age	
6–11 mo	32
12–16 mo	33
17–21 mo	35
Child race/ethnicity	
White	78
Hispanic	11
Black	5
Other or refused ^a	6
Child insurance	
Private	91
Public	8
Uninsured	2

Percentages do not add to exactly 100% because of rounding.

^a Asian, 3%; Native American, 1%; other ethnicities, 1%; refused, 1%.

TABLE 2 Comparison of Parental Knowledge and Attitudes Regarding Influenza Disease and Vaccination Before and After the 2003 to 2004 Influenza Season (n = 316)

Statement	Proportion Agreeing Before the Season, %	Proportion Agreeing After the Season, %	Absolute Change in Agreement, %	<i>P</i> ^a
Susceptibility to influenza infections				
Your child is not very likely to get the flu.	47	41	-6	.10
A healthy 40-y-old adult is more likely to get the flu than your child.	38	18	-20	<.01
Compared with other children your child's age, your child is more likely to get the flu.	36	40	+4	.23
Severity of influenza infections				
Influenza infections are usually more serious in a healthy 70-y-old adult than in a healthy 1-y-old child.	58	42	-16	<.01
Influenza infections are usually more serious in a healthy 40-y-old adult than in a healthy 1-y-old child.	25	14	-11	<.01
Complications from influenza infections are very rare in children <2 y old.	32	28	-4	.24
The flu is usually a mild disease.	52	43	-9	.01
Influenza infections cause many hospitalizations and deaths in the United States.	80	81	+1	.74
Benefits of vaccination				
The flu vaccine prevents children from catching the flu.	59	49	-10	<.01
Giving the flu vaccine to children will decrease their parents' time lost from work.	56	71	+15	<.01
Giving the flu vaccine to children will decrease their school absences.	69	77	+8	<.01
Risks of vaccination				
The flu vaccine is not safe to give to a 1-y-old child.	19	6	-13	<.01
The flu vaccine can cause the flu in some people.	69	58	-11	<.01
The flu vaccine will often cause minor reactions.	88	81	-7	.02
Your child is likely to have a serious reaction to the flu vaccine.	22	16	-6	.01
Social norms regarding vaccination				
Most of the parents you know take their children for flu shots.	37	71	+34	<.01
Most people important to you think you should give your child a flu shot.	38	70	+32	<.01
Knowledge of national recommendations				
National health organizations encourage or recommend flu shots for a healthy 1-y-old child.	43	84	+41	<.01

^a McNemar's test for paired data.

inconvenient. Finally, 10% of parents reported that other important tasks kept them from immunizing their child, and 8% reported that cost was a factor in whether their child was immunized.

Predictors of Immunization

On the basis of data from billing and registry databases, 244 subjects (77%) received ≥ 1 dose of influenza vaccine during the 2003 to 2004 influenza season. For an additional 14 subjects (4%), parents reported that their child was immunized although influenza immunization was not documented in billing or registry data. Overall, the registry and billing databases were in agreement with parental reports of immunization status for 94% of subjects.

Table 3 presents unadjusted and adjusted odds ratios of factors predictive of influenza immunization. Although Hispanic ethnicity was correlated negatively with influenza immunization in unadjusted analyses, it

did not remain predictive after controlling for other significant factors. In multivariate analyses, a doctor recommendation for immunization and an increase in the perception that immunization was the social norm were positive predictors of influenza immunization, whereas high perceived barriers to immunization, less parental education, and pre-season intention not to immunize were negative predictors. Although parents' knowledge and attitudes regarding influenza changed substantially, changes in perceived susceptibility to and severity of influenza and risks and benefits of vaccination were not predictive of immunization in multivariate analyses.

Parent-Reported Reasons for Not Immunizing

Parents of all 58 unimmunized children were asked in an open-ended question why their child did not receive influenza vaccination during the 2003 to 2004 influenza season. As can be seen in Table 4, parents had a wide range of attitudes and misperceptions regarding influ-

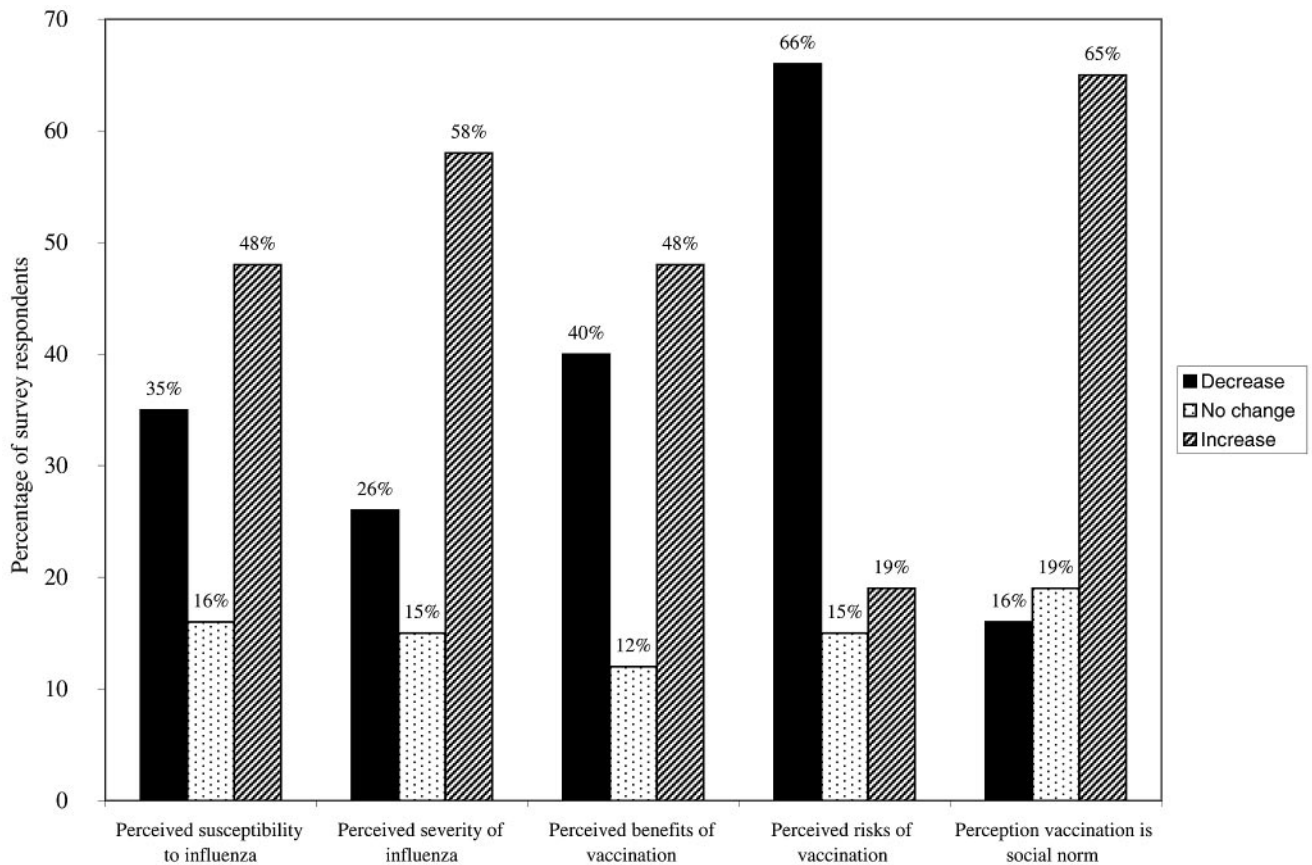


FIGURE 1
Changes in parents' attitudes regarding influenza disease and immunization during the 2003 to 2004 influenza season.

enza, including the ideas that injectable influenza vaccine can cause influenza, that children not in day care are not particularly susceptible to influenza, and that children >6 months of age are still too young for vaccination.

DISCUSSION

The ACIP recommendation for universal influenza immunization of 6- to 23-month-old children represents a major change in national influenza prevention strategies. Successful implementation of this new recommendation will depend in part on educating parents about influenza vaccine, a process that will be aided by an understanding of how parental attitudes about influenza are formed and may change. In this investigation, which was conducted during an influenza season that received intensive media attention, we documented a number of significant changes in parental attitudes regarding influenza. Compared with their attitudes before the influenza season, parents interviewed after the season were more likely to view influenza as a potentially severe disease among young children and were less likely to express concerns about the risks of influenza vaccination. Several factors were found to be positively predictive of influenza immunization, including a physician recom-

mendation for immunization and an increase in the perception that immunization was the social norm. Although few parents in this population reported barriers to immunization, parents who did encounter barriers were significantly less likely to immunize their child.

There are limited data regarding how the parents of young children view the recommendations for universal influenza immunization of the 6- to 23-month-old age group. Several previous studies examined parental attitudes about influenza, but those investigations included data on older children, with and without chronic medical conditions,^{12,13} and therefore may not be entirely applicable to parents of healthy young children. Issues that may be particularly relevant to influenza immunization among healthy young children include a lack of parental awareness of the severity of influenza in this age group, the number of other vaccinations scheduled for this group, and concerns about vaccine safety for developing children.¹⁴ We found that, before the influenza season, parents held a number of misperceptions about influenza and generally were unaware of existing vaccination recommendations. Despite these considerations, the influenza immunization rate in this setting was high.

The significant changes in parental influenza-related

TABLE 3 Predictors of Influenza Immunization During the 2003 to 2004 Influenza Season (n = 316)

Factor	Unadjusted Odds Ratio (95% CI)	Adjusted Odds Ratio (95% CI)
Increasing child age, mo	0.95 (0.89–1.02)	
Child race/ethnicity		
White	Reference	
Hispanic	0.30 (0.14–0.65)	
Black	0.87 (0.24–3.17)	
Other	0.87 (0.24–3.17)	
Education of parent/guardian		
College graduate or more	Reference	Reference ^a
Some college	0.24 (0.13–0.45)	0.30 (0.14–0.68) ^a
High school graduate or less	0.44 (0.17–1.12)	0.58 (0.18–1.86) ^a
Preseason intention to immunize		
Planned to immunize	Reference	Reference
Was undecided/not sure	0.42 (0.16–1.08)	0.31 (0.10–0.95)
Planned not to immunize	0.11 (0.04–0.25)	0.07 (0.02–0.22)
Increase in perception that vaccination is social norm ^b	1.51 (1.20–1.91)	1.99 (1.44–2.75)
Media exposure		
Heard about Colorado influenza outbreak	2.12 (0.71–6.35)	
Heard about local vaccine shortages	2.17 (0.79–5.99)	
Heard that young children should be immunized	1.97 (0.86–4.54)	
Perceived barriers to immunization ^b	0.35 (0.24–0.52)	0.40 (0.24–0.66)
Received recall letter ^c	1.11 (0.63–1.97)	0.85 (0.40–1.82)
Provider recommended vaccination	8.12 (4.35–15.14)	3.87 (1.84–8.15)
Parent vaccinated in 2003–2004	3.25 (1.80–5.84)	

CI indicates confidence interval.

^a Education of parent/guardian was significant overall in multivariate analyses; therefore, all 3 categories of education were retained in the multivariate analyses presented.

^b Composite scales; odds ratios represent the odds of immunization with each 1-point increase on a 4-point scale.

^c This factor, although not significant at $P < .05$, was retained in multivariate analyses because of the potential impact of recall letters on parental attitudes and immunization.

attitudes that we observed are likely to have contributed to the high immunization rate documented. Parental attitudes changed across a broad range of issues regarding influenza, and generally these changes would be expected to enhance parental acceptance of influenza vaccination for young children. However, it is interesting to note that parents interviewed after the season expressed less confidence in the ability of influenza vaccine to prevent their child from “catching the flu,” compared with their attitudes before the season. It may be that media stories highlighting the lack of a perfect match between vaccine strains and circulating strains of influenza contributed to this finding.^{18–21} Parents might also have encountered, in the media or elsewhere, information about the fact that influenza vaccination does not prevent all cases of influenza, even when there is concordance between vaccine strains and the predominant circulating strains. The decrease in parental confidence about vaccine efficacy, however, did not seem to dissuade parents in this setting from immunizing their child.

Because concern about vaccine safety seems to be increasing in the general public^{34–36} and parental vaccine safety concerns are associated with underimmunization,³⁷ it is important to note that we observed a substantial decrease in the perceived risks of influenza im-

munization after the 2003 to 2004 influenza season. It has been postulated that, as the incidence rates of vaccine-preventable diseases decrease, the perceived threat posed by these disease decreases in relation to concerns about the safety of vaccines.^{34,38} To our knowledge, however, it has not been proposed that the converse is also true, ie, that an increase in the perceived threat of a vaccine-preventable disease would lead to a decrease in vaccine safety concerns. This investigation provides new evidence to support the theory that such a “pendulum” regarding vaccine beliefs exists. Our findings suggest that, during the 2003 to 2004 influenza season, parents’ perceptions about the risks of influenza vaccination might have decreased because the perceived threat of influenza was so high. Although additional research into what factors influence public perceptions of vaccine safety is needed, health information messages that emphasize the real dangers posed by vaccine-preventable diseases may be effective in reducing vaccine safety concerns of the public.

Although most parents in our investigation reported few barriers to influenza immunization, those who did encounter barriers were significantly less likely to immunize their child. For the primary pediatric immunization series, socioeconomic factors, provider practices, and office factors all have been associated with under-

TABLE 4 Among Unimmunized Children, Parent-Reported Reasons for Not Immunizing

Specific Issue Raised by Parents	Proportion, % (n = 58)
Barriers to immunization	26
Vaccine shortages	
Insurance change prevented vaccination	
Child ill when examined	
Lack of time	
Risks of vaccination	12
Influenza vaccine can cause influenza	
Influenza vaccine gave parent influenza	
Vaccine hinders development of natural immunity	
Mercury used to manufacture vaccine	
Low perceived susceptibility to influenza	12
Child not in day care	
Child not at high risk of influenza	
Nobody in family catches influenza	
Influenza infection can be prevented by other means	
Thought vaccination unnecessary	10
Thought child did not need vaccination	
Thought child would be fine without vaccination	
Lack of perceived benefit of vaccination	7
Can be immunized and still get influenza	
Vaccine would not help much	
Vaccine not compatible with circulating influenza	
Media coverage about lack of vaccine efficacy	
Lack of physician recommendation	3
Vaccination not discussed with doctor	
Doctor suggested vaccination in January not necessary	
Lack of perceived severity	2
Child does not typically get very ill	
Other reasons	9
Confusion regarding vaccination schedule	
Parents do not believe in vaccination	
Child too young	
No specific reason offered	31

Percentages total >100% because up to 3 responses were allowed per respondent.

immunization.³⁹ In the current study, parents of unimmunized children cited similar barriers, such as vaccine cost, a change in insurance coverage, and their child being ill at the time of potential influenza immunization. Unfortunately, barriers such as these may prevent influenza immunization in otherwise willing populations. In fact, the impact of immunization barriers may be accentuated in the case of influenza because of the narrow time window for annual immunization; if parents are deterred by barriers in October, November, or December, they may not have another opportunity to immunize their child before the influenza season.

During the 2003 to 2004 influenza season, parents of young children in metropolitan Denver, Colorado, were highly exposed to media stories about influenza. In addition, parental reports of exposure to influenza-related media stories were associated with changes in attitudes regarding influenza infection and immunization. This finding is consistent with other work documenting the

influence of the media on the attitudes and behaviors of the general public regarding a variety of health issues (such as low back pain, breast cancer screening, and colon cancer screening).⁴⁰⁻⁴² However, it is important to recognize that parents have a variety of sources of information about vaccines, including their child's physician, their family members and friends, newspapers and magazines, and the Internet.⁴³ Therefore, although we documented a high degree of exposure to influenza-related media stories, our data cannot determine to what degree media stories, as opposed to other sources of vaccine information, led to the changes in parental attitudes that we observed.

This investigation has several limitations. The study population was well educated, was privately insured, and reported a relatively high household income, which limits generalizability to more disadvantaged populations and other clinical settings. Only 67% of those who completed the preseason survey were reinterviewed successfully after the influenza season. For comparison, rates of successful reinterviewing of parents in longitudinal telephone surveys ranged from 68% to 85% in recently published investigations.^{44,45} It is important to recognize that survey respondents might have differed from nonrespondents in ways that might influence our findings. Our data showed that respondents were more likely to have received influenza vaccine in a study practice, compared with nonrespondents. Although nonrespondents might have taken their child to a different clinic for influenza vaccine, we cannot exclude the possibility that some parents chose not to complete our survey specifically because of their unwillingness to immunize their child against influenza. Finally, this investigation was conducted during an atypical influenza season, and in a region of the country that experienced intensively publicized early-season pediatric deaths.¹⁸⁻²¹ Therefore, it is likely that patterns of changes in parental attitudes regarding influenza would have been different in other settings or during other influenza seasons.

CONCLUSIONS

Parental attitudes about influenza infection and immunization changed significantly during the 2003 to 2004 influenza season, with changes favoring increased parental acceptance of influenza vaccination for young children. During the season, parents of young children were highly exposed to media stories about influenza, and media messages might have contributed to changes in parental attitudes about influenza. However, in the setting of an intensively publicized influenza outbreak, a physician recommendation of vaccination remained an important predictor of influenza immunization.

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