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ARTICLE

Media Coverage of the Measles-Mumps-Rubella Vaccine and Autism Controversy and Its Relationship to MMR Immunization Rates in the United States

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What's Known on This Subject

In 1998, researchers suggested a link between MMR and autism. Although significantly flawed, this article was widely reported in the British media, with a subsequent decrease in MMR immunization.

What This Study Adds

This study is the first to measure the population-level impact of the MMR controversy in the United States and the first to quantify coverage of the MMR autism debate in the American media.

ABSTRACT

OBJECTIVE. The purpose of this work was to assess the association between media coverage of the MMR-autism controversy and MMR immunization in the United States.

METHODS. The public-use files of the National Immunization Survey were used to estimate annual MMR coverage from 1995 to 2004. The primary outcome was selective measles-mumps-rubella nonreceipt, that is, those children who received all childhood immunizations except MMR. Media coverage was measured by using LexisNexis, a comprehensive database of national and local news media. Factors associated with MMR nonreceipt were identified by using a logistic regression model.

RESULTS. Selective MMR nonreceipt, occurring in as few as 0.77% of children in the 1995 cohort, rose to 2.1% in the 2000 National Immunization Survey. Children included in the 2000 National Immunization Survey were born when the putative link between MMR and autism surfaced in the medical literature but before any significant media attention occurred. Selective nonreceipt was more prevalent in private practices and unrelated to family characteristics. MMR nonreceipt returned to baseline before sustained media coverage of the MMR-autism story began.

CONCLUSIONS. There was a significant increase in selective MMR nonreceipt that was temporally associated with the publication of the original scientific literature, suggesting a link between MMR and autism, which preceded media coverage of the MMR-autism controversy. This finding suggests a limited influence of mainstream media on MMR immunization in the United States.

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Key Words
media impact, vaccines

Abbreviations
MMR—measles-mumps-rubella vaccine
NIS—National Immunization Survey
OR—odds ratio
CI—confidence interval

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THE LAST DECADE has seen a steady growth in the production and availability of new vaccines to the pediatric market. During the past 2 years alone, 4 new vaccines were introduced into the routine pediatric immunization schedule in the United States, and 3 existing vaccines were given new indications.[1] This expansion in vaccine recommendations has been met by increasing concern for vaccine safety raised by individuals who question the potential for vaccine adverse effects despite a lack of reliable data to support these claims.[2] In the face of this growing skepticism, the challenge for our public health community is to better understand how physician and public perception of vaccines and vaccine-preventable diseases affects vaccine uptake.

Perhaps one of the best opportunities to examine the influence of public perception on vaccine uptake is to focus on the putative link between the measles-mumps-rubella (MMR) vaccine and autism first put forth by Wakefield et al in February 1998.[3] Although this study was significantly flawed and later discredited,[4] it was widely publicized in the British press. Consequently, national rates of MMR coverage in Britain fell from 92% to 73%, with rates in parts of London as low as 50%.[5] This decrease in coverage resulted in measles outbreaks[6] and the first measles death in the United Kingdom in more than a decade.[5] Although there was a dramatic impact on MMR receipt in Britain, the impact of the Wakefield et al[3] study and its subsequent media coverage have never been studied nationally in the United States, despite concern within the public health community.[7] The potential impact is not a trivial question.

In May 2005, a measles outbreak affected 34 individuals in Indiana, 32 of whom were unvaccinated. The primary reason for vaccine declination was concern for adverse events, specifically those related to media reports of the potential link between MMR and autism.[8]

The current study aimed to provide for the first time population-level estimates of MMR receipt in the United States after the publication of the article by Wakefield et al[3] and its subsequent media coverage. Our specific goals were to determine the temporal impact of the publication of this article[3] on MMR receipt in the country, whether media exposure of the controversy was associated with changes in MMR receipt, and which, if any, regional-level, system-level, and child-level characteristics were associated with changes in MMR receipt.

METHODS

The primary source of historical data for immunization delivery in the United States was the National Immunization Survey (NIS).[9] The NIS is a random-digit dialing survey administered to estimate immunization coverage in the United States each year. The survey consists of 2 parts. The first is a random-digit dialing survey in which households with children between the ages of 19 and 35 months are identified. If this criterion is met, basic demographic and health information are obtained from the child's primary caretaker. At the end of this interview, consent is obtained to contact the child's primary care physician, from whom vaccination records are verified. Only those children with valid provider data are included in yearly estimates of immunization coverage and were included in this study. The data collected in each year's NIS are weighted to represent the entire US population of children 19 to 35 months of age.

The outcome variables obtained from the public use files of the NIS between 1995 and 2004 were related to the receipt of MMR vaccine. One outcome of interest was overall MMR nonreceipt, which indicated all of the children who had not received the MMR vaccine. However, a potential concern in measuring MMR nonreceipt alone is the effect of other factors, notably, poverty and access to medical care, that have been associated with poor immunization rates in the past.[10] To better understand intentional MMR nonreceipt, we also identified those children who received all of the childhood immunizations except MMR. Children were defined as having selective MMR nonreceipt if they were up to date for 3 hepatitis B, 3 polio, 4 diphtheria-tetanus-acellular pertussis, and 3 *Haemophilus influenzae* type b vaccines but not MMR.

The NIS also allowed us to collect other covariates, including gender, age group at time of survey (19–23, 24–29, or 30–35 months), race (Hispanic, non-Hispanic white, non-Hispanic black, or other), census region (Northeast, Midwest, West, or South), family income ($0 to $30 000, $30 001 to $50 000, more than $50 000, or unknown), level of maternal education (<12 years, no college, some college, or college degree), maternal marital status (currently married or not), firstborn status of the child, and medical provider type (all public, all private, other, or mixed). Public providers included public health clinics and community health centers. Private providers included private clinics, health maintenance organizations, and group practices. Other providers included all other types of providers, such as hospitals, military facilities, and unknown responses. Mixed providers included >1 type of provider.

The source of data for media exposure was the LexisNexis Academic Universe (Lexis Nexis, Dayton, OH), a database of national and local television, national and local newsprint, and national and local radio. This database has been widely used in the communications literature and in previous studies of media coverage of vaccines[11,12] and other medical topics, including breast cancer,[13] diabetes,[14] and medication safety.[15,16] LexisNexis includes data from 295 newspapers in the United States, including the top 25 circulating papers and 90 of the top 100. It also captures all of the Associated Press newswire releases, all of the major television networks (ABC, CBS, Fox, NBC, and CNN), and National Public Radio broadcasts. All of the stories captured by the search terms "MMR" and "autism," or "measles" and "autism," or "Wakefield" and "MMR," or "Wakefield" and "autism," in story headline, lead paragraph, and terms were recorded. These search terms were culled from a longer list of search strategies after empiric testing with the LexisNexis database. Because the oldest children in the 1995 NIS were born in 1992, we searched LexisNexis from 1992 to 2004. Articles or stories not specifically about vaccines were excluded. All of the stories had their specific day and time, as well as region of the country recorded.

Data were described using frequencies for all of the categorical variables. There were no continuous variables reported. The frequencies of overall and selective MMR nonreceipt were calculated for each year in the study period. The NIS weights for children with adequate provider data were used to provide nationally representative estimates for each year.[17] Because the NIS includes children born over a 30-month period, media exposure for each survey year was calculated as the total number of stories to which the cohort was potentially exposed during the first year of life. Although media coverage could not be linked to families at the child level, these data were graphically superimposed on the cross-sectional immunization data to permit a temporal comparison.

In addition to the graphical representation of the data, we also performed repeated cross-sectional analyses using logistic regression models to assess risk factors for overall and selective MMR nonreceipt. All of the analyses were adjusted by using the NIS sample weights for children with adequate provider data. Predictor variables, including child and family demographic characteristics, health care provider characteristics, and year of survey (for secular trends), were chosen for the model based on their significance in univariate testing. Additional interaction was explored independently of the results of univariate analysis based on a priori hypotheses. These potential interactions included the differential impact of the type of health care provider by year on immunization rates, family characteristics by year on MMR nonreceipt, and health care provider by region of country. Results from these analyses are presented as odds ratios (ORs) with associated 95% confidence intervals (CIs).

All of the statistical analyses were performed by using Stata 9.0 (Stata Corp, College Station, TX). This study was granted exempt status by the Children's Hospital of Philadelphia Committees for Protection of Human Subjects.

RESULTS

The NIS over the interval of 1995–2004 included data on 215 643 individual children with adequate provider data, who were weighted to represent 57 489 099 children 19 to 35 months of age residing in the United States during this period. The weighted demographic characteristics of these children are presented in Table 1. Gender and age group were distributed evenly across the cohort. The majority of children were non-Hispanic white, had siblings, and received medical care in private practices.

The characteristics of children with overall and selective MMR nonreceipt are presented in Table 2. Younger children were more likely to have not received the MMR vaccine, both overall and selectively, reflecting greater time for older children to "catch up" on missed vaccinations. With respect to overall MMR nonreceipt, non-Hispanic black children, those with siblings, those residing outside the Northeast region, those seen in public health clinics, those residing in families with lower income, those with mothers with fewer years of education, and those with unmarried mothers were more likely to have not yet received the MMR vaccine. When examining selective MMR nonreceipt, these family level characteristics that have been traditionally associated with failure to immunize were no longer important. Apart

TABLE 1 Weighted Demographic Distribution of Children Included in the 1995–2004 NIS

Variable	Percentage of Children
Gender	
Male	51
Female	49
Age group, mo	
19–23	30
24–29	35
30–35	35
Race	
Hispanic	22
Non-Hispanic white	57
Non-Hispanic black	15
Other/multiple	6
Firstborn status	
Yes	28
No	72
Census region	
Northeast	18
Midwest	22
South	36
West	24
Income group	
\$0 to \$30 000	38
\$30 001 to \$50 000	19
More than \$50 000	27
Unknown	16
Maternal marital status	
Currently married	71
Other	29
Maternal education	
<12 y	18
12 y	37
>12 y, noncollege graduate	17
College graduate	28
Practice type	
All public	16
All private	57
Mixed or other	26

TABLE 2 Characteristics of Children With Overall and Selective MMR Nonreceipt (*n* = 215 643 Individual Children, Weighted to Represent 57 489 099)

Variable	Overall MMR Nonreceipt		Selective MMR Nonreceipt	
	Percentage of Children	*P*[a]	Percentage of Children	*P*[a]
Gender		.117		.198
Male	8.8		1.2	
Female	8.5		1.1	
Age group, mo		<.001		.007
19–23	11.1		1.3	
24–29	8.1		1.2	
30–35	7.1		1.0	
Race		<.001		.700
Hispanic	9.3		1.1	
Non-Hispanic white	7.9		1.2	
Non-Hispanic black	10.7		1.2	
Other/multiple	8.0		1.3	
Firstborn status		<.001		.168
Yes	7.0		1.2	
No	9.3		1.1	
Census region		<.001		.938
Northeast	6.1		1.15	
Midwest	8.8		1.14	
South	9.1		1.11	
West	9.6		1.16	
Income group		<.001		.958
\$0 to \$30 000	10.5		1.12	
\$30 001 to \$50 000	8.7		1.17	
More than \$50 000	5.7		1.14	
Unknown	9.0		1.12	
Maternal marital status		<.001		.293
Currently married	10.5		1.04	
Other	9.9		1.19	
Maternal education	8.2		1.04	
<12 y	5.9		1.19	
12 y		<.001		.834
>12 y, noncollege graduate	7.9		1.14	
College graduate	10.3		1.12	
Practice type		<.001		<.001
All public	9.6		0.89	
All private	7.8		1.21	
Mixed or other	9.9		1.12	

Overall MMR nonreceipt indicates children who did not receive the MMR vaccine; Selective MMR nonreceipt, children who received 3 hepatitis B, 3 polio, 4 diphtheria-tetanus-acellular pertussis, and 3 *Haemophilus influenzae* type b vaccines but not MMR.

[a] Data show the χ^2 significance level for unadjusted association of independent variables and nonreceipt.

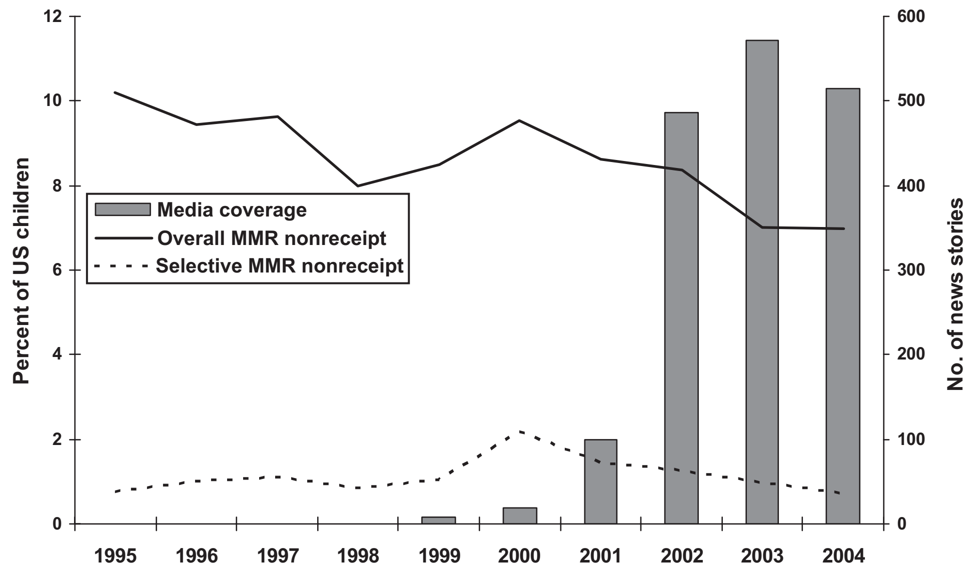

FIGURE 1
MMR nonreceipt and media coverage according to NIS survey year. Overall MMR nonreceipt indicates children who did not receive the MMR vaccine; selective MMR nonreceipt, children who received 3 hepatitis B, 3 polio, 4 diphtheria-tetanus-acellular pertussis, and 3 *Haemophilus influenzae* type b vaccines but not the MMR vaccine; news stories, all newspaper stories, television programs, and radio programs that reported the MMR-autism controversy to which children in each year's NIS may have been exposed.

from patient age, the only factor that remained important was receiving care in a private practice. In contrast to overall MMR receipt, for which rates of vaccination in private practices were higher than in public clinics, children seen in private practices were more likely to have selective MMR nonreceipt.

Trends in overall and selective MMR nonreceipt and media coverage during the study years are presented in Fig 1. In 1995, the first year of the NIS, ~10% of 19- to 35-month-old children did not receive the MMR vaccine. This decreased to 8% in 1998 then increased again to 10% in 2000 before falling to 7% in 2003 and 2004. Selective MMR nonreceipt increased from <1% from 1995–1999 to 2.2% in 2000, then returned to baseline over the next 2 years.

Superimposing data on media exposure from Lexis-Nexis failed to reveal a temporal association with the increase in nonreceipt that was seen in the 2000 cohort (Fig 1). An increase in media coverage began in 2001 (and is, therefore, reflected in the 2003 NIS cohort), but this occurred well after the observed increase in MMR nonreceipt. There were no reports mentioning MMR and autism before the article by Wakefield et al[3], which itself received little press in the United States (only 3 local television programs and no newspapers covered the initial story in February 1998). Additional analysis of the media data by month is presented in Fig 2. There was minimal media coverage of the MMR-autism story apart from 3 periods. A large media spike in April 2001 that was responsible for the majority of stories during the study period was associated with the Institute of Medicine report that rejected a causal association between MMR and autism. Smaller spikes in 2000 and 2002 reported the 2 US House Committee Reform hearings on the MMR-autism debate. Even during periods of increased media coverage, attention to the MMR-autism story was short lived. For instance, 141 of the 171 stories in April 2001 occurred within 24 hours after the release of the Institute of Medicine report on April 23.

The results of the multivariable analyses to examine the factors associated with overall and selective MMR nonreceipt appear in Table 3. In addition to the age-related association observed in univariate analysis, children who were non-Hispanic black, had siblings, lived outside of the Northeast, belonged to the lowest-income group, and had unmarried mothers or mothers with high-school education or less were more likely to have had overall MMR nonreceipt, confirming again that sociodemographic characteristics are significant predictors of overall missed vaccination opportunities ($P < .005$ for all of the comparisons). The relationship of these factors to the likelihood of selective MMR nonreceipt, however, was different. Although the age effect related to exposure time remained consistent with findings for overall nonreceipt, survey year and practice type were uniquely significant for their associations with selective nonreceipt. Children in the 2000 cohort ($P < .001$) and those receiving care in private practices ($P = .003$) were more likely to have selective nonreceipt. Tests for interaction between practice type and year, family characteristics and year, and practice type by region were not significant.

DISCUSSION

A review of the NIS data between 1995 and 2004 demonstrates a significant increase in both overall and selective MMR nonreceipt within the 2000 NIS cohort of which the MMR vaccinations would likely have occurred in close proximity to the publication of the article in 1998 by Wakefield et al.[3] This increase in selective nonreceipt at a population level was not trivial; ~1 in 50 children missed the opportunity for MMR immunization, and the rates were as high as 1 in 40 among

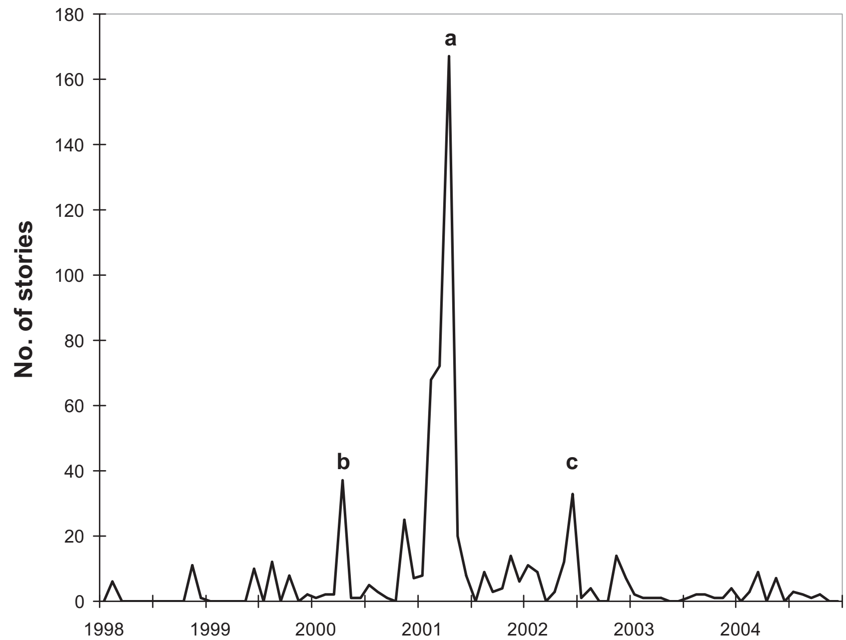

FIGURE 2
News transcripts reporting MMR and autism according to month: 1998–2004. Media coverage of the MMR-autism controversy was concentrated at 3 points in time: the Institute of Medicine MMR-Autism Report of April 2001 (a), the House Committee Reform Hearings of April 2000 (b), and the House Committee Reform Hearings of June 2002 (c).

children in private practices (data not shown). Significant media coverage of the MMR-autism controversy did not begin until nearly 2 years after this measurable increase in nonreceipt. To our surprise, selective MMR nonreceipt had already returned to baseline by the time this increased media coverage occurred. In the absence of widely reported newsprint, television, or radio reports, the likely explanation for the brief increase in MMR nonreceipt is that parents learned about the MMR-autism controversy from other sources.

Although the NIS does not ask parents how they obtain information about vaccines, our data provide insight into the decision-making process surrounding childhood vaccination. Essentially, the decision to immunize a child is influenced by 1 of 3 factors: the parent's willingness to immunize the child, the health care provider's attitude and input toward guiding this decision-making, and the availability of the vaccine. The only MMR shortage in the United States during the study period began in the winter of 2001, well after the observed increase in selective MMR nonreceipt, and did not affect receipt of the first MMR dose.[18] Therefore, only 2 plausible explanations for our observations remain: either families or physicians (or some combination of the two) became more reluctant to receive or provide the MMR vaccine.

One potential source of information for parents may have been the Internet. Nearly 70% of Americans access the Internet each day,[19] and 13% of adult Internet users state that they have specifically searched for information about vaccines online.[20] At the same time, the number of antivaccination Web sites has increased over the past decade.[21,22] However, in 1998, only 35% of households had access to the Internet,[19] and there were fewer antivaccination Web sites. Had the Internet played a large role in MMR nonreceipt, we might have expected higher family income to be associated with MMR nonreceipt, but we did not see this relationship.

Another potential explanation for our findings is that some medical providers, made aware of the article by Wakefield et al[3] through discussion in medical journals, may have become hesitant to administer the MMR vaccine. Several studies have reported that physicians are the most influential source of immunization information for parents,[23–25] including those who believe that vaccines are unsafe[26] and those who request exemptions.[27] Even if physicians were not the primary source of information about the MMR-autism controversy, they still would have been influential in the decision-making process. Bates et al[28] in 1994 found that, among children in an inner-city pediatric clinic, provider attitudes and behaviors were more important predictors of immunization status than parental beliefs. Another study of children in a private-practice cohort found that provider- and practice-associated characteristics were significantly associated with up-to-date immunization status, whereas family and child level characteristics were not.[29]

That physicians may play an important role in MMR delivery is further supported by the finding that neither selective nor overall MMR receipt changed significantly in the face of increased media coverage of the MMR-autism controversy that occurred after 1999, a time when families were more likely to be confronting their physicians with vaccine safety concerns during well-child visits. Why did MMR receipt not change significantly during this period? To some extent, daycare-entry and school-entry requirements may have preserved MMR coverage in this country. In addition, the greatest intensity of media coverage was associated with an Institute of Medicine report that refuted any link between the MMR vaccine and autism. This report, and the epidemiologic studies cited in it, may have reassured physicians and parents. Also, the MMR vaccine had been in routine pediatric use for many years with a demonstrated favorable risk/benefit and safety profile. Indeed,

TABLE 3 **Factors Associated With Overall and Selective MMR Nonreceipt in Multivariate Analysis**

Variable	Overall MMR Nonreceipt		Selective MMR Nonreceipt	
	Adjusted OR	95% CI	Adjusted OR	95% CI
Age group, mo				
19–23	Ref		Ref	
24–29	0.69[a]	0.65–0.74	0.90	0.78–1.05
30–35	0.58[a]	0.54–0.62	0.78[a]	0.67–0.93
Race				
Hispanic	Ref		Ref	
Non-Hispanic white	1.05	0.97–1.14	1.08	0.89–1.32
Non-Hispanic black	1.24[a]	1.12–1.37	1.09	0.83–1.39
Other/multiple	1.03	0.91–1.18	1.17	0.85–1.61
Firstborn status				
Yes	Ref		Ref	
No	1.41[a]	1.33–1.51	0.93	0.81–1.09
Census region				
Northeast	Ref		Ref	
Midwest	1.49[a]	1.36–1.62	1.02	0.84–1.24
South	1.46[a]	1.34–1.60	1.00	0.83–1.20
West	1.58[a]	1.43–1.74	1.05	0.84–1.31
Income group				
\$0 to \$30 000	Ref		Ref	
\$30 001 to \$50 000	0.94	0.87–1.02	1.00	0.82–1.23
More than \$50 000	0.70[a]	0.64–0.76	0.93	0.76–1.13
Unknown	0.88[a]	0.81–0.96	1.00	0.81–1.24
Maternal education				
<12 y	Ref		Ref	
12 y	0.97	0.89–1.05	1.08	0.86–1.36
>12 y, noncollege graduate	0.84[a]	0.76–0.92	0.93	0.73–1.23
College graduate	0.66[a]	0.59–0.72	1.03	0.81–1.35
Maternal marital status				
Currently married	Ref		Ref	
Other	1.10[a]	1.03–1.18	1.00	0.84–1.18
Practice type				
All public	Ref		Ref	
All private	1.02	0.95–1.10	1.35[a]	1.10–1.64
Mixed or other	1.17[a]	1.08–1.27	1.20	0.96–1.49
Year				
1995	Ref		Ref	
1996	0.92	0.81–1.04	1.31	0.92–1.83
1997	0.93	0.82–1.05	1.42	1.00–2.00
1998	0.75[a]	0.66–0.85	1.12	0.78–1.56
1999	0.80[a]	0.70–0.90	1.35	0.93–1.92
2000	0.93	0.83–1.05	2.89[a]	2.10–3.99
2001	0.83[a]	0.74–0.94	1.88[a]	1.35–2.60
2002	0.81[a]	0.71–0.92	1.64[a]	1.17–2.30
2003	0.65[a]	0.57–0.74	1.30	0.90–1.86
2004	0.64[a]	0.56–0.73	0.95	0.66–1.37

Overall MMR nonreceipt indicates children who did not receive the MMR vaccine; Selective MMR nonreceipt, children who received 3 hepatitis B, 3 polio, 4 diphtheria-tetanus-acellular pertussis, and 3 *Haemophilus influenzae* type b vaccines but not MMR; Ref, reference.
[a] $P < .05$.

previous data has shown that physicians perceive older vaccines to be more important than newer vaccines.[30] Finally, in comparison with other vaccine-preventable diseases, physicians' perception of measles severity was likely tied to recent memory after a resurgence of measles in the United States in the late 1980s and early 1990s, which resulted in 11 000 hospitalizations and 120 deaths.[31]

There are limitations that may impact the interpretation of our findings. One concern is that our data on media coverage may be incomplete. Although recent work has supported the validity of media database searches,[32] we only relied on 1 source, the publicly available LexisNexis Academic Universe, for our primary analysis. To test the sensitivity of our analysis to the choice of media database, we separately replicated our search methods with a more comprehensive version of LexisNexis, which is only available through private license. That search did increase the amplitude of the curve depicted in Fig 2 but did not change its overall shape. No additional periods of media activity were identified between 1998 and 2000 when there was minimal media coverage in our original analysis. Similarly, restriction of the media analysis to the top 5 circulating newspapers, the 5 major news networks, and the Associated Press newswire reduced the total number of stories but did not affect the temporal distribution of media coverage. The lack of media attention between 1998 and 2000 is not surprising; its relationship to immunization practice parallels the history of media coverage of other pediatric medication-related controversies. For instance, Reye syndrome, a severe form of liver disease associated with aspirin use during viral illness, was first described in the medical literature as isolated case reports that received little media coverage. The media did not widely report this story until larger epidemiologic studies were performed over the next several years. By the time this media coverage peaked, parents had already begun to switch from aspirin to acetaminophen with a resultant decrease in disease incidence.[33]

Other potential limitations include insufficient data on the content of news stories, response bias in the immunization survey, and generalizability to current vaccine practice. We chose not to qualify the content of news stories, because previous studies have shown that even the mention of a controversy in the media may impact public awareness regardless of specific content.[34,35] In addition, many reports presented both sides of the controversy equally, and in Britain this "balanced journalism" resulted in the public perception that there was equal scientific evidence supporting both sides, when this was not the case.[36] With respect to response bias, because we only included provider-verified data, it is possible that parents with vaccine safety concerns would have been unintentionally excluded because they may not have agreed to participate in an immunization survey or to attend the practices included in the survey. However, the exclusion of such parents in this study would bias our results toward the null. Finally, the generalizability of these data to more recent vaccines and their uptake in the community is perhaps a more important concern. It is possible that limited physician experience with newer vaccines may result in more significant and sustained reductions in use during periods of media scrutiny. The effects of recent safety concerns on the uptake of the newly licensed meningococcal and rotavirus vaccines will need to be followed closely to determine whether the media may have a more dramatic impact on uptake than we observed with the MMR vaccine.

Despite these limitations, these data still offer important lessons for our public health community as it confronts new threats to public acceptance of emerging vaccines. Although causal relationships are difficult to discern from these data, our findings suggest that physicians may have been an important buffer against the potential negative impact of media coverage of immunization controversies. As the media increasingly reflect the concerns of a skeptical public, public health officials must value the provider community as its best opportunity to confront these challenges. If providers do indeed become more cautious during periods of controversy, then the focus for public health officials should be on ensuring that providers are given timely advisories and access to credible recommendations. The lesson for the public health community may thus be that the willingness to immunize a child is a story played out in the examination room during the private conversation between a doctor and a family. Keeping the doctor frequently updated with the most credible information and with strategies for discussing vaccine safety with parents may be the most efficient way to guarantee successful immunization practices in the face of increasing amounts of often unreliable and misleading information.

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