Insurance Status and Vaccination Coverage Among US Preschool Children

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ABSTRACT. *Background.* **Insurance status has been shown to have an impact on children's use of preventive and acute health services. The objective of this study was to determine the relationship between insurance status and vaccination coverage among US preschool children aged 19 to 35 months.**

Methods. **We linked data from 2 national telephone surveys, the National Immunization Survey and the National Survey of Early Childhood Health, conducted during the first half of 2000. Children were considered up to date (UTD) when they had received at least 4 diphtheria-tetanus-acellular pertussis/diphtheria-tetanus-pertussis vaccines, 3 poliovirus vaccines, 1 MMR vaccine, 3 *Haemophilus influenza* vaccines, and 3 hepatitis B vaccines at the time the interview was conducted.**

Results. **Among the 735 children in our study sample, 72% were UTD. The vast majority (94%) reported some type of health insurance at the time of the survey. Children with private insurance were more likely to be UTD (80%) than those with public insurance (56%) or no insurance (64%). In a multivariate analysis that controlled for child's race/ethnicity; household income; maternal age/marital status/educational level; location of usual care; and Special Supplemental Nutrition Program for Women, Infants, and Children participation, insurance was no longer an independent predictor of vaccination.**

Conclusions. **The disparity in vaccination coverage among publicly, privately, and uninsured children is dramatic, underscoring its importance as a marker for underimmunization, despite the multivariate findings. The Vaccines for Children Program, a partnership between public health and vaccination providers who serve uninsured children and those enrolled in Medicaid, is well suited to target and improve vaccination coverage among these vulnerable children. *Pediatrics* 2004;113:1959–1964; *children, insurance status, vaccination, vaccination coverage.***

ABBREVIATIONS. SCHIP, State Children's Health Insurance Program; NIS, National Immunization Survey; NSECH, National Survey of Early Childhood Health; CDC, Centers for Disease Control and Prevention; UTD, up to date; WIC, Special Supplemental Nutrition Program for Women, Infants, and Children; VFC, Vaccines for Children Program.

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Reports based on the first half of the 2003 National Health Interview Survey reveal that 9.4% (6.9 million) of US children under age 18 were uninsured at the time of the survey interview.[1] On the basis of the same survey, uninsured rate among children fell from 9.9 million (13.9%) since 1997.[2] The decrease in the uninsured child population continues a trend in national rates of uninsurance reported in the 1970s and 1980s.[3]

The reduction in the percentage of uninsured children is attributable, in large part, to the creation and expansion of public insurance programs such as Medicaid and the State Children's Health Insurance Program (SCHIP). Although the decrease in the proportion of uninsured children is encouraging, an insurance gap remains with nearly 7 million children currently uninsured.

Given both the magnitude and longstanding nature of the problem of uninsurance among children, it is important to understand the relationship between insurance status and the utilization of health services. Previous studies have demonstrated that uninsured children's use of preventive care is different from that of children with insurance.[4,5] Similarly, uninsured children are less likely to use medically necessary acute care when compared with those with private insurance.[6] Finally, an assessment of 4 years of data from the National Health Interview Survey revealed that 4.7 million US children have experienced at least 1 unmet health need for medical care, dental care, vision care, or prescription medications and that uninsured children were 3 times more likely to have an unmet need than their privately insured peers.[7]

Linking data from households that participated in 2 national telephone surveys of US preschool children, the National Immunization Survey (NIS) and the National Survey of Early Childhood Health (NSECH), this study focuses on the relationship between insurance status and vaccination. The NIS is conducted annually by the Centers for Disease Control and Prevention (CDC) to evaluate the success of our national immunization program by assessing vaccine coverage levels among preschool children. As indicated by its title, this survey focuses on vaccination and selected sociodemographic factors known to be related to vaccination. In contrast, the

NSECH was a broad, 1-time survey focused on the content of and parental experience with well-child care. Using the data provided by these 2 surveys, we examined the hypothesis that children without health insurance and those with public health insurance were less likely to be up to date (UTD) for routine vaccinations than those with private health insurance.

METHODS

NIS

The NIS is an annual, list-assisted, random-digit-dial survey of US households that have children aged 19 to 35 months. As appropriate, the household interview is administered in English, Spanish, and 28 other languages. At the end of the household interview, the respondent is asked for consent to contact the child's vaccination providers. For households in which consent is obtained, vaccination providers are sent a mail survey to obtain the child's vaccination history.

Children for whom sufficient provider-reported vaccination data are available to determine reliably vaccination status (typically two thirds of the children sampled in the random-digit-dial portion of the interview) are included in the analysis of NIS data.[8] The NIS provides national, state, and local (for selected urban areas) estimates of vaccination coverage rates for 11 vaccines. Coverage estimates are adjusted to take into account the complex sampling design and effects such as household nonresponse and households without telephones or with multiple telephone lines that could potentially bias estimates of vaccine coverage rates.[9] The protocol for the NIS was reviewed and approved by the Institutional Review Board at the CDC.

During the first 2 quarters of 2000, 17 018 NIS telephone interviews with caregivers of children aged 19–35 months at the time of the survey (ie, those born from January 1997 through November 1998) were conducted. For 11 624 of those interviews, verbal consent to contact identified providers was obtained and adequate provider data were obtained, thus yielding validated vaccination coverage data for 68.3% of interviews.

NSECH

The NSECH was conducted among parents of children between 4 and 35 months of age, with an oversample of black and Hispanic children. NSECH used telephone calls used in the NIS screening process to identify households with children aged 19 to 35 months.

Telephone interviews, conducted between February 16, 2000, and July 31, 2000, with sampled children's parent or primary caregiver, were done immediately after the NIS screening process (for children 4–18 months of age) or NIS interview (for children 19–35 months of age). The NSECH telephone interview included questions about 7 topics: health care utilization, perceptions of quality of care, parent's interaction with the child's health care providers, family interactions and home safety, parent well-being and child health, socioeconomic and health insurance information, and demographic information. When appropriate, a Spanish version of the NSECH interview was administered.

Methods for this survey, including a detailed description of the weighting procedures used, are described by Blumberg et al[10] and are available on the CDC web site.[11] The protocol for the NSECH was reviewed and approved by the Institutional Review Boards of the American Academy of Pediatrics, the University of California at Los Angeles, and the CDC.

NSECH interviews were completed with parents of 2068 children aged 4 to 35 months. The interview completion rate (completed interviews among households identified with age-eligible children) was 79.2%. The Council of American Survey Research Organizations response rate, which accounts for interview completion as well as households with potentially eligible children that were not reached, was 65.6%.[10,11]

NSECH-NIS Linkage

The analysis was limited to those 735 children aged 19 to 35 months whose parents participated in both surveys and for whom NIS provider-reported vaccination data were available. With the use of a unique identifier assigned during the data-collection process, an NIS-NSECH data set linked at the child level was created. Survey estimates for the linked data set are weighted to represent the US population, including an adjustment that accounted for households without telephones or with multiple telephone lines.

Variables and Definitions

Variables from both data sets were used to conduct the analysis. Variables taken from the NIS included child's age, vaccination history data, first-born status, and household income. Variables taken from NSECH included child's race/ethnicity, current insurance status, and participation in managed care; maternal age, marital status, and educational level; having a particular clinician for well-child care; location of usual source of care; and participation in the US Department of Agriculture's Special Supplemental Nutrition Program for Women, Infants, and Children (WIC).

Children were considered UTD for vaccination when they had received at least 4 diphtheria-tetanus-acellular pertussis/diphtheria-tetanus-pertussis vaccines, 3 poliovirus vaccines, 1 MMR vaccine, 3 *Haemophilus influenza* vaccines, and 3 hepatitis B vaccines at the time the interview was conducted. Using data regarding family size and the federal poverty guidelines for 2000,[12] each participant's household income was categorized in relation to the federal poverty level (below, above but <$75 000, or above and ≥$75 000).

Self-reported race/ethnicity was categorized as non-Hispanic white, non-Hispanic black, Hispanic, and other. Children were classified according to their current health insurance coverage: private coverage only, public coverage only (includes Medicaid, Medicare, SCHIP, military coverage, and Indian Health Service coverage), other coverage (includes coverage by a private and a public source or a parental report of "some other coverage" that was not a single service plan), or uninsured (includes parental report of no health insurance or parental report of only a single service plan such as dental or vision). Among insured children, managed care participation was defined by parental report that the child's insurance plan required signing up with a certain doctor or clinic or that the child's plan required approval or referral for specialty care.

Children were defined as having a regular well-child care provider when their parent reported a particular doctor or other health care provider to whom the parent usually took the child for well-child care. The location of usual source of care was classified as a private or group practice, an urgent care or walk-in clinic or emergency department, a community health or public health clinic, a hospital clinic, other, or no one place. WIC participation was classified on the basis of lifetime participation for the child, ie, ever or never.

Statistical Analysis

The association between sociodemographic characteristics and vaccination coverage was determined using the odds ratio and 95% confidence intervals. Sociodemographic characteristics that were found, through bivariate analyses, to be significantly associated with vaccination coverage were entered into a multivariate logistic regression model to determine which characteristics were independent predictors of vaccination coverage. All analyses were conducted using SUDAAN software, version 8.0, a statistical package used to analyze complex survey data.[13]

RESULTS

Participants

Table 1 describes the sociodemographic characteristics of the 735 children in the NIS-NSECH linked data set. The majority of children had private insurance (56%), and very few (6%) were uninsured at the time of the interview. Among children with public insurance, the vast majority (98%) were covered by Medicaid or SCHIP. Approximately three fourths of children lived in households with annual incomes <$75 000. Mothers of 21% of children had never been married, and mothers of 20% had not completed high school. Forty-five percent of children had a particular provider, 76% received routine care in a

TABLE 1. Characteristics of Study Participants ($N = 735$)

	n (%)*
Child characteristics	
Age	
19–24 mo	291 (39)
25–29 mo	210 (29)
30–35 mo	234 (32)
Race/ethnicity	
White (non-Hispanic)	265 (64)
Black (non-Hispanic)	161 (15)
Hispanic	291 (18)
Other	18 (4)
Insurance status	
Private only	354 (56)
Public only	204 (25)
Other	112 (13)
Uninsured	65 (6)
Managed care participation ($n = 644$)†	
Yes	481 (72)
No	163 (28)
First-born	
Yes	264 (38)
No	471 (62)
Household income	
Below poverty	200 (23)
Above poverty, <$75 000	361 (53)
Above poverty, ≥$75 000	94 (16)
Unknown	80 (8)
Mother characteristics	
Age	
<20 y	34 (4)
20–24 y	152 (20)
25–29 y	192 (23)
30–34 y	179 (27)
35–39 y	122 (19)
40–44 y	45 (7)
45–49 y	9 (1)
Marital status	
Never married	188 (21)
Married	474 (70)
Widowed/divorced/separated	71 (9)
Educational level	
<High school	143 (20)
High school graduate	230 (33)
>High school	362 (47)
Utilization characteristics	
Child has particular clinician for well-child care	
Yes	316 (45)
No	413 (54)
Usual setting for well-child care	
Private/group practice	536 (76)
Urgent care/walk-in clinic/ED	19 (2)
Community/public health clinic	126 (16)
Hospital clinic	40 (4)
Other	10 (2)
No one place/don't know	4 (0)
WIC participation	
Ever	440 (53)
Never	282 (44)

ED indicates emergency department.
* The sample sizes (*n*) in each category are unweighted; the frequencies (%) are weighted.
† Asked only of insured children.

private or group practice, and 53% had participated in WIC.

Vaccination Coverage

Overall, 72% of children in the study sample were UTD. Vaccination coverage among children with private insurance was 80%, as compared with 56% among children with public insurance, 73% among children with "other" insurance, and 64% among uninsured children (Table 2). Vaccination coverage varied with other sociodemographic characteristics as well, including child's race/ethnicity, household income, maternal marital status and educational level, usual source of care, and WIC participation. Children of black or Hispanic origin, those living below poverty level, those whose mother had never been married or had not completed high school, and those who had ever participated in WIC were less likely to be UTD when compared with the referent group for that particular characteristic. Having a particular clinician for well-child care and participation in managed care were not associated with vaccination coverage. An analysis of the relationship between vaccination coverage and insurance status revealed that this relationship did not depend on whether children participated in managed care (data not shown).

Multivariate Logistic Regression

A multivariate logistic regression model with variables that were significantly associated with vaccination coverage in the bivariate analysis included child's race/ethnicity and insurance status; household income; maternal age, marital status, and educational level; location of usual source of well-child care; and WIC participation. From this model, the only 2 significant predictors of vaccination coverage were location of usual care and maternal educational level (Table 3). For children who were seen regularly in hospital clinics, the odds of being UTD were only one third of the odds for children who were seen regularly in private or group practices. The odds of being UTD for children whose mother had not completed high school were only half the odds for children whose mother's educational attainment exceeded high school graduation. After controlling for sociodemographic and health care factors found to be significant in bivariate analyses, insurance status was not found to be a significant predictor of vaccination coverage.

DISCUSSION

Principal Findings

The vast majority of preschool children had health insurance, and in a bivariate analysis, vaccination coverage varied widely among children by insurance status. Multivariate analysis using other significant predictors of vaccination coverage, many of which are highly correlated with each other and with insurance status, showed that sociodemographic factors dominate and that insurance status is not an independent predictor of vaccination.

The disparity in vaccination coverage levels between children of different insurance status is striking—with a difference of 24 percentage points between those with highest (privately insured children) and lowest (publicly insured children) vaccination coverage—and sufficiently large that the importance of insurance status as a marker for underimmunization is not diminished by the multivariate findings. The low vaccination coverage among publicly insured children likely reflects a combination of system

TABLE 2. Vaccination Coverage by Selected Characteristics and Odds of Being UTD* ($N = 735$)

	% UTD (95% CI)†	OR (95% CI)†
Child characteristics		
Age		
19–24 mo	67.9 (±7.7)	0.6 (0.4–1.1)
25–29 mo	72.3 (±8.1)	0.8 (0.4–1.4)
30–35 mo	76.6 (±7.8)	Reference
Race/ethnicity		
White (non-Hispanic)	77.9 (±6.2)	Reference
Black (non-Hispanic)	58.6 (±10.1)	**0.4 (0.2–0.7)**
Hispanic	64.5 (±7.0)	**0.5 (0.3–0.8)**
Other	60.3 (±25.2)	0.4 (0.1–1.3)
Insurance status		
Private only	79.6 (±5.7)	Reference
Public only	56.0 (±10.3)	**0.3 (0.2–0.6)**
Other	73.1 (±10.6)	0.7 (0.4–1.3)
Uninsured	64.4 (±15.3)	0.5 (0.2–1.0)
Managed care participation ($n = 644$)‡		
Yes	72.6 (±5.7)	Reference
No	70.0 (±9.7)	0.9 (0.5–1.5)
First-born		
Yes	72.6 (±7.7)	1.1 (0.7–1.7)
No	71.6 (±5.6)	Reference
Household income		
Below poverty	55.0 (±10.2)	**0.2 (0.1–0.4)**
Above poverty, <$75 000	75.6 (±6.2)	0.5 (0.3–1.1)
Above poverty, ≥$75 000	85.0 (±7.7)	Reference
Unknown	72.2 (±14.3)	0.5 (0.2–1.2)
Mother characteristics		
Age		
<20 y	53.3 (±24.8)	Reference
20–24 y	65.1 (±10.8)	1.6 (0.5–4.9)
25–29 y	67.3 (±10.0)	1.8 (0.6–5.4)
30–34 y	75.1 (±8.9)	2.7 (0.9–8.0)
35–39 y	82.9 (±8.2)	**4.2 (1.3–13.5)**
40–44 y	77.7 (±13.8)	3.0 (0.8–11.0)
45–49 y	48.4 (±37.8)	0.8 (0.1–5.1)
Marital status		
Never married	61.6 (±10.3)	**0.5 (0.3–0.9)**
Married	74.8 (±5.5)	Reference
Widowed/divorced/separated	73.8 (±12.7)	1.0 (0.5–1.9)
Educational level		
<High school	54.4 (±11.9)	**0.3 (0.2–0.5)**
High school graduate	70.8 (±8.2)	0.6 (0.4–1.0)
>High school	80.1 (±5.4)	Reference
Utilization characteristics		
Child has particular clinician for well-child care		
Yes	72.9 (±7.2)	Reference
No	71.3 (±5.9)	0.9 (0.6–1.5)
Usual setting for well-child care		
Private/group practice	74.6 (±5.1)	Reference
Urgent care/walk-in clinic/ED	70.3 (±26.2)	0.8 (0.2–2.9)
Community/public health clinic	67.0 (±12.7)	0.7 (0.4–1.3)
Hospital clinic	39.2 (±17.4)	**0.2 (0.1–0.5)**
Other	70.8 (±30.9)	0.8 (0.2–3.8)
No one place/don't know	77.7 (±41.3)	1.2 (0.1–13.1)
WIC participation		
Ever	64.0 (±6.9)	**0.4 (0.3–0.7)**
Never	80.9 (±5.5)	Reference

* Children were considered UTD with vaccination when they had received at least 4 DTaP/DTP vaccines, 3 poliovirus vaccines, 1 MMR vaccine, 3 *Haemophilus influenza* vaccines and 3 hepatitis B vaccines at the time the interview was conducted.
† Percentage UTD and OR in comparison with reference group is weighted; significant ORs ($P < .05$) shown in bold.
‡ Asked only of insured children.
OR indicates odds ratio; CI, confidence interval; DTaP, diphtheria-tetanus-acellular pertussis; DTP, diphtheria-tetanus-pertussis, MMR, measles-mumps-rubella.

and provider factors, as well as barriers related to poverty most prevalent among children with public insurance.

The disparity provides an opportunity to target health care providers in whose practices interventions are likely to yield the greatest benefit. For example, the Vaccines for Children Program (VFC) is an entitlement program that provides public-purchase vaccine to public and private providers for use in children who are Native American/Alaska Native, enrolled in Medicaid, or uninsured.[14] This program is administered by the states, which enroll

TABLE 3. Adjusted Odds of Being UTD ($N = 735$)*

	OR†	95% CI
Child's race/ethnicity		
White (non-Hispanic)	Reference	
Black (non-Hispanic)	0.6	0.3–1.2
Hispanic	1	0.6–1.9
Other	0.4	0.1–1.3
Insurance status		
Private only	Reference	
Public only	0.6	0.3–1.2
Other	1.2	0.6–2.3
Uninsured	0.8	0.3–2.0
Household income		
Below poverty	0.5	0.2–1.3
Above poverty, <$75 000	0.8	0.4–1.6
Above poverty, ≥$75 000	Reference	
Unknown	0.8	0.3–2.7
Maternal age		
<20 y	Reference	
20–24 y	1.1	0.4–3.3
25–29 y	1.1	0.4–3.2
30–34 y	1.1	0.4–3.4
35–39 y	1.7	0.5–5.6
40–44 y	1.1	0.3–4.1
45–49 y	0.5	0.1–3.4
Maternal marital status		
Never married	1.7	0.8–3.3
Married	Reference	
Widowed/divorced/separated	1.9	0.8–4.2
Maternal educational level		
<High school	**0.4**	**0.2–0.9**
High school graduate	0.7	0.4–1.3
>High school	Reference	
Usual setting for well-child care		
Private/group practice	Reference	
Urgent care/walk-in clinic/ED	1.1	0.4–3.2
Community/public health clinic	1.2	0.6–2.4
Hospital clinic	**0.3**	**0.1–0.8**
Other	1.1	0.2–6.0
No one place/don't know	2.4	0.2–37.1
WIC participation		
Ever	0.9	0.4–1.7
Never	Reference	

* Children were considered UTD with vaccination when they had received at least 4 DTaP/DTP vaccines, 3 poliovirus vaccines, 1 MMR vaccine, 3 *H influenza* vaccines, and 3 hepatitis B vaccines at the time the interview was conducted.
† OR in comparison with reference group is weighted; significant ORs ($P < .05$) shown in bold.

providers, purchase vaccine, and provide technical assistance about vaccine storage and handling, accountability, and interventions to improve vaccination coverage via routine provider site visits. Provider education about the value of insurance status as a marker for underimmunization could easily be incorporated into such site visits.

Although these site visits occur in all states, the proportion of VFC providers visited and the frequency of site visits vary across states. Expansion of this VFC-linked practice improvement assistance might be accomplished without an increase in current federal spending if undertaken by state-level entities (eg, immunization programs, State Medicaid agencies, provider organizations) that are currently working separately to improve care for the same population of children by assisting their providers with quality improvement activities. One current model is an ongoing initiative involving the CDC, the Centers for Medicare and Medicaid Services, state and urban-areas immunization programs, and state Medicaid agencies. Started in 1998, this initiative now involves all 50 US states and the District of Columbia at varying stages of implementation. Extremely low vaccination coverage among publicly insured children found in this study highlights the potential impact of this initiative.

Finally, the relationship between vaccination coverage and insurance status provides a simple way to screen for children who are at increased risk of underimmunization. In private practices, where the majority of preschool children are vaccinated, this screening process likely requires only basic communication between administrative staff and providers, using information already collected in the practice. By identifying a subset of patients who are most likely to benefit from recommended interventions such as a reminder or recall system, this approach may prove less burdensome than implementing such interventions practice-wide. Furthermore, successful implementation of such interventions within a subset of patients could provide evidence about feasibility that is currently lacking in the literature.

Strengths and Weaknesses of the Study

An important strength of the study is its generalizability to the national preschool population. The NIS is a long-standing, annual survey with a resource-intensive and carefully planned method for sampling, statistical adjustments, and provider verification of vaccination data. Because NSECH was conducted as a "piggyback" survey to NIS, the strengths apply to both sources of data used in this analysis.

The study has 2 important limitations. First, a complete insurance "history" was not collected for each participating child. In contrast, vaccination data obtained from the provider reflect all vaccinations delivered during a 19- to 35-month period. Because of the differences in the way insurance and vaccination data were collected, it is not possible to determine which vaccinations (or missed vaccinations) are attributable to the child's current insurance status. Second, our analysis was not able to control for other factors, such as the vaccination benefits of children with private insurance or state-level policies that may have an impact on vaccination coverage among preschool children.

Strengths and Weaknesses in Relation to Other Studies

Over the past decade, a number of other investigators have examined the relationship between insurance status and vaccination coverage. One study, conducted using data from the 1987 National Medical Care Expenditure Survey, found that uninsured children were twice as likely to be inadequately vaccinated for measles than insured children, but this difference disappeared after adjusting for poverty status and the child's race/ethnicity.[4] A second study evaluated the impact of New York's State Child Health Insurance Plan on utilization of services among children and found that preschool enrollees were more likely to be UTD for vaccination after enrollment than before, when the children were, by definition, uninsured.[15]

The findings from the current study are consistent with previous studies, substantiating differences in vaccination coverage between insured and uninsured children. What this study contributes to the body of literature about insurance status and vaccination coverage is an updated, national perspective, with gold standard vaccination data obtained via provider verification. Given the changes in the health care delivery system that have occurred over the past decade, periodic assessments of the impact of factors such as insurance status, which help to define access to care, are necessary and informative to shape public policy relevant to health care.

Unanswered Questions

The current study reveals an important disparity in vaccination coverage of preschool children according to insurance status. Being able to identify children who are at increased risk for undervaccination, however, is not a solution to the disparity that exists despite the availability of public-purchase vaccine for vulnerable children, a "safety net" of health department immunization providers, and the widespread existence of school entry vaccination requirements.

Research related to immunization delivery has repeatedly demonstrated the importance of provider practices.[16] Despite the proven benefits of practice-based interventions such as reminder and recall systems and coverage assessment and feedback,[17] such practices have not been widely implemented,[18] and little is known about the best ways to foster adoption of such strategies, particularly among providers who serve vulnerable children. VFC, which creates a partnership between private health care providers and state and local public health officials to serve these children, is a likely setting in which to study strategies for facilitating translation of evidence-based strategies into routine practice.

The disparity in vaccination coverage also raises important questions about the potential benefits of first-dollar-coverage laws for vaccination. By requiring health insurance to cover the cost of vaccines, these laws are intended to raise vaccination coverage rates by reducing out-of-pocket costs to parents, an evidence-based strategy for improving vaccination uptake.[17] Our study findings, however, reveal that children who are enrolled in Medicaid and SCHIP are less well immunized than their uninsured or privately insured peers, despite that federal policy, by requiring the provision of all routinely recommended vaccines, acts similarly to a first-dollar law for these children. Lower vaccination coverage among publicly insured children suggests that first-dollar-coverage laws may be an insufficient strategy among certain groups of vulnerable children. What additional efforts are needed to raise coverage levels among Medicaid enrollees? What is the impact of state variation in the type of first-dollar laws passed and the ways in which those laws are enforced? The answers to such questions will enable us to obtain maximal benefit from this potentially powerful legislative strategy.

Finally, the disparity in vaccination coverage raises questions about the quality of care received by children with public insurance. Vaccination is 1 of the most commonly used indicators of quality of health care among children, which assumes a strong correlation between receipt of recommended vaccines and that of other components of well care, such as developmental screening and anticipatory guidance. Additional research is needed to determine the nature of the association between vaccination and other components of well-child care to determine the validity of vaccination status as an indicator of health care quality.

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