

## Immunization Status Among Children Newly Enrolled in a Health Plan: A New Frontier for Quality Measurement?

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**Background:** The National Scientific Panel on Immunization Measurement Standards recently recommended that the assessment population for the childhood immunization measure of the Health Plan Employer Data and Information Set include 24-month-olds with  $\geq 6$  months of continuous enrollment in a health plan. The current inclusion criterion is  $\geq 12$  months of continuous enrollment. The new recommendation would expand the assessment population to include children with more recent enrollment.

**Objectives:** To compare the immunization status of children enrolled in a large health plan between ages 12 and 17 months vs earlier in life and to describe the proportion of children enrolled between ages 12 and 17 months that could be fully immunized by 24 months.

**Methods:** All children enrolled in a group-model HMO who turned 24 months old during a 12-month study were identified for a retrospective cohort study. A computerized immunization database was used to identify all vaccines administered to each child, and summary measures were created to describe immunization status at selected times. The full-text medical records of children who seemed to have no immunizations in the computerized database were reviewed.

**Results:** Of the 3448 children in the study population, 3130 (91%) enrolled between birth and 11 months of age and 161 (5%) enrolled between 12 and 17 months of age. Whereas 87% of children who enrolled between birth and 11 months of age were fully immunized at age 24 months, only 57% of those enrolled between 12 and 17 months of age were fully immunized at 24 months of age (risk difference, 30%; 95% confidence interval, 24%-36%;  $P < .001$ ). Of the 161 children enrolled between 12 and 17 months of age, 68% had received all of the immunizations in the primary series. Only 6% of these 161 children would have been impossible or difficult to fully immunize by age 24 months using accelerated catch-up vaccination schedules.

**Conclusions:** Children who enrolled in an HMO between 12 and 17 months of age were less likely than those who enrolled earlier in life to be fully immunized by age 24 months, but it would be feasible to bring almost all of them up to date by that age. Including such children in immunization measures, either together with earlier-enrolled children or as a separate stratum, would expand the scope of the quality of care under evaluation.

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In the past decade, childhood immunization coverage rates have become widely accepted measures of the quality of healthcare in the United States.<sup>1</sup> Healthy People 2010 has set national goals for increasing the percentage of children aged 19 to 35 months who receive routinely recommended vaccines.<sup>2</sup> Childhood immunization coverage rates are a cornerstone of the Health Plan Employer Data and Information Set (HEDIS) of the National Committee on Quality Assurance (NCQA), which evaluates quality of care delivered by health plans.<sup>3</sup> Immunization rates are also assessed by public health agencies at local, state, and national levels to monitor the population's level of protection against preventable diseases. The largest of these efforts, the National Immunization Survey (NIS), has measured immunization coverage rates in the US population, each of the 50 states, and selected urban areas since 1994.<sup>4</sup>

In recent years, public health officials, NCQA representatives, and the Institute of Medicine have noted several disparities in the HEDIS and NIS methods that make it hard to compare immunization coverage rates from the 2 sources. The gaps between the 2 measures stem from differences in the definition of fully immunized and differences in how

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the assessed population is selected.<sup>5</sup> In one analysis,<sup>6</sup> when HEDIS criteria for being fully immunized were applied to NIS data, the immunization coverage rate decreased from 78% to 58%. The Institute of Medicine specifically recommended that government agencies develop a standard set of performance measures for use in monitoring the immunization status of health plan enrollees.<sup>7</sup>

The lack of comparability between HEDIS and NIS immunization coverage rates is particularly important and troublesome for state Medicaid directors. Increasing numbers of children are enrolled in managed Medicaid plans,<sup>8</sup> which tend to have lower immunization coverage rates than commercial health plans.<sup>9</sup> To improve accountability among managed Medicaid plans, it would be useful to know how their rates compare with those of the general population. The disparities between HEDIS and the NIS make this comparison difficult. To address this

issue, the Centers for Disease Control and Prevention and the NCQA convened the National Scientific Panel on Immunization Measurement Standards in 2000. This panel made 6 recommendations to harmonize the HEDIS and NIS methods of immunization coverage assessment (Table 1).

The most controversial of the 6 recommendations was to expand the population under assessment by reducing the minimum duration of continuous enrollment in the health plan from 12 months (with no more than a 1-month gap) to 6 months (with no gaps) before the age of assessment. The aims of this recommendation were to broaden the population evaluated by HEDIS, increase health plan accountability, and enhance comparability between HEDIS and the NIS. Currently, the HEDIS childhood immunization measure includes only children who have had continuous enrollment for 12 months before the 24-month birthday; these children would have joined the health plan between birth and 12 months of age. By reducing the continuous enrollment minimum to 6 months, the recommended revision would include children who had joined the health plan between 12 and 18 months of age. Including these children might be especially important in Medicaid populations, which have high rates of immigration and out-migration.<sup>10</sup>

The panel acknowledged that lowering the minimum period of continuous enrollment would place more stringent requirements on health plans. If children enrolling in health plans between ages 12 and 18 months were greatly underimmunized, it could be challenging to have them fully immunized by age 24 months. Except for the fourth dose of diphtheria-tetanus-pertussis vaccine (DTP), all needed vaccines could be administered under accelerated catch-up schedules in approximately 3.5 months. However, children newly enrolled at age 18 months and lacking  $\geq 2$  DTP doses would be impossible to fully immunize by 24 months according to the guidelines of the Advisory Committee on Immunization Practices. Although the panel believed that the proportion of new enrollees who met these criteria would be small, it recommended empiric research on the immunization status of new enrollees.

This study was designed to address the gap in information about children who are not currently included in the HEDIS immunization measurement because they were too newly enrolled in their health plans. The objectives were to compare the immunization status of children who enrolled in a large health plan between ages 12 and 17 months with those who enrolled earlier in life and to describe the proportion

**Table 1.** Recommendations Made by the National Scientific Panel on Immunization Measurement Standards for Harmonizing the Methods of Assessing Immunization Coverage in HEDIS and the NIS\*

1. In the denominator of the HEDIS measure, include all children with continuous enrollment for 6 mo with no gap (instead of the current 12 mo with up to a 1-mo gap) before the age of assessment.
2. Use or add a variable in the NIS to enable analyses to be limited to children who meet the same continuous enrollment criterion as HEDIS requires.
3. Emphasize single-antigen measures; reduce reliance on combination measures.
4. Count only valid vaccine doses, maintaining alignment with the recommendations of the Advisory Committee on Immunization Practices.
5. Keep the age of assessment at 24 months.
6. Incorporate new vaccines in National Committee on Quality Assurance measurement 2 to 3 years after publication of recommendations by the Advisory Committee on Immunization Practices.

\*HEDIS indicates Health Plan Employer Data and Information Set; NIS, National Immunization Survey. The panel was convened in May 2000 by the Centers for Disease Control and Prevention and the National Committee on Quality Assurance. Panel members were Tracy Lieu, MD (chairperson); Kathryn Coltin, PhD; Michael Curran, MPH; Bill Hayes, PhD; Vicki Kunerth; Michael Marcy, MD; Elizabeth McGlynn, PhD; Lance Rodewald, MD; Patrick Roohan, MS; and Joseph Thompson, MD, MPH. Ex-officio members and liaisons were Blake Caldwell; Adeline Deladisma, MPH; Mehran Massoudi, PhD; Heather Colvin; Paul Stange; Monina Klevens, PhD; and Gerry Fairbrother, PhD.

**Figure.** Proposed Addition of 6 Months Enrollment

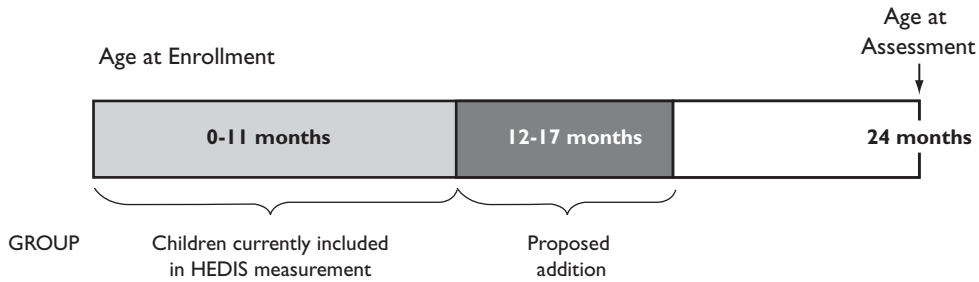


Diagram showing the proposed addition of children with minimum enrollment of 6 months before the age of assessment to the population included in the denominator of the Health Plan Employer Data and Information Set (HEDIS) childhood immunization measure.

of children enrolled between ages 12 and 17 months who could be fully immunized by age 24 months.

METHODS

**Design and Study Population**

This retrospective cohort study included all children insured by Harvard Pilgrim Health Care who were patients of Harvard Vanguard Medical Associates (formerly Harvard Community Health Plan) who turned 24 months old during 1997. In this HMO, services were fully capitated, and members received primary care at 1 of 14 health centers in the greater Boston area. Children who received primary care at 13 of the 14 health centers were included; those at 1 health center were excluded because the center initiated a change in computerized data systems during the study. Approximately 10% of the children were insured by Medicaid, and the remaining had private, usually employment-based, insurance.

**Data Collection**

Computerized databases were used to identify the most recent period of continuous enrollment in the health plan before the 24-month birth date. Immunizations for each child were identified using the vaccine databases of the HMO's Automated Medical Record System, which includes coded utilization events and full-text medical records. These computerized databases are the only source of information about a patient; no paper records are retained. Because the computerized immunization records are the sole data source for clinical care and school and day care forms, they are believed to be relatively complete. For children new to the health plan who had received immunizations from previous

providers, records were routinely requested. When such records were available, the previous immunizations were entered into the database and flagged as having been administered elsewhere.

Preliminary analyses identified a subgroup of children who were enrolled in the HMO at 12 to 17 months of age and who seemed to be underimmunized at age 24 months based on computerized immunization data. We manually reviewed the computerized full-text medical records of these children to check the accuracy of the computerized immunization data.

**Statistical Analysis**

Children were categorized according to their age of most recent continuous enrollment in the HMO (Figure). Children were classified as fully immunized at 24 months of age if they had received 4 DTPs, 3 polio vaccines (either inactivated or oral polio vaccine), 1 measles-mumps-rubella vaccine, 2 *Hemophilus influenzae* type b vaccines (with 1 given between ages 12 and 24 months), and 3 hepatitis B vaccines. This definition corresponded to the HEDIS Combination #1 (4:3:1:2:3) measure. Comparisons between groups for categorical variables (eg, underimmunized vs fully immunized) were made using the  $\chi^2$  test with Yates correction for 2 x 2 tables.

RESULTS

The study population included 3448 children who turned 24 months old during the study period and who were HMO members at that age. Of these children, 3130 (91%) had enrolled between birth and 11 months of age, 161 (5%) had enrolled between 12 and 17 months of age, and 157 (5%) had enrolled

between 18 and 23 months of age (Table 2). Of children who enrolled between 12 and 17 months of age, only 57% were fully immunized by 24 months compared with 87% of children who enrolled between birth and 11 months of age (risk difference, 30%; 95% confidence interval [CI], 24%-36%;  $P < .001$ ) (Table 2). Of children who enrolled between ages 18 and 24 months, only 45% were fully immunized by age 24 months. Combining all children enrolled between birth and 17 months of age, the overall immunization rate is 85% (95% CI, 84%-87%).

Medicaid-insured children comprised 368 (11%) of the 3448 children enrolled at 24 months of age. Among those enrolled between birth and 11 months of age, 81% of Medicaid-insured children and 87% of privately insured children were fully immunized at age 24 months ( $P < .001$ ) (Table 3). Among those enrolled between ages 12 and 17 months, a higher proportion of Medicaid-insured children (64%) compared with privately insured children (55%) were fully immunized at age 24 months, but this difference was not statistically significant. Among all children enrolled between birth and 17 months of

age, a lower proportion of the Medicaid insured (79%) than the privately insured (86%) were fully immunized by age 24 months ( $P < .001$ ).

The recommendation by the National Scientific Panel on Immunization Measurement Standards to lower the HEDIS minimum continuous enrollment period to 6 months would result in including children enrolled between 12 and 17 months of age (Figure). For the 161 children in this subgroup, we evaluated immunization status at the time of enrollment using the computerized vaccine database. In this subgroup, 110 (68%; 95% CI, 60%-75%) had received all immunizations in the primary series (defined as all vaccines due by age 12 months: 3 DTPs, 2 polio vaccines, 2 hepatitis B vaccines, and 1 *Hemophilus influenzae* type b vaccine). Of the 51 children who had missed immunizations in the primary series, 20 (12%) seemed to be missing all immunizations, 15 (9%) were missing  $\geq 1$  DTPs with or without missing other vaccines, and 16 (10%) were missing other vaccines but not DTPs.

For children enrolled at 16 or 17 months of age who were missing  $\geq 2$  DTPs, it would be impossible

**Table 2.** Immunization Status of 24-Month-Olds in Harvard Vanguard Medical Associates, by Age at Enrollment\*

	Age at Enrollment, Mo					
	0-11		12-17		18-24	
	No. (%)	95% CI	No. (%)	95% CI	No. (%)	95% CI
Patients, total no. immunization status at age 24 mo <sup>†</sup>	3130	—	161	—	157	—
4 DTPs	2941 (94)	93-95	119 (74)	67-81	94 (60)	52-68
3 Polio vaccines	3055 (98)	97-98	128 (80)	73-86	106 (68)	60-75
1 MMR	3054 (98)	97-98	134 (83)	77-89	103 (65)	58-73
2 HIBs <sup>‡</sup>	2916 (93)	92-94	116 (72)	65-79	91 (58)	50-66
3 HBVs	2980 (95)	94-96	116 (72)	65-79	97 (62)	54-69
Fully immunized at age 24 mo <sup>§</sup>	2719 (87)	86-88	92 (57)	49-65	71 (45)	37-53

\*CI indicates confidence interval; DTP, diphtheria-tetanus-pertussis vaccine; MMR, measles-mumps-rubella vaccine; HIB, *Hemophilus influenzae* type b vaccine; and HBV, hepatitis B vaccine.

<sup>†</sup>Based on the primary provider group's records.

<sup>‡</sup>One of the HIBs had to have been given between ages 12 and 24 months.

<sup>§</sup>Differences between groups were significant at  $P < .001$ . Fully immunized at age 24 months was defined as having 4 DTPs, 3 polio vaccines, 1 MMR, 2 HIBs (with 1 given between ages 12 and 24 months), and 3 HBVs.



**Table 3.** Immunization Status of Medicaid vs Privately Insured 24-Month-Olds in Harvard Vanguard Medical Associates, by Age at Enrollment\*

	Age at Enrollment, Mo					
	0-11 <sup>†</sup>		12-17		18-24	
	No. (%)	95% CI	No. (%)	95% CI	No. (%)	95% CI
<b>Medicaid insured</b>						
Total no. in group	286	—	42	—	40	—
Fully immunized at age 24 mo <sup>‡</sup>	231 (81)	76-85	27 (64)	50-79	24 (60)	45-75
<b>Privately insured</b>						
Total no. in group	2844	—	119	—	117	—
Fully immunized at age 24 mo <sup>‡</sup>	2488 (87)	86-89	65 (55)	46-64	47 (40)	31-49

\*CI indicates confidence interval.

<sup>†</sup>Differences between Medicaid and privately insured groups were statistically significant at  $P < .001$  for the group enrolled between birth and 11 months of age. Differences were not significant for the groups enrolled at ages 12 to 17 or 18 to 24 months.

<sup>‡</sup>Fully immunized at age 24 months was defined as having 4 diphtheria-tetanus-pertussis vaccines, 3 polio vaccines, 1 measles-mumps-rubella vaccine, 2 *Hemophilus influenzae* type b vaccines (with 1 given between ages 12 and 24 months), and 3 hepatitis B vaccines.

or difficult to complete their immunizations by 24 months. We identified 10 children who were enrolled at 16 or 17 months of age who had  $\leq 2$  DTPs. Thus, 6% (10/161; 95% CI, 2%-10%) of the children enrolled between 12 and 17 months of age, or 0.3% (10/3291; 95% CI, 0.1%-0.5%) of all the children who would be included in HEDIS assessment under the new recommendation, would be impossible or difficult to fully immunize by age 24 months. All 10 of these children were privately insured.

We requested the full-text medical records of the 69 children enrolled between 12 and 17 months of age whose computerized immunization data indicated that they were underimmunized at 24 months of age. Of the 63 children with available medical records, 4 were fully immunized at 24 months and 59 were underimmunized. Most underimmunized children (44 of 59) seemed to be receiving care at the HMO and to have missed needed immunizations between 18 and 24 months of age. For several children (8 of 59), the medical record noted that immunization records from previous providers had not been received. Based on medical records, 9 of the 59 underimmunized children seemed to have no immunizations by 24 months of age. (These numbers sum to  $> 59$  because multiple inferred reasons for underimmunization could be recorded.)

## DISCUSSION

This study found that children enrolled in an HMO between 12 and 17 months of age were much less likely to be fully immunized by 24 months of age than those enrolled earlier in life. Among children who enrolled between 12 and 17 months of age, most had completed their primary immunization series, and most of those who were underimmunized at 24 months seemed to have missed needed vaccines after enrollment in the health plan. Only 6% of these children would have been difficult or impossible to fully immunize by 24 months of age.

### Comparisons With Previous Studies

In this HMO, 90% of children who were members at 24 months of age had been enrolled between birth and 11 months and would have been included in HEDIS measurement. In this HMO, lowering the minimum duration of enrollment for inclusion in HEDIS to 6 months instead of 12 months would have included an additional 5% of the population at 24 months of age. However, this HMO's population was likely more stable than the average commercially insured population. The effect of expanding the HEDIS population to include children enrolled between 12 and 17 months of age would likely be greater in other health plans.

The present study needs to be replicated in Medicaid populations, in which the rates of in-migration and out-migration are much higher than in privately insured populations. More than half of new Medicaid recipients lose coverage within 12 months.<sup>10</sup> An analysis of managed Medicaid populations in 13 states found that fewer than half of the children met the HEDIS continuous enrollment requirement (G. Fairbrother, PhD, unpublished data). Including 24-month-olds with a minimum of 6 instead of 12 months of continuous enrollment in the HEDIS immunization measure would likely expand the population assessed to a greater degree for managed Medicaid plans than for commercial health plans.

If children enrolled between 12 and 17 months of age are included in immunization measures, it may be appropriate to report results for these new enrollees separately from those for children enrolled between birth and 11 months of age. Separating or stratifying immunization coverage rates by duration of enrollment in the health plan would enable recent enrollees to be included without biasing the assessment against plans that have higher in-migration rates. It may also be appropriate to exclude from assessment the small percentage of patients who would be impossible or difficult to fully immunize owing to enrollment at 16 or 17 months of age and lacking  $\geq 2$  DTPs.

Previously, the HEDIS childhood immunization indicator included only children with continuous enrollment from 42 days of age through their second birthday. A 1993 study<sup>11</sup> in an Arizona pediatric clinic found that under the former inclusion criterion, only 69% of children who were members at 24 months of age would have been included in HEDIS assessment. The previous study also suggested that the immunization coverage rate of children with shorter periods of continuous enrollment was lower than that of children with longer enrollment.

Failure to receive immunization records from previous providers may have played a role in the apparent underimmunization of a small proportion of the children enrolled between ages 12 and 17 months. Other research<sup>12</sup> has suggested that record scatter, in which a given child has multiple immunization records in different provider offices, is common and hinders the ability of clinicians to determine the immunization status of new patients. The present study followed the approach recommended by HEDIS of counting immunizations only if they were documented in the current medical record, although the immunizations could have been

given by the current provider or by a previous provider. Thus, our analysis probably overestimated the percentage of 24-month-olds who were truly underimmunized but provided an accurate replication of the immunization coverage rate using HEDIS methods.

### **Challenges for Healthcare Systems**

Future studies of this issue should evaluate barriers to immunization among new enrollees. The process of rapidly integrating new patients into healthcare systems is challenging. When children are enrolled in a health plan via a parent's employment-based insurance, it may take a month for the health insurer and even longer for the primary care provider to become aware that the child is a patient. This delay may be an important barrier to promptly initiating needed preventive services such as immunizations.

Children who are newly enrolled in a health plan between 12 and 17 months of age are likely to differ from children with longer continuous enrollment in several ways. A change in health insurance may be due to a parent's change in employment or to the family having moved. These or other factors associated with a change in health insurance may disrupt routines and create competing priorities that detract from the impetus to seek preventive care in a timely manner. Because Harvard Vanguard Medical Associates accepted only Harvard Pilgrim Health Care insurance at the time of this study, each of the children newly enrolled in Harvard Pilgrim Health Care was by definition a new patient to the Harvard Vanguard Medical Associates provider group. In other populations, children who change health insurers may not necessarily be changing primary care providers and may be less likely to experience disrupted immunization delivery.

### **Policy Implications**

Changes in the methods of HEDIS and the NIS have been initiated based on the report of the National Scientific Panel on Immunization Measurement Standards. The HEDIS measures will more closely follow the minimum intervals between immunizations recommended by the Advisory Committee on Immunization Practices and will incorporate new vaccines into measurement 3 years after they are recommended. However, the recommendation to reduce the minimum duration of enrollment for inclusion in the population assessed by the HEDIS measure from 12 months with up to a 1-month gap to 6 months with no gaps has not been

adopted. This recommendation received unfavorable response when offered for public comment, in part because health plans believed that the proposed change might be unreasonably stringent and might not include many more children than the current approach. The present study suggests that in a relatively stable, predominantly commercially insured population, the increase in the proportion of 24-month-olds included would be small (a 5% increment to the 91% already included in HEDIS). However, at least in this study's population, it would not be unreasonably stringent to expect almost all newly enrolled 12- to 17-month-olds to be fully immunized by age 24 months.

In the summer of 2001, the NIS began to collect data on the insurance status of participating children through a series of questions to parents. The ability to identify Medicaid-insured children for analysis within the NIS sample should enhance comparability between the HEDIS Medicaid and NIS measures. The NIS plans to calculate immunization coverage rates by counting vaccines given by age 24 months in addition to the current method of counting vaccines given up to age 36 months. In accord with HEDIS definitions, the NIS will also conduct analyses that count only those measles-mumps-rubella vaccines given at age 12 months or later. For new vaccines, the NIS will begin measuring and reporting coverage immediately on licensure. For its combination measures, the NIS plans to follow the Healthy People 2010 directive to incorporate new vaccines starting 7 years (5 years + 2 years because the sample is 19-35 months old) after they are universally recommended.

The results of the present study suggest that children who enroll in a health plan during the second year of life are less likely than those who enroll earlier to be fully immunized by age 24 months, despite it being technically feasible to bring almost all of them up to date by that age. Assessment of these children may represent the health plan's ability to rapidly initiate preventive care for new enrollees, as contrasted with its ongoing care for established enrollees. Including such children in immunization measures, either together with earlier-enrolled chil-

dren or as a separate stratum, would expand the scope of the quality of care under evaluation.

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