Impact of North Carolina’s Universal Vaccine Purchase Program by Children’s Insurance Status

Gary L. Freed, MD, MPH; Sarah J. Clark, MPH; Donald E. Pathman, MD, MPH; Robin Schectman, MSPH; Jane Serling, MSPH

Objective: To examine the impact of a new universal purchase vaccine program on immunization rates of children with different types of insurance.

Design: Ecologic study using parent telephone interviews, medical chart abstraction in sites of outpatient care, and insurance verification with Medicaid and private insurers.

Setting: State of North Carolina.

Participants: Of a random birth certificate sample of 4385 children born in North Carolina during 1994 and 1995, 507 were excluded. A total of 2767 children had completed parent interviews; 95% of those had medical chart abstraction and insurance data.

Main Outcome Measures: Immunization rates at each month during the first 2 years of age, site of delivery for immunizations and well-child visits, and insurance status.

Results: In month-by-month comparisons, children born in 1995 had immunization rates 4% to 10% higher than their 1994 counterparts. By 24 months of age, 84% of the 1995 cohort had completed the primary immunization series, compared with 79% of the 1994 cohort (P<.001). In all insurance subgroups, 1995 immunization rates were higher than 1994 rates. The largest increases occurred among privately insured children with no well-child coverage, children who had periods of being uninsured, and children enrolled in Medicaid exclusively or with private insurance. More children in the 1995 cohort received immunizations in the private sector.

Conclusions: Implementation of North Carolina’s universal purchase program was associated with improved immunization rates, especially for children with inadequate insurance for well-child care. However, insurance status still influences the ability of children to receive immunizations on schedule.


Despite the availability of effective vaccines, the annual incidences of several vaccine-preventable diseases continue to be higher than the targets outlined in the Healthy People 2000 report. Inadequate immunization has been linked to most cases of vaccine-preventable diseases.

There have been many attempts to determine the reasons some children do not receive recommended immunizations on schedule. Affordability of immunizations has been the focus of much recent research; private-sector charges for the primary immunization series have increased markedly over the past decade, and are thought to contribute to low immunization rates and the referral of patients from private offices to health departments for immunizations.

Children’s insurance status has an impact on preventive care delivery, immunization status, and the site of immunization provision (health department vs private office). Physicians have reported that they do not immunize uninsured and underinsured children (those whose private insurance does not fully cover preventive services) as frequently as insured children, opting instead to refer them to public clinics. Federal or state programs designed to reduce or eliminate the cost of immunization for those groups aim to increase immunization rates and to decrease the number of children referred from private providers to health departments. Evaluation of such programs, therefore, must examine these outcomes for the target groups of children.
SUBJECTS AND METHODS

STUDY DESIGN

The study compared 2 cohorts: children born in January or February 1994 and children born in January or February 1995. Although both cohorts had the potential to receive all of their immunizations under North Carolina's UP program, the process of enrolling private providers and integrating the program into the private-sector immunization delivery system took several months. As such, data from the 1995 cohort represent the impact of a fully operational program, while data from the 1994 cohort serve as provisional information about the program in its formative stages. While this study design does not provide a true “before-and-after” comparison, the use of a birth cohort from 1993 or earlier would have greatly impeded the task of locating parents and obtaining medical and insurance records, leading to a biased respondent pool. Thus, a comparison of the 1994 and 1995 cohorts was used to reflect changes associated with implementation of the UP program, although the magnitude of effect is likely greater than these data demonstrate.

SAMPLE SELECTION

In the summer of 1996, the North Carolina Office of Vital Records provided birth certificate information for a random sample of 2 cohorts: children born in January or February 1994 (N = 2196), and children born in January or February 1995 (N = 2189). Research staff then used a variety of sources (eg, commercial databases, local telephone directories, Internet public access files, directory assistance, US Postal Service records, state health department records) to locate addresses and telephone numbers of parents of these children.

DATA COLLECTION

Phase 1: Parent Interviews

Parent telephone interviews were conducted from July through December 1996. Parents were mailed an introductory letter explaining the study and how their child was selected for participation. Trained interviewers then called parents to obtain consent to participate and complete the interview. Interviewers asked to speak with the parent who usually took the child to the doctor. In a few instances where parents were unavailable, grandmothers completed the telephone interview. A written version of the interview form was received from 143 families who had no telephone, an unlisted telephone number, or who so requested. Spanish-speaking interviewers completed interviews upon request.

Parents gave specific information about all sites of medical care for the child since birth and the type of care provided at each site. Parents also were asked, for each site, whether an immunization had ever been administered there. Interviewers then asked about the child’s health insurance history from birth to present, including name of carrier, employer, group or subscriber numbers, and coverage dates. Several family demographic questions were asked, including ages of siblings, number of adults living in the home, and household income.

Phase 2: Medical Record Review

To obtain specific information on children's medical history, chart abstractions were conducted from February through June 1997 in each practice and health department where parents reported their children received outpatient care. The only sites not included in chart abstraction were emergency departments and subspecialty clinics (most commonly, allergy or ear-nose-throat clinics); not one parent reported that an immunization was administered at one of these excluded sites, nor was there any such indication in children’s primary care records.

In the early 1990s, the state of North Carolina sought to improve its childhood immunization rate by addressing financial barriers to vaccines and limiting the referral of children to health departments for immunizations. To accomplish these goals, the state established a universal purchase (UP) vaccine program, under which the state purchases vaccine for all children and distributes it free to all participating providers. Providers are not allowed to charge for the vaccine itself but are permitted to charge a state-determined administration fee. The UP program was publicized and administered solely to providers, not the general public. Implementation began officially on January 1, 1994; however, start-up tasks and processes (eg, enrolling providers, depleting existing private vaccine supplies) consumed much of the first year. By late 1994, the program was fully operational.

Although UP programs are in place in North Carolina and 14 other states, none had been evaluated to determine whether program goals were being achieved, particularly among the target groups of uninsured and underinsured children. In 1996, our research team was asked to conduct an evaluation of the North Carolina UP program. This report describes the results of an ecologic study that examined the impact of the UP program on immunization rates and site of immunization for children with various types of health insurance.

RESULTS

Of the original sample of 4385 children, 507 were declared ineligible because they had either moved from the state (n = 298), had obtained medical care at military bases or at sites outside North Carolina and thus were not eligible for the UP program (n = 202), were adopted or placed in the custody of the courts (n = 6), or had incomplete birth certificate information (n = 1). Of the remaining 3878 children, 2767 (71%) had completed parent interviews (1241 children in the 1994 cohort and 1526 in the 1995 cohort). Written surveys were received from 143 parents; the other respondents participated in telephone interviews. Of those who did have completed interviews,
Chart abstractions were performed by trained and certified medical record abstractors. Medical records were abstracted to obtain (1) dates of all vaccines administered in the practice, (2) dates of all office visits and type of visits (eg, well-child care, acute care, follow-up), (3) dates and type of visits to other providers during which vaccines were administered, and (4) information regarding patient transfer to other practices and names of the patient's other providers. Other sites of care obtained via chart abstraction were compared with parent-reported sites; additional chart abstractions were ordered if a site was missing from parental report. This occurred infrequently, and was not more common in one cohort over the other.

A total of 643 sites of medical care participated in the chart abstraction (500 private practices, 24 community health centers, 16 hospital-affiliated clinics, and 103 local health departments). At the time of chart abstraction, 91% of private practice and 100% of health departments were participating in the state UP program. Only 24 private practices refused to consent to chart abstraction; in addition, 3 solo physicians had retired by the time of the study and could not make their records available.

**Phase 3: Insurance Status Verification**

The final aspect of data collection was to verify children's health insurance history and identify insurance benefits for immunizations and well-child visits. Research staff contacted insurance companies and employers identified in the parent interviews to verify coverage for individual children. More than 150 different insurance companies and more than 200 employers provided historical information on children's dates of enrollment and benefit coverage for immunizations and well-child visits. Information about Medicaid participation was provided by the North Carolina Division of Medical Assistance. For each child, a chronology of insurance coverage was constructed with each policy classified into 1 of 6 categories: (1) **Uninsured**—not covered under any health insurance. (2) **Underinsured**—a private policy with no coverage for well-child visits or immunizations (eg, acute and curative care only). (3) **Medicaid**—enrolled in Medicaid program. (4) **Medicaid**—enrolled in Medicaid program. (4) **Medicaid**—enrolled in Medicaid program. (5) **Medicaid**—enrolled in Medicaid program. (5) **Medicaid**—enrolled in Medicaid program. (6) **Unknown**—coverage could not be determined or verified.

There was no assessment of children's Medicaid eligibility separate from enrollment.

**DATA ANALYSIS**

Initial analysis of data involved demographic assessment of the sample. Next, immunization data from all sources of chart review were synthesized to create a complete immunization history for each child. Discrepancies in vaccine type or administration date were resolved by the project coordinator based on primary vs secondary source, corresponding office visit dates, and other available information.

Each child's immunization status then was determined at each month of age based on the then-current combined immunization schedule. A 1-month grace period was allowed with each immunization required; for example, immunizations recommended at 6 months of age were required for up-to-date designation beginning at 7 months. Additionally, we required only 3 doses of *Haemophilus influenzae* type b (Hib) vaccine by 24 months because chart abstraction protocols did not allow specification of whether a 3-dose or 4-dose type of Hib vaccine was administered. The specific criteria used to evaluate immunization status from 7 to 24 months of age are shown below.

Finally, immunization status was merged with each child's insurance chronology. A χ² analysis was used to examine the immunization status of children with different types of insurance and by year of birth.

This study was approved by the Committee for the Protection of Human Subjects at the University of North Carolina at Chapel Hill.

64 parents declined participation, and the remaining parents could not be contacted.

Of the 2767 children with completed parent interviews, 84 had no chart data collected because their site of care refused participation or their chart could not be located, and 41 other children had missing immunization data from 1 or more sites. Thus, 2642 (95%) of the children with parent interviews had complete immunization information. Complete insurance information was collected for 2695 (97%) of the 2767 children with completed parent interviews.

Demographic characteristics of the sample are presented in **Table 1**, comparing mothers of children with completed parent interviews (respondents) with nonrespondents and with those declared ineligible. Nonrespondent mothers were more likely to be younger, black, not married, and less educated compared with respondent and ineligible mothers.

Among respondents, maternal characteristics of the 1995 birth cohort differed from those of the 1994 cohort. Mothers in the 1995 respondent group were more likely than the 1994 group to be teenagers (17% vs 14%; *P*<.01), to be black (28% vs 25%; *P*<.01), to be unmarried (32% vs 28%; *P*<.01), and to have not graduated from high school (22% vs 17%; *P*<.01). Since these characteristics were associated with lower immunization rates both in this study and in previous reports, the 1995 cohort would be expected to have lower immunization rates than the 1994 cohort.

The **Figure** demonstrates, however, that in month-by-month comparisons, children born in 1995 had immunization rates 4% to 10% higher than children born in 1994. From a longitudinal perspective, a given percentage of the 1995 cohort consistently became up-to-date earlier than the 1994 cohort. For example, the 1995 cohort had achieved the targeted 90% immunization rate for their first 3 vaccine series at 10 months of age, while the 1994 cohort did not reach this marker until 14 months of age. From a cross-sectional view, by 15 months of age, 95% of children in the 1995 cohort had received their first 3 series of immunizations vs 90% of the 1994 cohort (*P*<.001). By 24 months of age, 84%
of the 1995 cohort had completed the primary immunization series, compared with 79% of the 1994 cohort ($P < .001$).

A composite of children’s insurance coverage during the first 2 years of life is presented in Table 2. The largest group included children who were enrolled in Medicaid, either exclusively or in combination with private insurance that covered well-child care, through the first 2 years of life. The next largest group was those who were uninsured for some period of time during their first 2 years of life; more than half of the children in this category were enrolled in Medicaid at some time.

The relationship between immunization rates and insurance status is presented in Table 3. Up-to-date rates are shown for children at 12 months and 24 months of age. In all insurance subgroups, 1995 immunization rates were higher than 1994 rates (differences shown in the table). Although immunization rates were higher among insured children, the subgroup difference between the highest and lowest rate was significantly smaller in the 1995 cohort. At both 12 and 24 months of age, the largest increases from 1994 to 1995 were seen among children who had periods of being uninsured and those continuously enrolled in Medicaid or a combination of Medicaid and private insurance. Substantial 1994-to-1995 increases also were seen at 12 and 24 months of age among children who had periods of being uninsured and with partial coverage for well-child care.

Utilization of public health departments for immunization decreased from 1994 to 1995. For the 1994 cohort, 63% of vaccines were administered in private practices, and 37% in public health departments, compared with 68% in private practices and 32% in health departments for the 1995 cohort ($P < .001$). Across all insurance subgroups, the proportion of vaccines administered at public health departments was significantly less in the 1995 cohort (Table 4).

Results of this study demonstrate an association between North Carolina’s UP program and increased immunization rates. Immunization rates improved for all groups of children, especially those with inadequate or no insurance for preventive care. However, for both the 1994 and 1995 cohorts, insurance status still appeared to play a key role in the ability of children to receive immunizations on schedule.

**DIFFERENTIAL IMPACT OF THE UP PROGRAM—THE EFFECT OF INSURANCE STATUS**

Findings from this study demonstrate that the groups achieving the greatest rise in immunization rates during

---

**Table 1. Demographic Characteristics of Sample**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Respondents (n = 2767)</th>
<th>Nonrespondents (n = 1111)</th>
<th>Ineligible (n = 507)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child’s year of birth</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1994</td>
<td>45</td>
<td>64</td>
<td>48</td>
</tr>
<tr>
<td>1995</td>
<td>55</td>
<td>36</td>
<td>52</td>
</tr>
<tr>
<td>Mother’s age, y</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13-19</td>
<td>15</td>
<td>21</td>
<td>11</td>
</tr>
<tr>
<td>20-29</td>
<td>50</td>
<td>61</td>
<td>65</td>
</tr>
<tr>
<td>$&gt;30$</td>
<td>35</td>
<td>18</td>
<td>24</td>
</tr>
<tr>
<td>Mother’s race</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>68</td>
<td>54</td>
<td>72</td>
</tr>
<tr>
<td>Black</td>
<td>27</td>
<td>37</td>
<td>19</td>
</tr>
<tr>
<td>Hispanic/other</td>
<td>5</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>Mother’s marital status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married/separated</td>
<td>70</td>
<td>55</td>
<td>84</td>
</tr>
<tr>
<td>Not married</td>
<td>30</td>
<td>45</td>
<td>16</td>
</tr>
<tr>
<td>Mother’s education level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than high school</td>
<td>20</td>
<td>32</td>
<td>13</td>
</tr>
<tr>
<td>High school graduate</td>
<td>34</td>
<td>39</td>
<td>38</td>
</tr>
<tr>
<td>Some postsecondary</td>
<td>46</td>
<td>29</td>
<td>49</td>
</tr>
<tr>
<td>Mother’s county of residence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metropolitan</td>
<td>67</td>
<td>71</td>
<td>77</td>
</tr>
<tr>
<td>Nonmetropolitan</td>
<td>33</td>
<td>29</td>
<td>23</td>
</tr>
</tbody>
</table>

* Data are given as percentage. $P < .001$ for each variable comparing respondents with nonrespondents.

---

**Table 2. Composite Insurance Status Through 24 Months**

<table>
<thead>
<tr>
<th>Status</th>
<th>1994 Cohort (n = 1241)</th>
<th>1995 Cohort (n = 1526)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous private insurance with full coverage for well-child care</td>
<td>21.3</td>
<td>19.7</td>
</tr>
<tr>
<td>Continuous private insurance with (at least) partial coverage for well-child care</td>
<td>10.0</td>
<td>5.8</td>
</tr>
<tr>
<td>Periods of underinsuredness (private insurance with no coverage for well-child care)</td>
<td>17.9</td>
<td>13.3</td>
</tr>
<tr>
<td>Continuously enrolled, either all Medicaid or Medicaid plus private insurance</td>
<td>28.4</td>
<td>30.0</td>
</tr>
<tr>
<td>Period of uninsuredness</td>
<td>20.8</td>
<td>24.2</td>
</tr>
<tr>
<td>Other/unknown periods</td>
<td>1.6</td>
<td>7.0</td>
</tr>
</tbody>
</table>

---

**Comment**

Results of this study demonstrate an association between North Carolina’s UP program and increased immunization rates. Immunization rates improved for all groups of children, especially those with inadequate or no insurance for preventive care. However, for both the 1994 and 1995 cohorts, insurance status still appeared to play a key role in the ability of children to receive immunizations on schedule.

---

©1999 American Medical Association. All rights reserved.
the initial years of North Carolina’s UP program were those who, theoretically, should have gained the most: the uninsured and the underinsured. These populations historically have had difficulty with access to preventive care and with fragmentation of care,\textsuperscript{6,7,12} often obtaining well-child visits from private physicians but receiving immunizations privately purchased vaccines was no longer accepted. These populations.

As such, the UP program took steps focusing on Medicaid patients in the private practice, rather than refer them to health departments.

Finally, children with full insurance coverage for preventive care showed increased immunization rates associated with the UP program, although the increases were much smaller than those seen in other subgroups. This is somewhat surprising, as fully insured children would have had no financial barrier to immunization and thus would not have been expected to benefit from the program.\textsuperscript{13} However, it seems plausible that the UP program engendered broad improvements in overall immunization delivery, allowing participating physicians to immunize all children in the same manner without referrals to public clinics.

\textbf{THE ROLE OF THE MEDICAL HOME}

One of the main goals of the UP program was to decrease referrals to health departments for immunization and keep children in their medical home. Our data indicate limited progress in this area. Importantly, this trend has implications beyond immunization rates. Previous studies have shown that interventions that help to keep children in their medical home also improve other measurable aspects of primary care, such as screening for specific diseases and attendance for preventive care visits.\textsuperscript{16}

However, the UP program did not—and cannot—solve the issue of access to private-sector care for the uninsured and underinsured populations. Half of all uninsured children continue to receive immunizations at health departments. It is important to remember that immunizations are only one component of the package of preventive care that should be provided to young children. Programs aimed at expanding children’s insurance coverage, such as the State Child Health Insurance Program (CHIP), are expected to make further progress in this area.

\textbf{UNIVERSAL PURCHASE—THE POLICY DEBATE}

The North Carolina UP program is not without its critics. Concerns regarding UP programs generally fall into 3 areas. First, some contend that taxpayer money should not be spent to provide free vaccines for children whose insurance would otherwise pay for it. Second, vaccine manufacturers claim that UP programs unfairly provide for the purchase of all vaccines at lower government con-

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|c|}
\hline
\textbf{Status} & \textbf{1994} & \textbf{1995} & \textbf{Point Change} & \textbf{1994} & \textbf{1995} & \textbf{Point Change} \\
\hline
Continuous private insurance with full coverage for well-child care & 96.2 & 97.5 & +1.3 & 88.2 & 88.7 & +0.5 \\
Continuous private insurance with at least partial coverage for well-child care & 90.2 & 96.6 & +6.4 & 85.3 & 90.9 & +5.6 \\
Periods of underinsuredness & 89.9 & 94.0 & +4.1 & 80.2 & 86.5 & +6.3 \\
Continuous Medicaid alone or with private insurance & 80.9 & 90.1 & +9.2 & 74.8 & 83.7 & +8.9 \\
Periods of uninsuredness & 78.3 & 87.5 & +9.2 & 71.9 & 80.5 & +8.6 \\
\hline
\end{tabular}
\caption{Percentage of Children Up-to-date* for Immunizations at 12 and 24 Months of Age Stratified by Insurance Status}
\end{table}

\begin{table}[h]
\centering
\begin{tabular}{|c|c|c|c|}
\hline
\textbf{Insurance Type} & \textbf{1994 Cohort} & \textbf{1995 Cohort} \\
\hline
Private insurance with full coverage for well-child care & 16.7 & 13.9 \\
Private insurance with partial coverage for well-child care & 40.2 & 34.9 \\
Private insurance with no coverage for well-child care & 48.2 & 43.3 \\
Medicaid & 39.2 & 35.3 \\
Uninsured & 60.9 & 51.8 \\
\hline
\end{tabular}
\caption{Percentage of Immunizations Given at Public Health Departments for Children With Different Types of Insurance*}
\end{table}

* In this study, up-to-date immunization status was defined as follows: at 12 months: 3 diphtheria and tetanus toxoids and pertussis (DTP), 2 Haemophilus influenzae type b (Hib), 2 oral poliovirus (OPV), and 2 hepatitis B virus (HBV); at 24 months: 4 DTP, 3 Hib, 3 OPV, 3 HBV, and 1 measles-mumps-rubella.

* Based on children’s insurance at the time of immunization. P ≤ .01 for each category comparing 1994 cohort with 1995 cohort.
extract prices, thus eliminating the private market for vaccines and decreasing revenue. Third, although immunization charges to patients are reduced under UP programs, patients still pay for the vaccine administration fee and for the accompanying well-child visit; totally free immunizations are offered only at public health departments, as they were prior to the institution of UP.

Advocates of UP programs counter that their greatest advantage is the simplicity for providers. Many government programs have difficulty achieving high rates of provider participation because of the extra (uncompensated) effort required of them. Prior to adopting the UP program, the state conducted discussions, in which one of us (G.L.F.) participated, with North Carolina physicians, who insisted that they would not participate in any vaccine program that required office-based eligibility checks. The universal aspect of UP minimizes physicians’ administrative burden and ensures high participation rates.

Through this study we discovered another issue related to UP. It appears that the UP program has created a perverse incentive for insurance companies to include immunization fees—but not the cost of vaccine—as part of a preventive care package in employersponsored health plans. Providers who use state-supplied free vaccines to immunize all children are unable to bill insurers for the cost of vaccine. Since the initiation of UP in North Carolina, most insurance plans that covered immunizations ceased to include vaccine as a reimbursable expense; instead they reimburse only the state-determined administration fee. Also, many other private insurance plans have added coverage for immunizations, quite possibly because the insurer can cover this preventive service at a relatively low cost (ie, not paying for the vaccine). As a result, the government is performing a de facto subsidization of private insurers who need no longer to cover the cost of vaccines for their insured patients. State policy makers have begun looking at this issue. An option adopted by some UP states is mandating that insurance companies contribute to a trust fund to help finance the UP system, based on their savings on vaccines.

LIMITATIONS AND STRENGTHS

This ecologic study took advantage of a new phenomenon, the initiation of a UP program in North Carolina, to examine changes in immunization delivery to children. A unique strength of this study was the method of verification of the information provided by parents or guardians of subjects regarding site of preventive care provision and insurance coverage. This information was verified by chart review of all sources of care and direct contact with insurance companies and/or employers. To our knowledge, this is the most accurate information ever available on immunizations and insurance status for a sample of children of this size.

There are several limitations of the study that mitigate the ability to definitely demonstrate the impact of the UP program. First, as with any ecologic study, there were influences on immunization delivery beyond the new UP program. For example, local vaccine campaigns, sponsored by service groups or county government agencies, were conducted. Although there was no direct publicity of the UP program, there may have been other media coverage of vaccines or vaccine-preventable illnesses.

Second, as explained in the “Subjects and Methods” section, the study compared children born in 1994 with those born in 1995. However, the UP program was in place for the entire life span of both cohorts. As such, changes from 1994 to 1995 represent the impact of a program as it matured, rather than a true “before-and-after” comparison.

Another limitation of the study is that 32% of the 1994 cohort and 18% of the 1995 cohort were not able to be contacted for participation in this study. The non-respondent mothers of these children were more likely to be black, not married, younger, and less educated—factors associated with low immunization rates. This potential response bias would not account for the increase in immunization rates observed between the 2 cohorts because 1995 respondents had a slightly greater proportion of these same characteristics than the 1994 respondents. However, the response bias may impact the ability of this study to be generalized to specific populations.

BEYOND UP—UNMET NEEDS

Our data indicate that the UP program was associated with increased immunization rates for children in North Carolina. Further, while certain groups of children (uninsured, Medicaid) continue to have lower immunization rates, the gap between these groups and children who are fully insured has closed. Additional efforts, reaching beyond economic issues, are required to bring age-appropriate immunization rates above 90% for all groups of children. Future efforts should focus on follow-up and tracking systems.

Other studies of UP in North Carolina have shown that the cost of obtaining immunizations in the private sector is not limited to vaccine charges. While the UP program reduces one component of vaccine charges to parents, it does not provide access to the private sector for all those without insurance and unable to pay for well-child care. If policy goals are directed toward providing children with a medical home for all preventive care, UP programs can only be viewed as one step in that process. First-dollar insurance coverage for preventive services will be required to bring this level of care to all children in the United States.

Accepted for publication November 11, 1998.

Funding for this study was provided by the North Carolina Department of Health and Human Services and the Centers for Disease Control and Prevention, Atlanta, Ga.

We thank staff of the North Carolina Immunization Section, the Division of Medical Assistance, and the Department of Insurance, for their assistance.

Reprints: Gary L. Freed, MD, MPH, Division of General Pediatrics, University of Michigan, D3202 Medical Professional Building, 1500 E Medical Center Dr, Ann Arbor MI 48109-0718 (e-mail: gfreed@umich.edu).
REFERENCES


