Evaluation of New York State’s Child Health Plus: Children Who Have Asthma

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ABSTRACT. Background. Little is known about the impact of providing health insurance to uninsured children who have asthma or other chronic diseases.

Objectives. To evaluate the association between health insurance and the utilization of health care and the quality of care among children who have asthma.

Design. Before-and-during study of children for a 1-year period before and a 1-year period immediately after enrollment in a state-funded health insurance plan.

Intervention. In 1991 New York State implemented Child Health Plus (CHPlus), a health insurance program providing ambulatory and ED (ED), but not hospitalization coverage for children 0 to 12.99 years old whose family incomes were below 222% of the federal poverty level and who were not enrolled in Medicaid.

Subjects. A total of 187 children (2–12.99 years old) who had asthma and enrolled in CHPlus between November 1, 1991 and August 1, 1993.

Main Outcome Measures. Rates of primary care visits (preventive, acute, asthma-specific), ED visits, hospitalizations, number of specialists seen, and quality of care measures (parent reports of the effect of CHPlus on quality of asthma care, and rates of recommended asthma therapies). The effect of CHPlus was assessed by comparing outcome measures for each child for the year before versus the year after CHPlus enrollment, controlling for age, insurance coverage before CHPlus, and asthma severity.

Data Ascertainment. Parent telephone interviews and medical chart reviews at primary care offices, EDs, and public health clinics.

Main Results. Visit rates to primary care providers were significantly higher during CHPlus compared with before CHPlus for chronic illness care (995 visits before CHPlus vs 1.34 visits per year during CHPlus), follow-up visits (.86 visits vs 1.32 visits per year), total visits (5.69 visits vs 7.11 visits per year), and for acute asthma exacerbations (.61 visits vs .84 visits per year). There were no significant associations between CHPlus coverage and ED visits or hospitalizations, although specialty utilization increased (30% vs 40%; P = .02). According to parents, CHPlus reduced asthma severity for 55% of children (no change in severity for 44% and worsening severity for 1%). Similarly, CHPlus was reported to have improved overall health status for 45% of children (no change in 53% and worse in 1%), primarily attributable to coverage for office visits and asthma medications. CHPlus was associated with more asthma tune-up visits (48% before CHPlus vs 63% during CHPlus). There was no statistically significant effect of CHPlus on several other quality of care measures such as follow-up after acute exacerbations, receipt of influenza vaccination, or use of bronchodilators or antiinflammatory medications.

Conclusions. Health insurance for uninsured children who have asthma helped overcome financial barriers that prevented children from receiving care for acute asthma exacerbations and for chronic asthma care. Health insurance was associated with increased utilization of primary care for asthma and improved parent perception of quality of care and asthma severity, but not with some quality indicators. Although more intensive interventions beyond health insurance are needed to optimize quality of asthma care, health insurance coverage substantively improves the health care for children who have asthma. Pediatrics 2000;105:719–727; uninsured, underinsured, health insurance, children, asthma, utilization, quality of care, SCHIP.

ABBREVIATIONS. ED, emergency department; CHPlus, Child Health Plus; SCHIP, State Children’s Health Insurance Program.

Asthma is the most common chronic physical condition of childhood, affecting about 5% to 8% of children,1–3 and causing substantial morbidity for children and their families.4 Nearly one third of children who have asthma have limitations in their usual activities, and asthma results in an average of 5 days of school absence and 3 days in bed per year for each afflicted child.1 In addition, the financial costs for childhood asthma are large: US health care costs in 1990 for children who have asthma were estimated to be $712 million dollars in direct annual medical expenditures and 1 billion dollars in indirect costs (mostly attributable to school absences).1 In 1985, children who had asthma had >160 000 annual hospitalizations,5,6 860 000 emergency department (ED) visits,7 and >2 million office visits for acute exacerbations.1,3,5

Although the prevalence of asthma is similar
among uninsured and insured children,\textsuperscript{9} uninsured children with asthma are more likely to lack a usual source of care and to lack a visit with a medical provider during the previous year, compared with insured children with asthma.\textsuperscript{10} There is substantial concern that lack of health insurance coverage for children who have chronic conditions impedes receipt of needed medical care,\textsuperscript{11} and may even result in potentially avoidable hospitalizations.\textsuperscript{12} In addition, newer and improved medications for treating asthma, such as antiinflammatory medications and inhaled bronchodilators, are quite expensive.\textsuperscript{13} Lack of insurance coverage for these medications may result in inadequate compliance even if they are prescribed.

Asthma, therefore, is an excellent tracer condition for evaluating the impact of health insurance on utilization and quality of care for chronic illness. In addition to the issue of costs for asthma care, there is evidence that improved quality of asthma care can reduce morbidity from the disease.\textsuperscript{14,15} Furthermore, measures of severity\textsuperscript{16–18} and related quality of care guidelines\textsuperscript{18,19} have been developed for childhood asthma, making it feasible to assess the association between health insurance and either asthma severity or quality of asthma care.

The objective of this study was to assess the association between health insurance coverage and utilization of health care and quality of care for children who have asthma.

METHODS

This study was part of a larger study of the Child Health Plus (CHPlus) program. Additional information about the design and execution of the main study are described in an accompanying article.\textsuperscript{20}

Setting

In 1991, New York State introduced CHPlus, a statewide health insurance plan designed to increase access to preventive health care for low-income children by providing health insurance coverage for ambulatory care. CHPlus covered preventive care visits, acute and chronic illness visits, preventive screening and services, immunizations, visits to specialists by referral, ambulatory surgery, ED care, prescription drugs including commonly used asthma medications, but not hospitalizations. Children were eligible for CHPlus if they were residents of New York State, \textless 13 years old, not enrolled in Medicaid, and if they lacked equivalent health coverage. Families whose gross incomes were below 160\% of the federal poverty level were eligible for full state subsidy of the premium, those with income between 160\% and 222\% of the federal poverty level were eligible for partial subsidy ($25 per year per child up to a family maximum of $100 per year), and those with income above 222\% of the federal poverty level could purchase CHPlus at cost ($498 per child per year in the study region in 1994).

The study setting was a 6-county region in upstate New York, in which CHPlus was administered by a single independent practice association-model health insurance plan. The health care settings involved 164 primary care practices (400 physicians), all 6 county public health clinics, and all 12 EDs in the area.

Study Design

A before-and-during study design was used to obtain information for a 24-month period for each child: the year immediately preceding CHPlus enrollment and the first year immediately after enrollment. Parent interviews were performed at the end of the 24-month interval to assess demographic characteristics of the population, sources of health care both before and during CHPlus enrollment, experience with CHPlus, health status, and asthma severity. Medical charts were then reviewed to measure utilization and quality of care.

Subjects were eligible if they: 1) enrolled in CHPlus between November 1, 1991 and August 1, 1993; 2) remained enrolled for a minimum of 9 continuous months; 3) were 2 to 12.99 years old at enrollment; and 4) had a diagnosis of asthma according to their parents. The lower age cut-off was used because in younger children, the diagnosis of asthma is not as clear.\textsuperscript{16} The upper age cut-off was determined by the age limit of CHPlus (13 years). Eligible index children 0 to 6.99 years old were identified for the main study,\textsuperscript{20} and then subjects or siblings of the index children 2 to 12.99 years old who met the other eligibility criteria were selected for this asthma study.

Data Collection

Interviewers asked questions about family and demographic characteristics, experience and satisfaction with CHPlus, health status of children, use of health services, and all sources of health care during the year before and the year after enrollment in CHPlus.

Two screening questions, adapted from the National Health Interview Survey,\textsuperscript{9} were used to identify children who had asthma.

The first question asked parents whether their child had been given the diagnosis of asthma, reactive airway disease, bronchospasm, exercise asthma, cough variant asthma, chronic bronchitis, or wheezy bronchitis during the previous 3 years. The second question asked whether the child had received a prescription for a medication or inhaler for a breathing problem other than a common cold or flu during the previous 3 years; interviewers read off a list of 18 asthma medications and inhalers. A positive response to either screening question resulted in inclusion in the study, regardless of asthma severity at the time of interview. Parents were asked about their perceptions of their child’s health status, asthma severity, and the impact of CHPlus on health status and severity of asthma.

Medical Chart Reviews

Medical charts were reviewed at all primary care practices identified by parents or referenced in any other medical charts. A child’s medical chart review was considered complete if a chart review was completed for every source of primary care identified by the parent for the relevant 2-year period.

ED utilization was obtained by medical chart reviews from all 12 EDs in the area. Hospital admissions were identified from the ED chart reviews (96\% of children hospitalized for asthma in this region are admitted via the ED; personal communication, Rochester Healthcare Information Group, 1998). Finally, all medical records at the 6 public health clinics were reviewed, and data on any study subject were incorporated into the utilization histories.

Measures

Table 1 shows the key study measures, including asthma-specific measures.\textsuperscript{20}

Demographic Characteristics and Parent Experience With Health Insurance

Family characteristics and prior health insurance coverage were determined by interview.

Health Status and Access to Care

The interviewers assessed parents’ perception of the child’s overall health status, change in health status over 2 years, and whether that change was attributable to CHPlus. Questions about asthma severity included frequency of symptoms, wheezing with exercise, interruption of sleep, and missing school. An overall asthma severity score was adapted from a severity classification published by a National Heart, Lung and Blood Institute and the World Health Organization report\textsuperscript{10} and was computed from the 4 asthma severity measures (see footnote to Table 1). If any of the individual severity scores met the criteria for moderate/severe, the patient was classified as having moderate/severe asthma. Interviews also were used to obtain measures of access.

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Utilization of Health Services

Visits for asthma, measured by chart reviews, were classified as acute asthma exacerbations, follow-up, or asthma tune-up (either a preventive visit in which asthma was discussed or a specific asthma follow-up or management visit). Parent interviews were used to assess specialty utilization (primary care charts frequently lacked such information).

Quality of Care

Parents were asked to rate the overall quality of medical care before and during enrollment in CHPlus and to assess the impact of CHPlus on general pediatric care, quality of care, and their child’s asthma severity. Asthma-specific quality of care measures (by chart reviews) included receipt of recommended asthma services: an asthma tune-up visit\(^\text{18}\); receipt of the influenza vaccine (recommended for children who have moderate/severe asthma); receipt of inhaled bronchodilators or antiinflammatory medications as recommended for children who have moderate or severe asthma.\(^\text{19}\)

Statistical Analysis

The goal of the analysis was to estimate the effect of the CHPlus program on health care utilization, quality of asthma care, health status, and asthma severity. Additional information about statistical methods is in the accompanying article.\(^\text{20}\) Outcome measures were analyzed by using logistic regression for dichotomous outcomes and Poisson regression for outcomes that were counts (eg, number of primary care visits during a study period). Each child in the study typically contributed 2 observations to the analysis, 1 for the year before enrollment in CHPlus (pre-CHPlus period) and 1 for the year after enrollment (CHPlus period). Regression models were estimated by using generalized estimating equations,\(^\text{21}\) with an exchangeable working correlation structure for all observations from the same family. Tests of statistical significance were based on standard errors calculated by using an empirical (sandwich) variance estimator.

The explanatory variables in the regression models were: type of period covered by the observation (pre-CHPlus or CHPlus); age (in years) at the start of the period; type of health insurance coverage before CHPlus; gap in insurance coverage immediately before CHPlus enrollment; asthma severity (mild or moderate/severe); and interactions of period type with each of the other factors. The interactions were included to test whether the CHPlus effect differed across the levels of the other factors. A quadratic term for age and its interaction with period type were included to allow for possible nonlinear relationships between age and the outcome measures.

The regression models were used to estimate means of the outcome measures with and without CHPlus, while controlling for the other factors in the models. The means were standardized to the distribution of age, insurance history, and asthma severity for the children in our dataset, using the models. These distributions are summarized in Table 2. The difference between means with and without CHPlus was the estimate of the CHPlus effect for that variable. Means were calculated in the units of the outcome variable so that they are interpretable, but tests of the statistical significance of the CHPlus effect were conducted in the units of the underlying regression model (logs for logistic regression, logs for Poisson regression). For some dichotomous outcomes, nearly all observations had the same value (eg, few children were hospitalized during the study interval). This led to convergence problems for the logistic regression models. In these cases the models were simplified by leaving out interaction terms. When this was not sufficient to allow convergence, the data were analyzed by McNemar’s test (with exact, small-sample \(P\) values), treating the pre-CHPlus and
CHPlus observations for each child as paired data, and unstandardized means are reported. These cases are noted in the tables.

The proportion of acute office visits that had a follow-up visit was analyzed by treating each acute office visit as an observation and using logistic regression to model the probability of a follow-up visit as a function of the explanatory variables and interactions listed above. To allow for possible correlations between observations from the same child (ie, children who have >1 acute office visit), the model was fit by using generalized estimating equations with an exchangeable working correlation structure.

RESULTS

Interviews were obtained for 1828 children (0–6.99 years old) for the main study. These interviews identified 187 children 2 to 12.99 years old who had asthma based on the 2 screening questions; 105 of these children were in the original sample of 0 to 6.99-year-olds, and 82 children were siblings 7- to 12.99-year olds. The prevalence of asthma was 9.0% for 2- to 6.99-year-olds (105 of 1169 eligible index subjects 2–6.99 years old) and 7.8% for 7- to 12.99-year-olds (82 of 1058 siblings). Medical charts were reviewed for 169 of the 187 children who had asthma (90%).

Population Description

Table 3 shows demographic characteristics of the children who had asthma. Most children were white, came from working poor families, and were uninsured before enrollment in CHPlus.

Thirty-five percent of the children who had asthma were rated by parents as having excellent overall health, 49% as having good health, and 16% as having fair or poor health status. Although the proportion having fair or poor health status was fourfold higher than the general CHPlus population (16% vs 3%; P < .001), the majority of children who had asthma were still perceived as being generally healthy. Table 3 also shows results from the asthma severity measures. More than 20% of children were reported to have substantial symptoms on each measure. Based on the overall asthma severity score, 62% of the children were reported to have moderate or severe asthma at the time of the interview.

Utilization of Health Care

Primary Care

Overall, 184 children (98%) had an identified source of preventive care (a medical home) before CHPlus, and all 187 children had a medical home during CHPlus. Thirty-six children (20%) switched primary care providers on enrolling in CHPlus. Reasons for switching included: the former provider did not accept CHPlus (10 children), excessive distance to the previous provider (12 children), dissatisfaction with the previous provider (4 children), and other (12 children). Table 4 shows the mean number of annual visits to primary care offices before and during CHPlus for the 169 subjects who had asthma for whom medical charts were reviewed. The mean number of primary care visits was higher during CHPlus compared with the year before CHPlus. Although preventive visits also were more frequent, the difference was not statistically significant. Mean numbers of primary care visits were higher during CHPlus for chronic illness visits (by 42%), follow-up visits (by 53%), acute visits (by 19%), and total visits (by 25%). These CHPlus effects were adjusted for age, prior insurance, insurance gap, and asthma severity; generally the magnitude of the CHPlus effects did not vary significantly by age, prior insurance status, or asthma severity.

ED Utilization (Table 5)

There were no significant effects of CHPlus on ED utilization. Of note, however, the total number of ED visits was relatively small, even for children who had asthma.

Hospital Utilization (Table 5)

One child was hospitalized in the year before CHPlus, and 3 children were hospitalized during the year in CHPlus (P = .6 by McNemar’s test).

Specialty Utilization (Table 5)

According to parents, 30% of children saw a specialist in the year before CHPlus, while 40% saw a specialist the year during CHPlus (P = .02). The types of specialists seen by these children were typical of those seen by children in general.

Quality of Asthma Care

Parents were asked to rate whether their child’s asthma severity was improved, the same, or worse at the time of the interview (1 year after CHPlus enrollment) compared with 1 year before the interview.
(around the time of CHPlus enrollment). If a change was reported, parents were asked about the reasons for the change in asthma severity and the contribution of CHPlus toward their child’s asthma severity. Responses were obtained from parents of 165 children (88%). During CHPlus, 57% of children were reported to have improved asthma severity compared with before CHPlus, 34% had the same severity, and 9% had worse asthma severity. Parents of 144 children responded to the question about the effect of CHPlus on their child’s asthma severity: 55% stated that CHPlus reduced the asthma severity, 44% stated that CHPlus had no effect on asthma severity, and 1% stated that CHPlus worsened their child’s asthma severity. In addition, parents of 46% of children stated that their child’s overall health status was improved since enrollment in CHPlus, while parents of 53% stated that overall health status had not changed, and 1% stated that overall health status had worsened. Parents were asked whether CHPlus affected their child’s asthma care: 59% noted that CHPlus helped their child receive needed medical care, and 50% indicated that CHPlus helped them afford medications. There were no differences in responses according to children’s prior insurance status.

For the 107 children who had moderate or severe asthma, parent responses were similar to those of the entire group. Again, the majority indicated that CHPlus reduced their child’s asthma severity significantly, that their child was healthier overall after CHPlus, and that CHPlus helped them to seek medical care for their child (81%) and to afford medications (47%).

Table 6 shows quality of care measures for the year before CHPlus and the year during CHPlus, based on findings from medical chart reviews. Three findings are apparent. First, the majority of patients did not receive the recommended visits or treatments in either the year before or the year during CHPlus. For example, only about 50% of patients had an asthma tune-up visit, and 10% received the influenza vaccination. Second, a significantly higher proportion of children received asthma tune-up visits during CHPlus periods than during pre-CHPlus periods. Third, there were no significant differences associated with CHPlus for the other quality of care measures.

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**TABLE 3.** Demographic Characteristics, Health Insurance Experience, and Asthma Severity (*N* = 187*)

<table>
<thead>
<tr>
<th>Category</th>
<th>Characteristic</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographic characteristics</strong></td>
<td>Male</td>
<td>57</td>
</tr>
<tr>
<td></td>
<td>Median age (range: 2–12.99 y)</td>
<td>6 y</td>
</tr>
<tr>
<td></td>
<td>Race: White</td>
<td>84</td>
</tr>
<tr>
<td></td>
<td>Black</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Hispanic</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Two adults in house</td>
<td>64</td>
</tr>
<tr>
<td></td>
<td>Guardian education ≥12th grade</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td>Parent working (yes): One parent</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>Both parents</td>
<td>54</td>
</tr>
<tr>
<td></td>
<td>Income as % federal poverty level: 0–99%</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>100–159%</td>
<td>41</td>
</tr>
<tr>
<td></td>
<td>160–221%</td>
<td>27</td>
</tr>
<tr>
<td></td>
<td>≥222%</td>
<td>5</td>
</tr>
<tr>
<td><strong>Health insurance</strong></td>
<td>Insurance before CHPlus: None (uninsured)</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Underinsured</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Fully Insured</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Medicaid</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>Insurance Gap pre-CHPlus: None (insured)</td>
<td>29</td>
</tr>
<tr>
<td></td>
<td>1–5 mo</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>≥6 mo</td>
<td>47</td>
</tr>
<tr>
<td><strong>Overall health status</strong></td>
<td>General health status: Excellent</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Good</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>Fair</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Poor</td>
<td>1</td>
</tr>
<tr>
<td><strong>Asthma severity at interview</strong></td>
<td>Frequency of symptoms: &lt;2/wk</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>N = 159</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>2–3/wk</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>&gt;3/wk</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Wheezing with exercise: None</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>N = 150</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Within 5 min</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Immediately</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Interruption of sleep: &lt;2/mo</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td>N = 151</td>
<td>24</td>
</tr>
<tr>
<td></td>
<td>2–5/mo</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>&gt;5/mo</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>Missed school: &lt;1 d/mo</td>
<td>48</td>
</tr>
<tr>
<td></td>
<td>N = 143</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>1–4 d/mo</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>&gt;4 d/mo</td>
<td>12</td>
</tr>
<tr>
<td><strong>Overall asthma score:</strong></td>
<td>Mild (<em>N</em> = 65)</td>
<td>38</td>
</tr>
<tr>
<td></td>
<td>Moderate-severe (<em>N</em> = 107)</td>
<td>62</td>
</tr>
</tbody>
</table>

* The number of valid respondents for some questions was fewer than 187 because the questions were not applicable for all children (eg, some were too young for noting wheezing with exercise, or didn’t attend school).
† Asthma severity score = moderate/severe if: frequency of symptoms >3/wk, wheezing with exercise >none, interrupts sleep ≥2–5/month, or missed school ≥1–4 days/month; otherwise asthma severity score = mild. If any of the individual scores met criteria for moderate/severe, the overall asthma score was moderate/severe. Individual severity scores were missing for 15 children.
DISCUSSION

Children who have asthma often face financial barriers to receiving care, particularly because the costs of many of the newer medications are high. It is estimated that health care costs for a child who has asthma are 2 to 4 times the costs for the general child population. For families who are impoverished and who lack health insurance, these costs can lead to delays in seeking care and unnecessary morbidity. Across the United States there are >50,000 children who have asthma who are uninsured and an even greater number who are underinsured. Health insurance coverage for these children may help overcome financial barriers to health care and, thus, reduce the burden of disease on these children and their families. It is particularly important, therefore, to examine the effect of providing health insurance to uninsured or underinsured children who also have a chronic condition such as asthma.

CHPlus was associated with more frequent acute and chronic asthma-related visits to primary care practitioners at the medical home and with increased specialty visits. There was no significant association with ED or hospital utilization. A significant improvement was noted for several measures of quality such as asthma tune-up visits and parent report of

TABLE 4. Mean Number of Visits Per Year to Primary Care Physicians for the Year Before* and the Year During† CHPlus (N = 169)

<table>
<thead>
<tr>
<th>Visit Type</th>
<th>Before CHPlus</th>
<th>During CHPlus</th>
<th>Difference: Estimated CHPlus Effect§</th>
<th>P Value §</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall visits Preventive</td>
<td>.55</td>
<td>.65</td>
<td>+.10</td>
<td>.2</td>
</tr>
<tr>
<td>Acute</td>
<td>2.99</td>
<td>3.48</td>
<td>+.55</td>
<td>.02</td>
</tr>
<tr>
<td>Chronic</td>
<td>.995</td>
<td>1.34</td>
<td>+.40</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Follow-up†</td>
<td>.86</td>
<td>1.32</td>
<td>+.46</td>
<td>.005</td>
</tr>
<tr>
<td>Weekend</td>
<td>.56</td>
<td>.67</td>
<td>+.11</td>
<td>.2</td>
</tr>
<tr>
<td>Nursing</td>
<td>.48</td>
<td>.44</td>
<td>−.04</td>
<td>.2</td>
</tr>
<tr>
<td>Total</td>
<td>5.69</td>
<td>7.11</td>
<td>+1.42</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Asthma-specific visits‡</td>
<td>Acute exacerbation</td>
<td>.61</td>
<td>.84</td>
<td>+.23</td>
</tr>
<tr>
<td>Follow-up after acute exacerbation</td>
<td>39%</td>
<td>38%</td>
<td>−1%</td>
<td>1.0</td>
</tr>
</tbody>
</table>

* Before represents the 12-month period before enrollment in CHPlus.
† During represents the 12-month period during enrollment in CHPlus.
‡ Asthma-specific visits are included in the overall visits.
§ Means and statistical tests are adjusted for age, prior insurance type, insurance gap before CHPlus, and asthma severity.
¶ Significant variation in the CHPlus effect with age (largest effects at age 2 years and ages 10–12 years).
|| Total visits to primary care offices (not equal to the sum of above types of visits).

TABLE 5. Utilization of EDs, Hospitalizations, and Specialty Utilization, for the Year Before* And Year During† CHPlus (ED Visits Were Determined By Chart Review (N = 169); Specialty Visits Were Determined By Parent Interview [N = 187])

<table>
<thead>
<tr>
<th>Visit Type</th>
<th>Before CHPlus</th>
<th>During CHPlus</th>
<th>Difference: Estimated CHPlus Effect§</th>
<th>P Value §</th>
</tr>
</thead>
<tbody>
<tr>
<td>ED utilization At least 1 ED visit</td>
<td>27.6%</td>
<td>30.5%</td>
<td>+3.0%</td>
<td>.6</td>
</tr>
<tr>
<td>At least 1 ED visit for asthma</td>
<td>8.99%</td>
<td>11.0%</td>
<td>+2.1%</td>
<td>.5</td>
</tr>
<tr>
<td>Mean number of ED visits for asthma</td>
<td>.122</td>
<td>.141</td>
<td>+.019</td>
<td>.4</td>
</tr>
<tr>
<td>Hospitalizations Admitted to hospital via ED‡</td>
<td>.6%</td>
<td>1.8%</td>
<td>+1.2%</td>
<td>.6</td>
</tr>
<tr>
<td>Specialty utilization Used a specialist</td>
<td>30%</td>
<td>40%</td>
<td>+10%</td>
<td>.02</td>
</tr>
<tr>
<td>Mean number of specialists seen</td>
<td>.36</td>
<td>.48</td>
<td>+.12</td>
<td>.02</td>
</tr>
</tbody>
</table>

* Before represents the 12-month period before enrollment in CHPlus.
† During represents the 12-month period during enrollment in CHPlus.
§ Means and statistical tests are adjusted for age, prior insurance type, insurance gap before CHPlus, and asthma severity.
‡ Only 4 hospitalizations occurred: 1 during a pre-CHPlus period and 3 during CHPlus. P value is by McNemar’s test.

TABLE 6. Quality of Care Measures in the Year Before* and Year During† CHPlus (N = 169)

<table>
<thead>
<tr>
<th>Quality Measure</th>
<th>Before CHPlus</th>
<th>During CHPlus</th>
<th>Difference: Estimated CHPlus Effect§</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilization measure Asthma tune-up during the year</td>
<td>48%</td>
<td>63%</td>
<td>+16%</td>
<td>.008</td>
</tr>
<tr>
<td>Asthma treatments Influenza vaccination‡</td>
<td>6.8%</td>
<td>9.1%</td>
<td>+2.3%</td>
<td>.4</td>
</tr>
<tr>
<td>Received inhaled bronchodilators</td>
<td>26%</td>
<td>31%</td>
<td>+5%</td>
<td>.2</td>
</tr>
<tr>
<td>Received antiinflammatory agents</td>
<td>15%</td>
<td>19%</td>
<td>+4%</td>
<td>.2</td>
</tr>
</tbody>
</table>

* Before represents the 12-month period before enrollment in CHPlus.
† During represents the 12-month period during enrollment in CHPlus.
§ Means and statistical tests are adjusted for age, prior insurance type, insurance gap before CHPlus, and asthma severity.
‡ Interaction of CHPlus with other explanatory variables not tested because of small numbers.
the impact of CHPlus on both quality of care and on their child’s asthma severity. However, there was no significant benefit from CHPlus on some other measures of quality of care such as the receipt of recommended asthma medications or influenza vaccination.

CHPlus and Utilization of Services

CHPlus was associated with significantly more asthma tune-up visits, acute asthma visits, and total visits to the primary care practitioner. The magnitude of these effects was large, with a 40% increase in chronic asthma and acute asthma visits and a 25% increase in total primary care visits. It is likely that before CHPlus, financial barriers prevented parents from taking their children to primary care physicians as often as parents thought necessary and that CHPlus reduced those financial barriers. This is supported by the finding that 59% of parents stated that CHPlus helped their child receive medical care, primarily through coverage of services. In addition, a recent study in Pennsylvania (not focusing on asthma) of children enrolled in a similar health insurance plan also found that insurance facilitated receipt of needed medical care. Lack of insurance may have placed parents in the position of using financial calculations to decide whether to seek medical care for their child’s asthma. Health insurance appeared to relieve some of those constraints.

The increase in utilization was confined largely to the primary care office and to specialist visits, with no effect on ED visits or hospitalizations. The total number of visits for acute asthma exacerbations increased substantially, but all of the increase was borne by the primary care physician’s office. Thus, CHPlus enabled the use of appropriate care and chronic asthma care within the primary care office rather than in the ED or hospital. Such increased contact with primary care physicians is a major benefit of CHPlus for children who have asthma.

CHPlus and Quality of Asthma Care

Parents stated that CHPlus improved quality of care by facilitating access to health services and by helping them obtain and afford medications. Parents of half the children stated that CHPlus had directly reduced their child’s asthma severity. Similar results were noted in the study in Pennsylvania, in which many parents stated that receipt of health insurance allowed their children to receive care they would not otherwise have received.

One objective measure of quality of care that improved significantly was the number of asthma tune-up visits. These visits are recommended at least yearly for children who have asthma (more frequently for children whose asthma is moderate to severe) to provide opportunity for discussion of overall asthma management. CHPlus was associated with a 16% relative increase in asthma tune-up visits and a 42% relative increase in chronic illness visits (most of which included asthma management). It was not possible to determine the quality or appropriateness of care that occurred during those tune-up visits. Unfortunately, only 63% of children (66% of children whose asthma was moderate or severe) had an asthma tune-up visit, even when covered by CHPlus, when there were no costs for the primary care visits or for asthma medications.

Optimal quality of asthma care was not achieved during CHPlus. For example, <10% of children received the influenza vaccination during the CHPlus year, even though 138 children (86%) made a visit to the primary care office for preventive or asthma care. This very low rate of influenza vaccination is similar to national rates and reflects missed opportunities and failure by primary clinicians to follow recommended guidelines for influenza vaccination. Similarly, the low rate of use of antiinflammatory medications or inhaled bronchodilators, even among children who had moderate/severe asthma, suggests that quality of care could be improved. Thus, it appears that improving compliance with recommended guidelines for asthma care will require more than expanding insurance coverage, supporting previous studies that have demonstrated that health insurance by itself does not guarantee optimal quality of care for children.

Strengths and Limitations

This study has several strengths. The use of multiple data sources facilitated measurement of utilization and quality. Chart reviews avoided recall errors or bias for many outcome measures, and chart reviews at all ED and primary care office sites enhanced capture of utilization before and during CHPlus. Findings from interviews provided critical information on the burden of asthma and the impact of CHPlus on quality and asthma severity from the parents’ perspective. The accompanying article on methodology of the CHPlus evaluation notes the study limitations, which include potential effect of secular trends, interview response rate of 50%, and potential recall errors on interview. In addition, there are several limitations specific to the asthma study. One involves possible errors in the identification of children who have asthma and classification by asthma severity. There is no single standard definition of asthma, and we adapted questions from the National Health Interview Survey to identify children who had asthma. Although it is possible that misclassification of asthma may have occurred and some children who had asthma may have been missed by the screening questions, this is unlikely to change the association between CHPlus coverage and asthma outcomes for children identified as having asthma. Furthermore, the prevalence of asthma was similar to that in the general population, suggesting that the screening questions accurately identified children who had asthma.

A related limitation is that it is difficult to determine asthma severity. Researchers frequently use receipt of medications or acute asthma visits as criteria for severity. However, those measures are outcomes that are likely to be affected by health insurance. Thus, parental report of the frequency and severity of asthma symptoms was used to designate mild versus moderate/severe asthma. It was not...
possible to determine asthma severity separately for the before-CHPlus and during-CHPlus study years for each child, and asthma severity may have changed between the 2 years. Because children whose asthma is moderate or severe are recommended to receive inhaled bronchodilators or anti-inflammatory medications and because that group was not defined with certainty, it was impossible to know precisely the proportion that should have received these medications. Thus, the relative proportions (before versus during CHPlus) are more important than the absolute numbers.

The study had a relatively small sample size (particularly for unusual outcomes such as hospitalizations); this is a reflection of the fact that asthma occurs in only about 5% to 9% of children. Because the sampling frame included all available subjects, it was not possible to increase the sample size within the 6-county study region.

Implications for Policy

The State Children’s Health Insurance Program (SCHIP) may provide health insurance coverage for millions of uninsured children across the United States, and state health insurance reforms may expand comprehensive coverage for additional children who are underinsured (Gauthier AK, Schrodel SP. State Initiatives in Health Care Reform: Expanding Children’s Coverage: Lessons From State Initiatives in Health Care Reform. May 1997. Unpublished report). Many of these uninsured or underinsured children have asthma or other chronic conditions. For other states that adopt health insurance programs similar to CHPlus, this study provides insight into the potential effects of these programs on access, utilization, and quality of care.

Children who have asthma experienced moderate improvements in patterns of health care utilization and in quality of care after enrolling in CHPlus. CHPlus resulted in greater involvement of primary care physicians in asthma care. Parents reported dramatic improvements in the quality of their children’s asthma care and even in the severity of asthma attributable to CHPlus, due to improved accessibility and affordability of health care services and asthma medications. Although several measures of quality of care were not improved, the overall positive impact on the lives of children appears to be substantial.

The findings suggest that health insurance coverage can enhance care for children with chronic conditions who lack insurance coverage, but that insurance by itself does not guarantee receipt of optimal quality of care. Intensive interventions targeted toward clinicians or toward patients will be needed in addition to appropriate health insurance coverage to optimize the quality of care for children who have chronic conditions such as asthma. Health insurance programs like CHPlus or SCHIP will facilitate these disease-specific interventions by relieving some of the financial barriers that are particularly burdensome for families of children who have chronic conditions.

ACKNOWLEDGMENTS

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Evaluation of New York State's Child Health Plus: Children Who Have Asthma

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