Can Universal Access to Health Care Eliminate Health Inequities Between Children of Poor and Nonpoor Families?*

A Case Study of Childhood Asthma in Alberta

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Study objectives: Children from poor families are much more likely to have emergency visits for asthma than those from nonpoor families, which may be related to financial access barriers to good preventive care for the poor. We sought to determine whether in a health-care system that provides free access to outpatient and hospital services, the disparities in the rates of emergency visits for asthma would be less apparent across the income gradient.

Design: Longitudinal, population-based study.

Setting: Alberta, Canada.

Participants: All children born in Alberta, Canada between 1985 and 1988 (n = 90,845) were classified into three mutually exclusive groups based on the reported annual income of their parents from the previous year: very poor, poor, and nonpoor groups.

Measurements and results: We compared the relative risk (RR) of emergency visits for childhood asthma among children of very poor, poor, and nonpoor families using a Cox proportional hazard model during a 10-year follow-up. We found that the very poor children were 23% more likely to have had an emergency visit for asthma than those from nonpoor families (RR, 1.23; 95% confidence interval [CI], 1.14 to 1.33), adjusted for a variety of factors. The poor group, however, had a similar risk of asthma emergency visits as the nonpoor group (RR, 0.97; 95% CI, 0.91 to 1.04). The average number of office visits for asthma was similar between the very poor and nonpoor groups.

Conclusions: In a setting of universal access to health care, children of poor and nonpoor families had similar rates of asthma emergency visits; the very poor children, however, continued to experience an excess risk. These findings suggest that a universal health-care system can reduce, but not fully eliminate, the disparities in emergency utilization of asthma across income categories.

Key words: asthma; emergency; poor; rates

Abbreviations: CI = confidence interval; FSA = forward sortation area; RR = relative risk; SES = socioeconomic status

Socioeconomic status (SES) is a powerful determinant of health outcomes and health-service utilization in the United States and elsewhere.1,2 Numerous studies1–5 have shown that individuals with low income bear a disproportionate burden of chronic illnesses and suffer worse health status and outcomes compared to high-income earners. The reason(s) for this remains largely a mystery.6 Increasingly, some believe that inadequate access to quality health care is the most important barrier to good health outcomes among the poor.7,8 In the United States, a vast

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majority of low-income families do not have any health-care coverage, and they lack access to important health services.9 Owing to their inability to pay, individuals without health insurance have fewer office visits for preventive and follow-up care,10,11 less continuity of care (even when they receive primary care),12 and decreased utilization of appropriate diagnostic and therapeutic ambulatory procedures.13 In turn, the uninsured have a larger number of unmet health-care needs,11 a greater dependency on emergency departments and hospitals for rescue care14 and increased overall morbidity and mortality from chronic illnesses.15,16 This has led some to speculate that access to health services is the primary determinant of health outcomes in society, and that by providing universal access to medical care the health effects of SES may be attenuated.7 Despite the logic, there is a paucity of data to indicate that improved access enhances health indicators such as a reduction in the frequency of rescue care in emergency departments.

Canada has a single-payer, publicly administered health-care system. In contrast to the United States and other industrialized nations, Canada does not have a parallel private health-care system.17 Under the Canada Health Act, the Canadian government ensures that all residents have equitable and uniform access to hospital and physician services; no cost-sharing is allowed for most services.17 If access to health care is indeed the centerpiece of ensuring similar health outcomes between the rich and the poor, the influence of SES on health indicators should be less apparent in the Canadian health-care system. This would be particularly so for ambulatory care-sensitive conditions such as childhood asthma.7

In this population-based, longitudinal study, we examined the rates of emergency visits for asthma in a group of children from families who are very poor, poor, or nonpoor in Alberta, Canada. We hypothesized that that since Canadian children, regardless of the ability to pay of their parents, have similar access to primary and preventive care, their use of emergency services should be similar across the socioeconomic gradient.

**Materials and Methods**

**Data Source**

We identified all live births occurring in Alberta, Canada between April 1, 1985, and March 31, 1988, using the Alberta Health Care Insurance Plan registry (n = 96,359). To make our cohort as homogeneous as possible, we excluded all children of aboriginal descent (n = 5,514). This registry contains information on sex, birth weight, gestational age of the infant, as well as data concerning mother’s age, marital status, area of residence, and history of prior pregnancies (if any). All children in the cohort were followed up until they were 10 years of age.

**Diagnosis of Asthma**

From the physician's claims database, we identified all physician encounters occurring in emergency departments for which asthma was the principal diagnosis during the study period. We used the International Classification of Diseases, Ninth Revision, Clinical Modification code 493.x to capture the asthma encounters.

**Classification of Personal and Area-Based SES**

The government of Alberta charges a small premium for health-care insurance for all its residents, prorated according to taxable income from the previous calendar year. Families with combined annual adjusted taxable income of ≤$7,500 are exempted from this fee, while families with annual incomes between $7,501 and $12,620 receive partial health-care premium subsidies from the government; families with an annual income >$12,620 pay the full rate.14 For this study, children from families receiving full subsidies were considered as “very poor,” partial subsidies as “poor,” and no subsidies as “nonpoor” groups. The very poor group also received social assistance from the provincial government, which allowed them to purchase prescription medications without cost-sharing. The poor group, however, received only partial government subsidies for prescription medications; thus, some cost-sharing for prescription medications was involved for this group of individuals.

Area-based measures of SES were determined by calculating the median income for each neighborhood area corresponding to the first three digits of the resident’s postal code (ie, forward sortation area [FSA]). This was done by merging the Alberta Health Care Insurance Plan registry with the 1996 official Canadian census data. This process identified 136 unique FSAs, with each FSA containing approximately 2,500 to 8,000 residents.

We then divided the neighborhoods into five equal categories (quintiles) according to the reported median family income of each FSA. The median income of quintile 1 was $38,515, of quintile 2 was $43,555, of quintile 3 was $50,064, and of quintile 5 was $67,703. The lowest median income of any FSA was $24,554.

**Statistical Analyses**

The rates of emergency visits among the very poor, the poor, and the nonpoor groups during the 10 years of follow-up were compared using a Cox proportional hazards model. In this model, we controlled for sex, birth weight, gestational age, area of residence (metropolitan vs nonmetropolitan), presence or absence of birth defects, and certain maternal factors such as history of multifetal pregnancies, maternal age, number of prior pregnancies, and marital status. Birth weight, gestational age, and maternal age were included as continuous as well as categorical variables. As there were no significant differences in the results, we chose to include these as categorical variables to achieve parsimony. Birth weight was dichotomized into normal weight (≥2,500 g) and low weight (<2,500 g) groups. Gestational age was categorized into normal (≥37 weeks) or premature (<37 weeks) groups. Maternal age was divided into ≤18-year-old, 19- to 34-year-old, and ≥35-years-old groups. Area of residence was divided into metropolitan (total populations ≥500,000) or nonmetropolitan centers (population <500,000). To increase the validity of the model, we used a group-corrected prognosis method for constructing the adjusted emergency visit rate curves.19 As there were some differences in the sociodemo-
graphic characteristics of the three groups, we performed a series of secondary analyses in various subgroups to determine the robustness and consistency of our main findings. We reasoned that confounding by baseline demographic factors should be less in these subgroups. All tests were two tailed in nature, and p values < 0.05 were considered significant. Continuous variables are shown as mean ± SD, unless otherwise indicated. All income data are presented in Canadian dollars.

Results

Sociodemographic Characteristics of Study Participants

There were 90,845 children in the study cohort. Of these children, 48.7% (n = 44,207) were female. The mean gestational age was 39.3 ± 1.8 weeks. The mean birth weight was 3,375.0 ± 536.9 g; 12.4% (n = 11,238) of the study children were born prematurely, while 11.6% (n = 10,527) had a low birth weight; 8.6% (n = 7,831) of the children were part of a multifetal pregnancy (i.e., twins, triplets, etc.). There were 3,495 children (3.8%) who had a congenital defect or anomaly at birth. A majority of the children (64.2%, n = 58,336), and 88.6% (n = 74,830) were born to married couples. The average maternal age of the study cohort was 27.2 ± 4.7 years. In total, there were 18,026 children (19.8%) in the poor group and 14,944 children (16.4%) in the very poor group. The rest were categorized into the nonpoor group.

The characteristics of children in the very poor, poor, and nonpoor groups are described in Table 1. Gender distribution was similar across the income categories. Children in the very poor category were more likely to have had low birth weight, experienced premature birth, and to have resided in single-parent families and in metropolitan areas than those in the poor or nonpoor groups. They were, however, less likely to have had birth defects or anomalies. There were no significant differences in the number of office visits for asthma between children in the very poor and nonpoor groups.

Income Class and Emergency Visits for Childhood Asthma

During the 10 years of follow-up, 5,935 children (6.5%) had at least one emergency visit for asthma. Emergency visits were most common in the very poor category (n = 1,171, 7.8%), while children in the nonpoor and poor groups had a similar risk of emergency visits (n = 3,665, 6.3% for the nonpoor; n = 1,099, 6.1% for the poor). Among children with at least one emergency visit, the median number (fifth to 95th percentiles) of office visits for asthma were 7 visits (0 to 34) in the nonpoor, 6 visits (0 to 31) in the poor, and 6 visits (0 to 31) in the very poor groups.

Crudely, children in the very poor group had a 25% higher rate of emergency visits than those in the nonpoor category (relative risk [RR], 1.25; 95% confidence interval [CI], 1.17 to 1.33). Similar rates were observed between children in the nonpoor and poor groups (RR, 0.96; 95% CI, 0.90 to 1.03). Adjustments for sex, maternal age, marital status, area of residence, birth weight, gestational age, number of prior pregnancies, and presence of birth defects and multifetal pregnancies made little difference to the overall findings. In this adjusted analysis, the very poor children were 23% more likely to have had an emergency visit for asthma than those in the nonpoor group (RR, 1.23; 95% CI, 1.14 to 1.33).

Table 1—Sociodemographic Features of Children Born in Alberta, Canada Between 1985 and 1988

<table>
<thead>
<tr>
<th>Features</th>
<th>Nonpoor</th>
<th>Poor</th>
<th>Very Poor</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of children</td>
<td>57,875</td>
<td>18,026</td>
<td>14,944</td>
<td>0.49</td>
</tr>
<tr>
<td>Women</td>
<td>28,198  (48.7)</td>
<td>8,775 (48.7)</td>
<td>7,234 (48.4)</td>
<td>0.005</td>
</tr>
<tr>
<td>Metropolitan residence</td>
<td>38,624  (66.7)</td>
<td>9,032 (50.1)</td>
<td>10,690 (71.5)</td>
<td>0.005</td>
</tr>
<tr>
<td>Gestational age</td>
<td>39.3 ± 1.7</td>
<td>39.3 ± 1.8</td>
<td>39.2 ± 2.0</td>
<td>0.005</td>
</tr>
<tr>
<td>Birth weight, g</td>
<td>3,391.7 ± 531.2</td>
<td>3,362.7 ± 537.3</td>
<td>3,295.3 ± 552.8</td>
<td>0.005</td>
</tr>
<tr>
<td>Birth defects</td>
<td>2,306 (4.0)</td>
<td>667 (3.7)</td>
<td>522 (3.5)</td>
<td>0.01</td>
</tr>
<tr>
<td>Multifetal pregnancies</td>
<td>978 (1.8)</td>
<td>255 (1.5)</td>
<td>224 (1.8)</td>
<td>0.75</td>
</tr>
<tr>
<td>Low birth weight</td>
<td>5,068 (8.8)</td>
<td>2,042 (11.3)</td>
<td>3,417 (22.9)</td>
<td>0.005</td>
</tr>
<tr>
<td>Premature births</td>
<td>5,357 (9.60)</td>
<td>2,196 (12.2)</td>
<td>3,485 (23.3)</td>
<td>0.005</td>
</tr>
<tr>
<td>Maternal age</td>
<td>28.0 ± 4.3</td>
<td>26.5 ± 4.8</td>
<td>24.5 ± 4.9</td>
<td>0.005</td>
</tr>
<tr>
<td>Single-parent families‡*</td>
<td>2,928 (5.3)</td>
<td>1,876 (11.2)</td>
<td>4,837 (39.1)</td>
<td>0.005</td>
</tr>
<tr>
<td>Prior pregnancies</td>
<td>1.9 ± 0.9</td>
<td>2.2 ± 1.3</td>
<td>2.1 ± 1.2</td>
<td>0.005</td>
</tr>
<tr>
<td>Office visits for asthma‡*</td>
<td>0.0 (0.0, 0.3)</td>
<td>0.0 (0.0, 0.1)</td>
<td>0 (0 to 0.2)</td>
<td>0.46</td>
</tr>
</tbody>
</table>

*Dichotomous data are presented as no. (% column totals); continuous data are presented as mean ± SD, unless otherwise indicated.
‡Very poor vs non-poor groups.
*There were 6,374 missing data.
§Geometric mean (95% CI).
Similar to the crude analysis, the adjusted RR for the poor group compared to the nonpoor group was 0.97 (95% CI, 0.91 to 1.04).

Other factors associated with increased emergency visits for asthma are shown in Table 2. Male sex, birth into single-parent families, presence of a birth defect, low birth weight, prematurity, and first pregnancies all significantly increased the risk of emergency visits.

Secondary Analysis

We performed a series of secondary analysis to determine the robustness of our findings. In all secondary analyses, we used a Cox proportional model that controlled for sex, birth weight, gestational age, area of residence (metropolitan vs nonmetropolitan), presence or absence of birth defects, and certain maternal factors such as history of multifetal pregnancies, maternal age, number of prior pregnancies, and marital status. Across all strata, the associations observed in the primary analysis were present. For instance, among children residing in metropolitan areas, the very poor group had a 31% higher rate for asthma emergency visits than the nonpoor group (RR, 1.31; 95% CI, 1.19 to 1.43); the poor group, however, had similar rates as the nonpoor group (RR, 1.02; 95% CI, 0.92 to 1.12) [Fig 1]. Among full-term children, the very poor group had a higher rate of emergency visits for asthma (RR, 1.23; 95% CI, 1.13 to 1.33) but not among the poor group (RR, 0.98; 95% CI, 0.91 to 1.05). Similarly, among full-weight children, the very poor group had an elevated risk (RR, 1.23; 95% CI, 1.14 to 1.37) but the poor group did not (0.98; 95% CI, 0.91 to 1.05). Among girls, the very poor had an RR of 1.43 (95% CI, 1.26 to 1.63) and the poor had an RR of 1.04 (95% CI, 0.93 to 1.17). Among boys, the very poor had an RR of 1.14 (95% CI, 1.03 to 1.26) and the poor had an RR of 0.94 (95% CI, 0.86 to 1.02).

**Table 2—Factors Associated With Emergency Visits for Childhood Asthma**

<table>
<thead>
<tr>
<th>Factors</th>
<th>Adjusted RR*</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Women</td>
<td>0.57</td>
<td>0.54–0.60</td>
</tr>
<tr>
<td>Single-parent families</td>
<td>1.14</td>
<td>1.04–1.23</td>
</tr>
<tr>
<td>No birth defect</td>
<td>0.84</td>
<td>0.75–0.95</td>
</tr>
<tr>
<td>Low birth weight</td>
<td>1.27</td>
<td>1.11–1.44</td>
</tr>
<tr>
<td>Prematurity</td>
<td>1.26</td>
<td>1.12–1.42</td>
</tr>
<tr>
<td>Maternal age &lt; 18 yr</td>
<td>0.84</td>
<td>0.71–1.00</td>
</tr>
<tr>
<td>Maternal age &gt; 35 yr</td>
<td>0.98</td>
<td>0.88–1.01</td>
</tr>
<tr>
<td>Prior pregnancies</td>
<td>0.50</td>
<td>0.72–0.90</td>
</tr>
<tr>
<td>Residence in metropolitan</td>
<td>0.99</td>
<td>0.94–1.05</td>
</tr>
<tr>
<td>centers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Area-based SES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quintile 1 (poorest)</td>
<td>0.90</td>
<td>0.82–0.97</td>
</tr>
<tr>
<td>Quintile 2</td>
<td>0.96</td>
<td>0.89–1.04</td>
</tr>
<tr>
<td>Quintile 3</td>
<td>1.06</td>
<td>0.98–1.15</td>
</tr>
<tr>
<td>Quintile 4</td>
<td>0.98</td>
<td>0.82–0.97</td>
</tr>
<tr>
<td>Quintile 5 (richest)</td>
<td>1.0 (reference)</td>
<td></td>
</tr>
</tbody>
</table>

*All the factors have been adjusted for sex, birth weight, gestational age, area of residence, presence of birth defects, and certain maternal factors (eg, history of multifetal pregnancies, maternal age, no. of prior pregnancies, and marital status).

**Discussion**

In this large, population-based study of children, we found no significant association in the rate of emergency visits for childhood asthma between the poor and the nonpoor groups in Alberta. The very poor group, however, had a slightly higher rate of emergency visits than the rest of the population, adjusted for a variety of different factors.

Our findings need to be interpreted in the context of the Canadian health-care system. Unlike the United States, all Canadian residents have universal access to hospital and outpatient physician services regardless of their ability to pay. While prescription medications are excluded from the public health-care system, the very poor and the poor groups receive government assistance for drug coverage, which makes it possible even for those in poverty to receive appropriate ambulatory care for chronic illnesses. Since even small co-payments for health services discourage preventive and follow-up care, as well as utilization of diagnostic and therapeutic procedures, it is tempting to speculate that a universal health-care system, which minimizes out-of-pocket expenses, may be, at least partially, responsible for the lack of observed differences in emergency visit rates for childhood asthma between the poor and nonpoor groups in our study. However, our data also indicate that even within such a health-care system, some disparities in health-service utilization persist among the very poor group. This suggests that there are factors other than access that may be contributing to increased emergency service utilization among those in extreme poverty. These may include poor health habits, crowded living conditions, inconsistent patterns of immunization and prenatal care, obesity, substandard nutrition, and poor physical fitness among children of the lowest socioeconomic stratum.

Similar to prior reports, the very poor children in our study were more likely to have had low birth weights, experienced premature births, and have resided in single-parent families than the poor or the nonpoor children, elevating their risk for severe childhood asthma. Interestingly, the poor children also had many of these risk factors (but not to the same magnitude as those in the very poor group),

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yet their risk for emergency or office visits was no different than that of the nonpoor group.

Our findings are also consistent with several reports showing the importance of access to health care in the United States. Newacheck et al\(^{10}\) showed that uninsured compared to insured children were six times less likely to have an usual source of care and five times less likely to receive needed (ambulatory) care. Uninsured children also have three times the rate of unmet medical needs as children with health-care insurance.\(^{25}\) Improvements in health-care coverage through Medicaid resulted in increased utilization of appropriate health services, improved continuity of care, and decreased frequency of unmet health needs.\(^{26}\) While the study by Newacheck et al\(^{26}\) did not specifically address childhood asthma, improvements in these health indicators should, in theory, decrease reliance on emergency departments for rescue care.

As with most observational studies, confounding by external factors is a major concern for our study. To minimize this possibility, we used multivariate methods to adjust for differences in baseline sociodemographic and maternal factors in our analysis. Moreover, we performed a series of subgroup analyses. It was reassuring that the main findings were consistently present regardless of the way in which the data were analyzed. We did not have data concerning social conditions or health habits of the study participants or their parents, which is a limitation of this study. We also did not have patient information concerning why patients used the emergency departments for asthma. A previous report indicates that up to 20% of emergency department visits are for “nonurgent” care, suggesting that in some instances emergency departments are being used as sites of primary care.\(^{27}\) A lack of information on time of emergency admission and precise reasons for the emergency visit is a limitation of this study. We also did not have data concerning other common childhood illnesses. Thus, it is uncertain whether the findings from asthma apply to other conditions. Although it was reassuring that the rates of childhood asthma between areas of lowest income quintile and highest quintile were similar, because our databases did not contain personal income information of the nonpoor families we could not fully evaluate the potential role of income on asthma rates within the nonpoor category.

Continued rise in asthma prevalence, morbidity, and mortality in children from poor and very poor families remain a major public health concern.\(^{28}\) In
the Canadian system, the rates of emergency care for asthma are similar in 84% of the childhood population, suggesting only small differences in emergency department utilization across the income gradient. Among the very poor group, nonaccess factors may be contributing to the small excess risk in emergency utilization for childhood asthma. Future studies are, however, needed to determine their relative contributions to asthma morbidity and mortality in children in the United States and elsewhere.

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