ELSEVIER

Prematurity as a Predictor of Childhood Asthma among Low-Income Children

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PURPOSE: The purpose of this study was to evaluate the association among birth weight, prematurity, and the prevalence of asthma later in childhood and to assess the degree to which this association may differ between black and white children.

METHODS: Michigan Medicaid claims data from 2001 through 2003 were analyzed to determine asthma prevalence for 150,204 children between ages 5 and 18 years. Asthma cases were identified using Healthcare Effectiveness Data and Information Set persistent asthma criteria and included children having claims for any of the following services within a calendar year: at least one inpatient or one emergency department (ED) claim with an asthma primary diagnosis; at least four asthma medication–dispensing events; or at least four outpatient visits with an asthma diagnosis, and at least two asthma medication–dispensing events. Birth weight and gestational age from birth certificate data were matched with Medicaid files to determine size-for-gestational-age criteria.

RESULTS: Overall, 8.3% of children had persistent asthma; black children had slightly higher asthma prevalence (8.6%) than white children (7.8%; odds ratio [OR] = 1.11, 95% confidence interval [CI]: 1.07–1.15). Children born very preterm (≤32 weeks) had higher prevalence of childhood asthma (11.7%) compared with term births (8.0%; OR = 1.51, 95% CI: 1.40–1.63). However, no significant differences were observed in odds of asthma between black and white children born very preterm, preterm (33–36 weeks), or small for gestational age (SGA).

CONCLUSIONS: Regardless of race, children born very preterm had an increased risk of childhood asthma. Although overall asthma prevalence is higher among black children enrolled in Medicaid compared with their white counterparts, these differences were attenuated when prematurity or SGA status were taken into account.

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KEY WORDS: Asthma, Prematurity, Medicaid, Prevalence, Risk.

INTRODUCTION

Asthma is a serious chronic illness affecting more than 6 million children in the United States (1). The health services burden of asthma is substantial, accounting for more than 700,000 emergency department (ED) visits and nearly 200,000 hospitalizations among children annually (2). Over the past two decades the prevalence of asthma among children in the United States has increased, especially among minority populations (3), although the causes of this increase remain unclear (4). Asthma prevalence and health services use are disproportionately high for non-Hispanic black children compared with white children, including higher rates of ED use, hospitalizations, and mortality (2, 5–10).

The underlying root of these differences appears to be associated with multiple factors including lower socioeconomic status (8, 11), urban residence (8, 12) and a range of related environmental characteristics (11, 13, 14). In addition, there is increasing evidence suggesting that improved survival rates among premature infants may have long-lasting implications in terms of reduced lung function. Birth characteristics such as low birth weight (LBW) (9, 10, 15–19) and prematurity (18–24) have been associated with asthma later in life. At the same time, substantial differences in birth weight and prematurity exist between race and ethnic groups. For example, black infants have rates of prematurity and very LBW that are two- to three-fold that of white infants (25, 26). Although birth weight is closely related to gestational age, substantial classification differences may occur when prematurity risk categories are established strictly on the basis of birth weight rather than gestational age. For example, fewer than 70% of infants who are LBW (<2,500g) are also considered preterm (<37 weeks' gestation); conversely, half of preterm infants are also considered

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Selected Abbreviations and Acronyms

AGA = appropriate for gestational age
CI = confidence interval
ED = emergency department
HEDIS = Healthcare Effectiveness Data and Information Set
LBW = low birth weight
LGA = large for gestational age
MDCH = Michigan Department of Community Health
OR = odds ratio
SGA = small for gestational age

LBW (27). Some infants classified as LBW may have birth weights regarded as being appropriate for gestational age (AGA) when their shorter duration of gestation is taken into account, whereas another infant born after the same duration of gestation may have a sufficiently LBW to be considered small for gestational age (SGA). An infant's size for gestational age may have different effects on their risk of developing asthma later in life, although few studies have taken this factor into consideration (24, 28).

Given the elevated prevalence of asthma among racial minorities and the reported associations among birth weight, prematurity, and race, we wished to better understand the risks of childhood asthma, taking these potentially confounding effects into account. Importantly, the distinctions between birth weight, gestational age, and size for gestational age may offer additional insight into understanding the disproportionate prevalence of asthma across race and ethnic groups, such as the higher prevalence of asthma among blacks (9, 16). The objectives of this study were to evaluate the association between gestational age and the prevalence of asthma later in childhood among low-income children and to assess the degree to which this association may differ between black and white children.

METHODS

This study is based on an analysis of administrative claims data from the Michigan Medicaid program and was approved by the University of Michigan and Michigan Department of Community Health (MDCH) Institutional Review Boards.

Study Population

A total of 199,027 children between 5 and 18 years of age were continuously enrolled in the Michigan Medicaid program during 2001–2003 with no other source of health insurance. Children younger than 5 years were excluded since the diagnosis of asthma is difficult for very young children and administrative claims records may not reliably reflect persistent asthma cases for young children (29). Medicaid program eligibility status, race, and other demographic characteristics were obtained from MDCH administrative data files. The MDCH Vital Statistics Branch matched birth certificate data from electronic files based on an algorithm used extensively by vital records officials (30).

Birth Characteristics

Birth certificate data available for matching with Medicaid beneficiary data included birth weight (measured in grams) and gestational age (reported on the birth certificate; calculated as the number of weeks from date of mother's last menses to child's date of birth). Birth weight was classified as low (<2500 g), normal (2,500–4,500 g), and high ($>4,500$ g). Gestational age was measured in weeks and was classified as very preterm ($\leqslant 32$ weeks), preterm (33–36 weeks), term (37–41 weeks), and post-term ($\geqslant 42$ weeks). Birth certificates with extreme weight or gestational age values based on criteria used by the MDCH Vital Statistics Branch and accepted practice were excluded from this analysis. Births meeting the following gestational age and birth weight criteria were identified and excluded from further analysis: >32 weeks and <500 g; >42 weeks and <1500 g; >46 weeks and <2250 g; <20 weeks and >2000 g; or <24 weeks and >4000 g.

Although national norms for size for gestational age are available by race (31, 32), our study was specifically focused on low-income children. Consequently, we developed race-specific size for gestational age criteria from a Medicaid beneficiary population to restrict our norms to children of similar sociodemographic backgrounds. Size for gestational age was determined from matched records using birth weight and gestational age using a methodology consistent with previous studies (33). We determined the distribution of birth weights by race within each gestational age week and then established the lower and upper 10th percentile birth weights. These criteria were applied to classify birth weights into one of three size-for-gestational-age categories: $\leqslant$10th percentile, SGA; $>$90th percentile, large for gestational age (LGA); birth weights between these points were classified as AGA.

Outcomes Measured

Asthma cases were identified in each of the three study years using Michigan Medicaid administrative claims data. The Healthcare Effectiveness Data and Information Set (HEDIS) case definition for persistent asthma is used extensively by Medicaid and commercial health plans as well as in asthma outcomes studies (29, 34–36). Under HEDIS criteria, a person is identified as having persistent asthma based on having any of the following health services use in a year: (1) at least four asthma medication–dispensing events, (2) at least one visit to an ED where the primary diagnosis was asthma, (3) at least one visit to the hospital where the primary diagnosis was asthma, or (4) at least 4 outpatient visits where the primary diagnosis was asthma and at least 2 asthma medication–dispensing events. In this study,