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Examination of Racial Disparities in Childhood Asthma Management Practices

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Abstract

Objective: To analyze asthma management plan practices for children with asthma in the United States considering race and other demographic and person-level characteristics. Methods: Univariate/Bivariate/Multivariate analysis was performed to examine asthma management plan physician recommendations among children in the United States utilizing secondary data analysis of the 2002 and 2003 National Health Interview Survey. Results: The majority of the study participants reported not having an asthma management plan at (59.00%). In multivariate analysis using SAS callable SUDAAN, Whites were significantly more likely to have an asthma management plan (OR=1.66, p=.0031). Conclusion: Findings from this study indicate that Black and Hispanic children with asthma are less likely to have an asthma management plan. Mandating all insurers to provide an asthma management plan to children with asthma may reduce the race-based inequities and requiring emergency room physicians to provide children with an asthma management plan may target those children that do not have a plan.

Key Words: public health, asthma, racial disparities, adolescent health services, health services

Introduction

In the United States asthma affects approximately five million children.1 Asthma not only impacts school absence in children; it is also the leading cause of hospitalizations and emergency department visits. More importantly, asthma can lead to death. Asthma mortality rates in the United States

have increased within the last decade. From 1980-1993, hospitalizations due to asthma increased by 27% (from 16.8 to 21.4 per 10,000) among individuals age 0-24.2 Based on a study conducted by Mannino et al. (2002) in the United States from 1992-1999 there was a 14% increase in the amount of children less than the age of fourteen, that had an emergency department visit due to asthma.2

Asthma disparities continue to persist. Asthma creates a burden on racial and ethnic minorities and low-income children.3 In a study conducted by Quinn et al. (2006) non-Hispanic Blacks were twice as likely to have undiagnosed asthma as non-Hispanic Whites and Hispanics.4 Several national studies have documented disparities in childhood asthma among Black and White children which has increased since the 1980's.5 Black children also have a higher prevalence of asthma, and are four times more likely to be hospitalized for asthma complications.6

Negative asthma related outcomes are largely preventable.7 The National Heart, Lung, and Blood Institute (NHLBI) developed recommendations for physicians to provide individuals with asthma guidelines to improve the home management of asthma exacerbations which included having a written asthma action plan with information on what to do at home, when to call the clinician, and when to seek emergency care. An asthma management plan is a document tailored specifically for the child where the health care provider, along with the child and family, develop an action plan to assist in managing asthma episodes.8

Asthma management plans are integral for effective treatment of asthma.9 Asthma management plans are associated with reduced morbidity and hospitalizations and increased quality of life.10 Prior studies have found that Black children are more frequent users of reliever medications and not control therapies .11

This study analyzed asthma management plan practices for children with asthma in the United States considering race and other demographic and person-level characteristics.

Methods

Theoretical Framework: Symptom Management Model

The occurrence of symptoms is the most common reason millions of patients seek health care each year. The initial sign of symptoms brings the problem to the attention of the patient and the primary care provider. Asthma patients who have a recommended asthma management plan may understand the early warning signs of symptoms. Toward that end, people with an asthma management plan may be able to alleviate potential negative

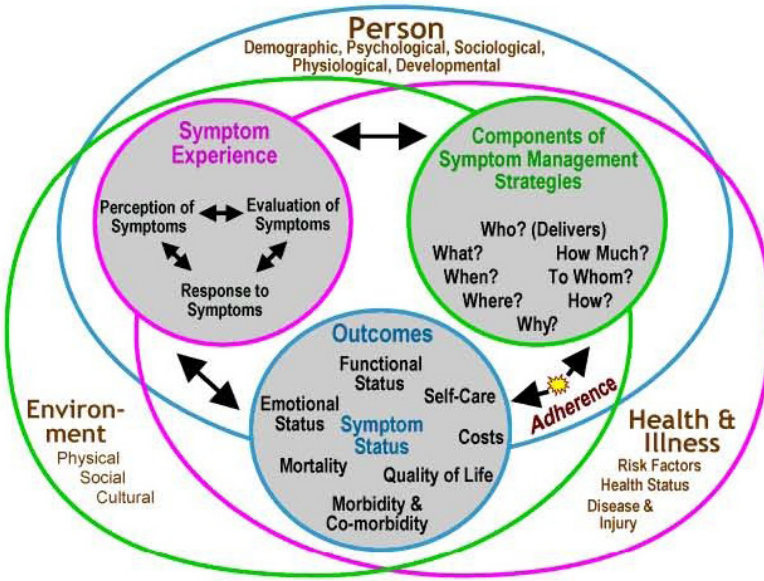
outcomes of an asthmatic episode. Symptoms are not only a major complication for the individual that has an asthma episode, but the management of symptoms is also a tremendous issue and responsibility.12

The University of California San Francisco Symptom Management Model (Model 1) along with Aday and Andersen's Access to Health Services (Model 2) were the frameworks used to examine asthma management and outcomes regarding disease symptom experience and management. (See Figure 1 & 2) In particular, these models provided a framework for having an asthma management plan and its impact on asthmatic episodes. The domains of Model 1 include: person, health/illness, and environment act as contextual variables that influence the three dimensions of the model which include: symptom experience, management strategies, and outcomes. The person domain is comprised of demographic, psychological, sociological, physiological, and developmental variables. For example, racial/ethnic minority and poor children in the United States are negatively impacted by the burden of asthma.13 The domain of health and illness consist of risk factors, injuries, or disabilities that are related to the health or illness state of an individual. Risk factors to consider from the health and illness domain are environment, which is a common reason for hospitalizations and morbidity due to asthma and asthma is more prevalent in inner city children.14

In the symptom experience, an individuals perception of a symptom, evaluation of the symptom, and response to the symptom are considered important in successful symptom management.12 A perception of a symptom can be positive or negative and include multiple perceivers. For example, an asthmatic child that begins wheezing and coughing will perceive respiratory distress and the parent perceives the child's distress and attaches to the perception.15 The evaluation of a symptom includes its intensity, location, nature, frequency, and affective impact. As illustrated in a study, over eight-six percent of acute asthma patients reported delay of treatment due to disruption of social situation or expectations.16

The outcomes and symptom dimensions of the model encompasses functional status, costs, self-care, emotional status, mortality, morbidity/co-morbidity, and quality of life. For example, practices that support early interventions for asthma, particularly with written asthma management plans have a direct relationship with a reduction in adverse outcome among children with asthma.17 This study examined the components of the Symptom Management Model as it relates to asthma management plan status and episodes among children. The symptom management model is a framework for understanding symptoms, designing strategies, and evaluating outcomes.

Figure 1. Symptom Management Model



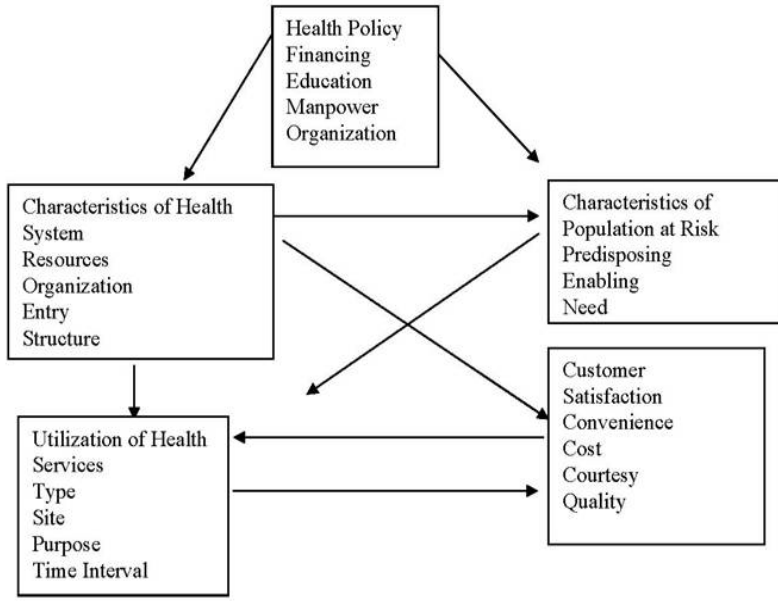
Theoretical Framework: Aday and Andersen's Access to Health Services

Having adequate access to health care is also a challenge for vulnerable populations, especially low-income minority children. Model 2 is a framework for understanding access to care. This framework was used in this study to identify predictors and determinants of access to appropriate health care services, specifically recommendations of an asthma management plan by physicians. There are several different components that influence individuals to access appropriate health care services.

According to this model access to health care is not just the utilization of health care services, but whether the patient perceives the services obtained as medically necessary.18 Model 2 suggest that an individuals use of health services simply does not include structural changes and service utilization, but it is a function of predisposing factors (i.e. race, age, gender); enabling factors (i.e. income level, education level, insurance coverage); and need (asthma/asthma related symptoms) to determine how a patient accesses and utilizes health care services. The predisposing variables in this study include: age (< 5 and 5-17), race (Hispanic, Non-Hispanic White, Non-Hispanic Black), gender, and health status (better, worse, about the same). The enabling factors include: income status, parental education, insurance coverage, region,

general doctor visit in the past twelve months, and respiratory therapist visit in the past twelve months. The need factors are the condition for which health care services are sought which include: current asthma status, advised to change environment for asthma, asthma episode in the past twelve months, ever taken preventive asthma medications, emergency department visit due to asthma, and ever given an asthma management plan.

Figure 2. Framework for Study of Access Aday and Andersen



Study Variables

This study is a retrospective study and secondary data analysis of the 2002 and 2003 National Health Interview Survey (NHIS).19 The independent variables are age, race, gender, parental income, region, parental education, health status, health care utilization, source of health care, and health insurance coverage, and the outcome variable is having an asthma management plan.

Data Management

The data was initially processed with Statistical Analysis Software 8.2 (SAS Institute, Inc, Cary, NC).20 The data was further analyzed using SAS callable

SUDAAN to account for the complex multistage sampling design of the NHIS (Research Triangle Institute, Research Triangle Park, NC).21 Each individual year of data was merged to create a final combined dataset using only the variables of interest. The variables in the study are categorical. If the response to a question included, "Don't Know or Refused" responses were set to missing. Institutional Review Board exemption from the University of South Carolina has been granted.

Statistical Data Analysis

Parametric testing using Univariate/Bivariate/Multivariate analysis was performed to examine asthma management plan physician recommendations among children in the United States. The unit of analysis for the evaluation of the hypothesis was having an asthma management plan. In preliminary analysis, frequency distributions and univariate statistics were measured to describe the population (PROC FREQ in SAS). The chi square test statistic was used to test for independence between age, race, gender, income, region, parental education, health status, health care utilization, health insurance coverage, and asthma management plan status. Distribution of variables according to age, race, gender, income, region, parental education, health status, health care utilization, health insurance coverage, and asthma management plan status are presented with p-values and proportions with 95% confidence intervals (CI) and odds ratios (OR).

Bivariate analyses were used to compare asthma management plans and asthmatic episodes with the independent variables using the Chi Square statistics test. The bivariate statistics provided the first indication of the differences and associations between the variables. Multivariate analysis for each outcome variable was used to adjust for other demographic factors and dichotomous variables. The estimates produced in this study were weighted to present the United States population and to adjust for potential survey response bias. For all analysis statistical significance was set at $P<.05$.

The fitting of the multivariate models was based on empirical and conceptual considerations. Each model was adjusted for race, age, gender, health insurance status, and health care utilization. The theoretical framework presented in Model 1 that includes person, health and illness, and environment was used to determine which variables to include in the model. The framework proposed by Model 2 was replicated to decide which variables to consider in the model by including: predisposing, enabling, and need variables in the multivariate models.

The partial t-test in each model was considered. The partial t-test was taken into consideration with the presence of other variables in the model. When the partial t-test was significant (p-value<alpha value) the null hypothesis was rejected, and it was assumed that the variable was needed in the model, given that the other variables are present. When the partial t-test was not significant (p-value>alpha value) indicates that the variable is not needed in the model, given that the other variables are present. The model was then rerun without the variable that was not significant. The variables that were not significant were removed one at a time to simplify the model. To construct efficient models, stepwise regression procedure was used to identify demographic predictors for each outcome. In the stepwise regression procedure all variables were considered and then removed if the p-value>.05.

Results

Using SAS, descriptive statistics were obtained from the National Health Interview data on 0-17 year old children with asthma in the United States. The 2002 and 2003 original weighted sample population consisted of approximately 13,000 children, and a subset of the data were used to account for the 3,102 children identified as having asthma based on the question in the survey (Has a doctor or other health professional ever told you that your child has asthma?) and then a follow-up question (Does your child still have asthma?) led to a final study population of 2,110 children.

The study population included Hispanic (22.92%), Non-Hispanic White (50.96%), and Non-Hispanic Black (26.12%) children. The gender distribution of the children was male (57.11%) and female (42.89%). The percentage of children under five years of age was (28.90%), and for children five to seventeen years of age was (71.10%). Among the children in the sample population participants identified their family income as $65,000 and over (29.58%), $45,000-$64,999 (14.82%), $25,000-$44,999 (24.56%), and $15,000-$24,999 (14.08%), $01-$14,999 (16.96%). The majority of the parents in this study identified their highest level of education as a high school graduate/GED recipient, Mom (29.01%), and Dad (30.28%). The proportion of the study population that was located in the Northeast region was (21.23%), Midwest (22.70%), South (36.30%), and West (19.76%). The percentage of children with asthma that had private insurance was (53.59%), Medicaid (25.49%), CHIP (4.90%), Tricare (1.76%), and Uninsured (6.85%).

The majority of the study participants reported not having an asthma management plan at (59.00%). Among the children in this study the

majority of them were provided services from a general doctor in the past twelve months (87.93%). Those who reported ever using preventive asthma medications were (57.19%). Half of the participants in this study at (50.96%) reported being advised to change their environment due to their asthma. Overall the study population reported their health status to be better (40.03%), worse (4.32%), or about the same (55.65%). (See Table 1)

Table 1: Demographic Characteristics of Children with Asthma (n=2110) 2002-2003

Characteristics	Frequency (n)	Percentage (%)
Race		
White	1036	50.96%
Black	531	26.12%
Hispanic	466	22.92%
Total	2033	100%
Age		
Under 5 Years of Age	633	28.90%
5 to 17 Years of Age	1477	71.10%
Total	2110	100%
Income		
$01-$4,999	277	29.58%
$15,000-$24,999	230	14.82%
$25,000-$44,999	401	24.56%
$45,000-$64,999	243	14.08%
$65,000 and over	483	16.96%
Total	1633	100%
Education (Mother)		
No high school diploma	327	16.91%
High school graduate, GED	561	29.01%
Some college, no degree	442	22.85%
Associate Degree	233	12.05%
Bachelor's degree and above	371	19.18%
Total	1934	100%
Education (Father)		
No high school diploma	232	17.87
High school graduate, GED	393	30.28
Some college, no degree	235	18.10
Associate Degree	107	8.24
Bachelor's degree and above	331	25.50
Total	1298	100%

Characteristics	Frequency (n)	Percentage (%)
Region		
Northeast	448	21.23%
Midwest	479	22.70%
South	766	36.30%
West	417	19.76%
Total	2110	100%
Insurance Status		
Private	1193	55.59%
Medicaid	561	25.49%
Tricare	37	1.76%
Uninsured	191	6.85%
Total	2110	100%
Health Status		
Better	843	21.23%
Worse	91	22.70%
About the Same	1172	36.30%
Total	2110	100%
General Doctor Visits in the Past Twelve Months		
Yes	1850	87.93%
No	254	12.07%
Total	2104	100%
Use of Preventive Asthma Medications in the Past Twelve Months		
Yes	1201	57.19%
No	899	42.81%
Total	2110	100%
Advised to Change Environment Due to Asthma		
Yes	1040	50.96%
No	1001	49.04%
Total	2041	100%
Provided an Asthma Management Plan		
Yes	850	41.00%
No	1223	59.00%
Total	2073	100%

In the bivariate analysis using SAS callable SUDAAN marginal statistical significance was found in the logistic regression model where White children were more likely to report having an asthma management plan compared to Black and Hispanic children (OR=1.25, p=.0648). In this study children that experienced an asthma episode in the past twelve months were less likely to have an asthma management plan (OR=.51, p<.0001). Children in this study who were advised to change their environment due to their asthma conditions were less likely to have an asthma management plan (OR=.27, p<.0001). Children with an asthma management plan were less likely to report not using preventive asthma medications (OR=.21, p<.0001). (Table 2)

Table 2: Characteristics of Children with an Asthma Management Plan (Bivariate)

Characteristics	Odds Ratio	95% CI	P Value
Race			
White	1.25	(0.99, 1.57)*	.0648*
Black	1.00	(1.00, 1.00)	
Hispanic	0.96	(0.72, 1.27)	
Asthma Episode			
Yes	0.51	(0.42, 0.63)*	<.0001*
No	1.00	(1.00, 1.00)	
Advised to Change Environment Due to Asthma			
Yes	0.27	(0.22, 0.33)*	<.0001*
No	1.00	(1.00, 1.00)	
Use of Preventive Asthma Medications			
Yes	0.21	(0.17, 0.25)*	<.0001*
No	1.00	(1.00, 1.00)	

In multivariate analysis using SAS callable SUDAAN, Whites were significantly more likely than Blacks and Hispanics to have an asthma management plan (OR=1.66, p=.0031). In this study, children who were advised to change their environment due to their asthma condition were less likely to have an asthma management plan (OR=.32, p<.0001). Children who were using preventive asthma medications were significantly less likely to have an asthma management plan (OR=.22, p<.0001). Children with an asthma management plan were less likely to experience an asthma episode in the past twelve months (OR=.60, p<.0001). (See Table 3)

Table 3: Characteristics of Children with an Asthma Management Plan (Multivariate)

Characteristics	**Odds Ratio**	**95% CI**	**P Value**
Race			
White	1.25	(0.99, 1.57)*	.0648*
Black	1.00	1.00, 1.00	
Hispanic	0.96	(0.72, 1.27)	
Advised to Change Environment Due to Asthma			
Yes	0.27	(0.22, 0.33)*	<.0001*
No	1.00	(1.00, 1.00)	
Use of Preventive Asthma Medications			
Yes	0.21	(0.17, 0.25)*	<.0001*
No	1.00	(1.00, 1.00)	
Asthma Episode in the Past Twelve Months			
Yes	0.51	(0.42, 0.63)*	<.0001*
No	1.00	(1.00, 1.00)	

Discussion

Health disparities continue to persist in the United States and the reasons are not well understood. To our knowledge, this is the first study to examine quantitative evidence concerning the relationship between race and other demographic characteristics and the rates of asthma management plans that will help answer the question regarding inequities. This study sought to examine the disparities in having an asthma management plan and one or more asthmatic episodes adjusting for race and demographic characteristics. The study findings support the hypotheses. Findings from this study indicate that Black and Hispanic children with asthma are less likely to have an asthma management plan.

In the bivariate analysis White children were 25% more likely than Black and Hispanic children to have an asthma management plan after controlling for the child's and parental characteristics. In the multivariate analysis, Black and Hispanic children were still less likely to have an asthma management plan compared to White children (OR=1.66, p=.0031). Moreover minority children have a substantially greater likelihood of not having an asthma management plan. Children with an asthma management plan were less likely to have one or more asthma episodes in the past twelve months (OR=.6, p=.0002). These findings suggest that reduction in negative outcomes of asthma is potentially possible if children are provided the recommended asthma management plan. The disparities of asthma management plan practices found in this study are comparable to those observed in a study conducted by Simon et al. (2003) that found documented disparities in childhood asthma.5

The results of this study found that person level demographics of age, sex, and race were significant variables that have a relationship between asthma management and outcomes. Consistent with findings from other studies, this study found that parental characteristic (i.e. education, insurance status, and income), are factors that impact a child's asthma outcomes and ability to obtain an asthma management plan. Parents inappropriate response to asthma symptoms within the past two decades, and especially among minority children have increased doctor visits, hospitalizations, emergency room visits, and asthma episodes.14 Within this study children without an asthma management plan were more likely to have negative outcomes due to their asthma status.

Within this study, symptom experience or the reaction to symptoms is based on the child's asthma management plan recommendations. Those children without an asthma management plan (i.e. Blacks and Hispanics)

may be less likely to know how to properly respond to asthma symptoms and episodes. Also in this study children with an asthma management plan were more likely to have been advised to change their environment due to their asthma, and less likely to have an asthma episode in the past twelve months. Considering symptom status a large percentage of children in this study had experienced an asthma episode in the past twelve months. Of the children that reported experiencing an asthma episode, they were less likely to have an asthma management plan. In this study children with asthma that reported ever taken preventive asthma medications reflected the child's self-care abilities. The majority of the children in this study reported their quality of life as "about the same".

In this study the majority of asthmatic children lived in the South. Physical environment is thought to play a unique and important role in the control of asthma, and a large proportion of children in the South and Midwest live in rural areas compared to children in the Northeast and West, and literature shows these children have marked disadvantages which include limited access to health care as a result of geographic barriers, distance to site, and availability of transportation.22

Strengths of this study include the utilization of the National Health Interview Survey provided a large nationally representative sample, as well as instrument accuracy and reliability was a major strength of this study. The use of SUDAAN for all data analysis increased the preciseness and validity of the study results. Potential limitations of the study are that it is limited based on its reliance solely on parental reporting of the asthma status of the child without analyzing medical records, which could lead to a potential over-estimation or under-estimation bias. Another potential limitation is the parent recall of health care visits for their child without confirmation of the medical records. Future studies will have to consider these limitations in order to better assess asthma management plan recommendations for children with asthma.

Policy Implications

Despite the many medical milestones and accomplishments of the American medical system, there is still a disproportionate amount of health disparities that exist, and this issue is a major health policy priority. Mandating all insurers to provide an asthma management plan to children with asthma may reduce the race-based inequities related to having an asthma management plan. Requiring emergency room physicians to provide children with an asthma management plan at the end of their visit for an asthmatic episode

may improve appropriate self-management and prevent negative outcomes, and it will also target those children that do not receive an asthma management plan from their primary care physician. Policy initiatives should consider the recommendations from the National Heart, Lung, and Blood Institute and the findings from this study to better manage asthma outcomes. Policies to address these issues should focus on fundamental health system changes.

Suggestions for Future Research

Further studies are needed to explore these findings, and to identify what factors contribute to physician recommendations of an asthma management plan. More attention is needed to particularly identify the health practices of pediatricians. The latest production of data from the National Health Interview survey has included questions to consider that would be very useful for future work seeking to understand asthma disparities. Many of the studies that consider asthma are cross-sectional or case-control, future studies may want to consider a longitudinal design.

The findings of this study confirm the benefit of having an asthma management plan for improving asthma among children. These findings point to the continued need to improve the management of children with asthma. There are gaps in physician recommendations for an asthma management plan, a finding that is consistent with the results of this study. The findings of this study confirm the benefit of having an asthma management plan for improving asthma among children. The concept of asthma management among minority populations is not a new phenomenon (NAEPP, 1995).23 Methods to convince primary care providers to embrace management efforts to control asthma are essential. It is important to continue research on asthma disparities and develop sustainable interventions to increase asthma management plan recommendations. Broad-based structural changes will be a necessity to resolve the underlying disparities that exist among asthma management plan recommendations for children with asthma.

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