ORIGINAL RESEARCH

Demographic disparities in patient-reported use of inhaled corticosteroids among patients with persistent asthma

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Background: Despite the presence of existing guidelines, underuse of inhaled corticosteroids (ICSs) still exists among patients with persistent asthma in the United States. Inappropriate utilization of asthma medications has been attributed as one of the reasons for the significant economic burden due to asthma.

Objectives: To determine the demographic factors predicting patient-reported use of ICSs among patients with asthma.

Methods: The study utilized data from the 4-state sample of the National Asthma Survey (NAS), sponsored by the National Center for Environmental Health (NCEH), Centers for Disease Control and Prevention (CDC). The study population consisted of patients with persistent asthma as defined by National Heart, Lung, and Blood Institute (NHLBI) guidelines. Frequency distributions were made to characterize the study population. Logistic regression analysis was carried out to determine the odds of reported use of ICSs across various demographic variables (age, gender, race, income level, insurance coverage, and disease severity). Data were analyzed using SAS v9.0 software.

Results: Underutilization of ICSs was found to exist in the patients with asthma, as more than half of the study population (52.8%, n = 304) did not report the use of ICSs. African American patients were found to have much lower odds for use of ICSs (odds ratio [OR] = 0.495; confidence interval [CI], 0.248–0.987) when compared with whites. Insured patients had significantly higher odds for the use of ICSs (OR = 2.378; CI, 1.106–5.110) compared with uninsured patients. The findings held true even after adjusting for other demographic factors.

Conclusion: Underuse of ICSs continues to be a problem in patients with asthma. Vulnerable populations identified in this study are targeted for the use of ICSs. The importance of adherence to treatment and use of ICSs is an issue that needs to be addressed.

Keywords: inhaled corticosteroids, asthma, demographics

Introduction

Asthma affects an estimated 300 million people of all ages and ethnic backgrounds worldwide and remains a source of significant morbidity and mortality despite well-established guidelines for proper management.[1] Consequently, poor control of this disease is posing a significant economic burden on society. Utilization costs attributed to asthma rank amongst the highest for chronic diseases.[2] These costs have been increasing despite the presence of existing guidelines and effective preventive therapy.[2] Currently, asthma management is governed by the guidelines of US National Heart, Lung, and Blood Institute (NHLBI) titled Expert Panel Report-3 (EPR-3).[3] According to these guidelines, asthma control is defined as the degree to which symptoms, impairment, and risk are reduced and the degree to which the therapy goals are met.[3]

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101

Based on this definition, more than half of the US population with asthma have been classified as having uncontrolled asthma.[4] It is also one of the main causes for the increasing expenditure on asthma medication among patients with persistent asthma. This poor control is often attributed to inappropriate utilization of asthma medications. Medications such as inhaled corticosteroids (ICSs) play an important role in controlling inflammation and minimizing asthma exacerbations, which ultimately reduce utilization of the use of other health-care resources and related costs.

The guidelines describe ICSs as the preferred long-term therapy choice in children and adults. ICSs have shown to be well tolerated and safe at recommended doses.[3] Evidence in the literature supports the benefits of ICSs in decreasing symptoms and reducing risk of death. Despite evidence in favor of the use of ICSs, recent studies have found that underuse of ICSs is prevalent among patients with persistent asthma.[5,6] These studies suggest that the underuse of long-acting controller drugs may worsen asthma control in the long run. In turn, this leads to an increase in health-care utilization by the patient in the form of increased physician visits and more frequent hospital admissions for asthma-related complications.[6] Therefore, inappropriate use of medications and failure to adhere to therapy have been found to lead to undesirable consequences for the patients.[7]

The economic costs and outcomes, such as hospitalization and emergency room (ER) visits, attributed to asthma have been correlated with not only the severity of the disease but also the additional factors such as demographic characteristics.[2] Studies have shown that female patients tend to have higher costs for asthma compared with male patients.[8] Race-wise comparisons have shown that whites tend to have significantly more primary care visits, while African Americans had significantly more ER visits.[9,10] Therefore, demographic characteristics, such as age, race, and gender, have a role in determining the costs of medication for the disease. However, critical gaps exist in the current literature about disparities at the asthma treatment level, particularly regarding the appropriate utilization of asthma medications in a diverse patient population.

Based on the evidence present in the literature, the researchers hypothesize that demographic disparities exist in utilizing ICSs amongst patients with asthma. The issue of disparities in the use of ICSs has not been addressed in literature that studied a large population. Identifying disparities will help in directing policy changes and improve patient care in the population with asthma. Improving care and adherence will consequently increase the quality and effectiveness of asthma management. The primary objective of this study

was to describe reported use of ICSs among patients with persistent asthma and identify any demographic disparities in reporting such use among the study population.

Methods

The study used a retrospective, cross-sectional research design. This study was approved by the University of Toledo Institutional Review Board.

Data source

The data for this study were collected from the National Asthma Survey (NAS). NAS is sponsored by the National Center for Environmental Health (NCEH), Centers for Disease Control and Prevention (CDC). It examines the health, socioeconomic, behavioral, and environmental predictors that relate to better control of asthma.[11] The researchers used the data of 4-state study, which was conducted as a part of NAS in Alabama, California, Illinois, and Texas. NAS was carried out using random-digit-dial telephone survey method, and the data were collected by the State and Local Area Integrated Telephone Survey (SLAITS) of the National Center for Health Statistics (NCHS), CDC. The survey contains approximately 160 questions, 114 of which pertain to asthma and the rest are related to survey eligibility and demographics. The 4-state survey was carried out only for those respondents who were screened as being asthma positive. The participants of the study included children aged 0–17 years and adults older than 18 years. If the selected household member was a child younger than 18 years, the questions were addressed to an adult of the household who was knowledgeable about the child's health. The 4-state study was carried out from March 1, 2003, through March 10, 2004, and a total of 5,741 detailed interviews were completed during this period. The response rate for the survey, as reported by the Council of American Survey Research Organizations, was 48.5%.[12]

Inclusion criteria

Guidelines recommend daily use of ICSs in patients with persistent asthma; therefore, the study population was restricted to patients with persistent asthma. Patients with persistent asthma were identified based on the symptoms reported by them. According to NHLBI guidelines, asthma symptoms experienced at least 2 times a week during the day along with at least 2 times during the night characterize patients with persistent asthma. After selecting the patients with persistent asthma, they were further screened to identify those (or parents in case of children) who reported receiving

all the medications available at the time of their interview. Response to the survey question "Am I correct that you have all the medications?" helped to determine such patients. Finally, the survey respondents who had missing values for race and ethnicity variables were excluded from the final sample.

Dependent and independent variables

The dependent variable for this study was the reported use of ICSs. A comprehensive record on the use of medication was available in the database. After analyzing these records, patients who reported having at least one of the available ICSs were identified and categorized as ICS users, and others were categorized as non-ICS users. Independent variables used in the analysis included demographic characteristics, such as age, race, gender, ethnicity, and income level. Race was categorized into white, black, and other minorities. Income level was categorized by the patient's annual income of <20,000, 20,000–34,999, 35,000–54,999, and >55,000. Other than these variables, insurance status and asthma severity were also included as independent variables. To categorize patients based on asthma severity levels, symptom scoring system of National Asthma Education and Prevention Program (NAEPP) was used. Based on the symptoms experienced, patients were categorized into mild (>2 d/wk daytime symptoms and 3–4/mo nighttime symptoms), moderate (daytime symptoms experienced daily and >4/mo nighttime symptoms), and severe (daytime and nighttime symptoms experienced daily). Insurance status was obtained from the survey data, and patients were categorized as insured or uninsured depending upon their response.

Statistical analysis

Chi-square test was used to determine if there are any demographic differences concerning the reported use of ICSs. Patients were stratified into ICS users and non-ICS users, and differences with respect to demographic variables and other characteristics were determined. A logistic regression model was built to determine the odds of reported use of ICSs adjusted for independent variables. Results were weighted to the total population of 4 states using the sample weights provided by NAS. To account for the complex survey design, stratum and cluster variables were also included in the analysis. It also incorporated adjustments for multiple-telephone households, nonresponse unit, and noncoverage of nontelephone households and adjustments to known population-control estimates.[3] SAS 9.1 software (SAS Institute, Cary, North Carolina, USA) was used to analyze the data.

Results

The total number of unweighted survey respondents was 5,741. The sample for analysis was derived from this unweighted population based on the inclusion criteria. After applying the inclusion criteria, 576 participants met all the requirements for this study. The 4-state samples were nearly evenly distributed (Table 1) among these 4 states, with the maximum number of patients being from Alabama (31.8%). The final sample consisted of more female patients

Table 1 Unweighted sample distribution

Variable	Frequency (%)
Race	
Whites	387 (67.2)
African Americans	114 (19.8)
Others	75 (13.0)
Total	576 (100.0)
Ethnicity	
Hispanics	72 (12.5)
Non-Hispanics	504 (87.5)
Total	576 (100.0)
Gender	
Female	373 (64.8)
Male	203 (35.2)
Total	576 (100.0)
Age group	
Adults (≥18 y)	411 (71.4)
Child (<18 y)	165 (28.6)
Total	576 (100.0)
Insurance	
Yes	498 (86.5)
No	78 (13.5)
Total	576 (100.0)
Disease severity	
Mild	294 (51.0)
Moderate	92 (16.0)
Severe	190 (13.0)
Total	576 (100.0)
State	
California	133 (23.1)
Illinois	121 (21.0)
Alabama	187 (32.5)
Texas	135 (23.4)
Total	576 (100.0)
Income category	
Annual income	
<20,000	165 (28.6)
20,000–34,999	112 (19.4)
35,000–54,999	84 (14.6)
>55,000	157 (27.3)
Missing	58 (10.1)
Total	576 (100.0)
Inhaled corticosteroids	
No	304 (52.8)
Yes	272 (47.2)
Total	576 (100.0)

(64.8%) than male patients (35.1%), and a majority of the patients were adults (71.4%). Because of the oversampling performed, the African American population (19.8%) was significantly less, whereas whites (67.2%) formed the majority of the population (Table 1).

Overall, patient-reported use of ICSs was low, with only 272 (47.2%) patients reporting its use (Table 1). With respect to the use of ICSs, Chi-square tests showed significant difference in race and insurance categories (Table 2). Whites were significantly more likely to report ICS usage when compared with African Americans or other races ($P < 0.05$). Patients having some form of health insurance were more likely to report ICS usage compared with uninsured patients ($P < 0.05$). No significant differences were found for ethnicity, disease severity, state of residence, income level, age group, or gender.

Results of the logistic regression analysis are reported in Table 3. Confirming the results from Chi-square test, regres-

Table 2 Use of inhaled corticosteroids and demographic characteristics

Characteristic	Inhaled corticosteroid use		P value
	Yes	No	
Race			
Whites	51.29	48.71	<0.05
African Americans	32.68	67.32	–
Others	36.72	63.28	–
Ethnicity			
Hispanics	46.80	53.20	0.761
Non-Hispanics	44.11	55.89	–
Insurance			
Yes	46.86	53.14	<0.05
No	28.64	71.36	–
Disease severity			
Mild	41.10	58.90	0.398
Moderate	44.54	55.46	–
Severe	50.24	49.76	–
State			
Alabama	43.36	56.64	0.620
California	41.96	58.04	–
Illinois	46.94	53.06	–
Texas	48.86	51.14	–
Income category			
Annual income			
<20,000	44.51	55.49	0.784
20,000–34,999	40.63	59.37	–
35,000–54,999	50.80	49.20	–
>55,000	46.96	53.04	–
Missing (N = 58)	–	–	–
Age group			
Adults (≥18)	81.62	18.38	0.102
Child (<18)	74.50	25.50	–
Gender			
Male	46.84	53.16	0.670
Female	36.69	63.31	–

Table 3 Results of the multivariate logistic regression analysis

Variable	Reference	Odds ratio	95% Confidence interval
Age			
Children (0–18 y)	Adult	0.632	0.366–1.093
Race			
African Americans	White	0.495	0.248–0.987
Gender			
Male	Female	0.925	0.558–1.533
Ethnicity			
Hispanic	Non-Hispanic	1.482	0.668–3.289
State			
California	Texas	0.718	0.401–1.286
Illinois	Texas	0.934	0.497–1.755
Alabama	Texas	0.886	0.501–1.566
Annual income			
20,000–34,999	<20,000	0.969	0.465–2.019
35,000–54,999	<20,000	1.304	0.636–2.670
>55,000	<20,000	1.039	0.545–1.983
Insurance status			
Insured	Uninsured	2.378	1.106–5.110
Asthma severity			
Moderate	Mild	1.145	0.591–2.218
Severe	Mild	1.530	0.854–2.743

sion analysis showed decreased odds of reported use of ICSs among African Americans and uninsured patients in the study population. Compared with whites, African Americans had significantly decreased odds of reported use of ICSs (odds ratio [OR] = 0.495; confidence interval [CI], 0.248–0.987). Increased odds for the use of ICSs were also found for insured patients (OR = 2.378; CI, 1.106–5.110) compared with uninsured patients. In the case of all remaining independent variables, no significant difference was observed in terms of reported use of ICSs.

Discussion

Our study showed that underuse of ICSs continues to be a problem in patients with asthma. More than half of our study population did not report the use of ICSs; this issue was more severe for minorities and the uninsured population. This underuse not only makes the control of disease difficult but also increases the health-care expenditure. Colice et al[13] had shown that hospitalizations and ER visits for infrequent ICS users were significantly more when compared with consistent users. Despite the wealth of literature highlighting the importance of ICSs, the problem still exists as seen in our study, and it needs attention by policy makers.

Further, the findings of our study indicate the disparities in reported use of ICSs in study population. The primary difference was found on the basis of race, and African Americans

were found to have much lower odds of using ICSs when compared with majority whites. This difference was present even after adjustments for other demographic factors. Racial and ethnic disparities in patients with asthma have gained attention and have been discussed earlier in literature.[2] Studies have shown disparities in asthma outcomes, but less is known about disparities at the treatment level, especifically the role that utilization of ICSs plays in improving asthma outcomes. Our study attempted to explore whether disparities in controller medications may partly explain the overall disparities in asthma outcomes.

Several possible reasons have been discussed in the literature as a cause for these disparities. Two broad, underlying reasons that have been discussed are lack of access to care and inconsistencies in health-care treatment using NHLBI guidelines.[6] Another cause may be the higher likelihood of alternative treatments in place of traditional medications in the African American population.[14] Based on the evidence in literature and results seen in our own study, the need is paramount to implement some sort of intervention programs for minorities. An action agenda to eliminate asthma disparities has identified that lack of cultural competencies at many sites of asthma care do exist, and steps should be taken to bridge this critical gap in the future.[15] Use of quality improvement strategies and improvement in communication skills of the providers have also been suggested when designing interventions for minority populations.[16] Past efforts have included programs such as the Multifamily Asthma Group Treatment (MFAGT), which aimed at improving asthma management specifically in African Americans and Hispanics.[17] This small-scale study had managed to improve knowledge and decrease ER visits in the target population. Similar interventions on larger scale can help in reducing the existing disparities as found in this study. By highlighting these disparities, the authors hope to build a case for urgent need for such intervention programs to help the vulnerable population.

Besides race, insurance status was also found to be a significant predictor for the use of ICSs. People with insurance had a higher likelihood of using controller drugs than people without insurance. Insurance status has been linked to the utilization of necessary health-care services by many studies.[6] With the new health-care reform bill, it is hoped that the number of uninsured patients with asthma will be reduced. Consequently, this will improve access to ICSs and eliminate disparities because of health insurance.

Poor adherence to ICSs is a growing issue in managing asthma amongst the population with persistent asthma.

Investigating disparities in use of ICSs provides important information about subpopulations that are vulnerable to nonadherence with ICSs. Results from this study help to point out such populations in a hope to direct policy makers to formulate specific strategies to diminish the disparities. The results also help to educate and inform health-care providers about the issue of underutilization of ICSs and existing disparities.

Limitations
The study has limitations that are both unique and attributable to the large database nature of a retrospective study. The survey used patients with asthma from 4 states only; therefore, these findings cannot be generalized to the national population with asthma. The study is fairly generalizable to patients with asthma in these 4 states, which are highly populated and diverse in terms of patients with asthma. As the survey used self-reporting of data by the patient, it is likely to suffer from recall bias. As the survey was cross-sectional in nature, there was no way researchers can identify any causal effect. Further research needs to be done probing the cause of these disparities and why the underuse of ICSs continues to exist despite the existence of established treatment guidelines and recommendations.

Conclusion
The study confirmed the findings from existing literature about the underuse of ICSs among patients with persistent asthma despite the strong recommendations from national guidelines. The study population also showed certain disparities regarding reported use of ICSs. African Americans and patients with no health insurance demonstrated a disproportionally lower percentage of reported use of ICSs. Further research needs to be done probing the cause of these disparities and why the underuse of ICSs continues to exist. This study was successful in identifying vulnerable populations that can be targeted for the use of ICSs. The importance of adherence to treatment and use of ICSs is an issue that needs to be addressed.

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Disclosure
The authors report no conflicts of interest in this work.

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