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Persistent differences in asthma self-efficacy by race, ethnicity, and income in adults with asthma

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Abstract

Objective—The objective of this population-based study was to determine if and to what extent there are differences in asthma self-efficacy by race/ethnicity and income, and whether health status, levels of acculturation, and health care factors may explain these differences.

Methods—We conducted a secondary data analysis of asthma self-efficacy using the 2009 and 2011-2012 California Health Interview Survey, in adults with asthma ($n = 7874$). In order to examine if and how the effect of race /ethnicity and income on asthma self-efficacy may have been altered by health status, acculturation, and health care factors, we used staged multivariable logistic regression models. We conducted mediation analyses to evaluate which of these factors might mediate disparities in self-efficacy by race/ethnicity and income.

Results—69.8% of adults reported having high asthma self-efficacy. Latinos (OR 0.66; 95% CI 0.51–0.86), African-Americans (OR 0.50; 95% CI 0.29–0.83), American Indian/Alaskan Natives (OR 0.55; 95% CI 0.31–0.98), and Asian/Pacific Islanders (OR 0.34; 95% CI 0.23–0.52) were less likely to report high self-efficacy compared to Whites. Individuals with income below the federal poverty level (OR 0.56; 95% CI 0.40–0.78) were less likely to report high self-efficacy compared to higher income individuals. The relationship between income and self-efficacy was no longer significant after further adjustment for health care factors; however, the differences in race and ethnicity persisted. Receiving an asthma management plan mediated the relationship in certain subgroups.

Conclusions—Addressing modifiable health care factors may play an important role in reducing disparities in asthma self-efficacy.

Keywords

management/control; education; prevention; quality of life

Introduction

Over 16.4 million adults in the United States (U.S.) have asthma (1, 2). Asthma control, defined as having minimal or no symptoms or exacerbations, stable pulmonary function, ability to participate in activities of daily living and “optimal quality of life” (3), is vital for reducing asthma morbidity and mortality. Several effective strategies for the management and control of asthma include the consistent use of preventive medication, patient self-management education, and control of environmental factors that trigger asthma (4). Despite the existence of these strategies, many adults are unable to achieve asthma control (5), and asthma persists as a major source of morbidity and mortality in the U.S., with over 1.8 million asthma-related emergency room visits every year (6). Additionally, as there are persistent racial and ethnic and income-related disparities in the morbidity, mortality, and health care utilization patterns of adults with asthma (7-10), understanding mechanisms that create and maintain these health-related disparities is a major priority in asthma research (11).

Self-efficacy, the confidence an individual has in their ability to complete a task, has been identified as an important predictor of the management and control of chronic diseases (12-14). Asthma self-efficacy has been associated with adherence to asthma maintenance (15, 16) as well as improved asthma quality of life (17). Prospective cohort studies have shown that asthma self-efficacy is an independent predictor of asthma quality of life (18), and that increases in self-efficacy (through asthma management programs) have been associated with increases in asthma self-management behaviors, increases in activity-related quality of life, and decreases in asthma symptom days (17, 19-24). Low asthma self-efficacy has been associated with asthma hospitalizations and emergency department visits (25-27). Collectively, existing research suggests that asthma self-efficacy is an important determinant of self-management behaviors and is predictive of health outcomes (15-27).

Despite the importance of asthma self-efficacy, no studies have explicitly investigated if and how individual sociodemographic characteristics, particularly race, ethnicity, and income, are associated with asthma self-efficacy among a population-based sample of adults with asthma. Particularly, the pathways by which access to health care, use of asthma related care, and quality of asthma care, potentially influence the relationship between individual sociodemographic characteristics and asthma self-efficacy remain unknown (9). Identifying the factors that are potentially in the pathway between sociodemographic characteristics and asthma self-efficacy may reveal mechanisms for inadequate asthma control in vulnerable populations. Even with evidence of important population-level disparities in self-efficacy among adults with diabetes, hypertension and heart disease (28), there is a paucity of literature addressing similar population-level disparities among adults with asthma as existing studies on asthma self-efficacy have been limited by the use of clinic-based convenience samples with limited generalizability (9, 24, 25, 29, 30).

In order to address this gap in the literature, we utilized a large, diverse, population-based survey to describe the correlates of asthma self-efficacy among adults with asthma. To our knowledge, this is one of the first studies to describe the social determinants of asthma self-efficacy in adults, using a population-based sample. Previous research has shown that

sociodemographic characteristics, such as race/ethnicity and income, are strongly associated with health status (6, 10, 31, 32), levels of acculturation (33, 34), and health care factors (e.g., health care access, utilization, and quality) (32, 35). In addition, one clinic based study in a small group of adults found that asthma self-efficacy was associated with socioeconomic status and asthma severity (27). Therefore, we conceptualize asthma self-efficacy to be affected by four major factors: individual level sociodemographic characteristics, health status, levels of acculturation, and health care factors (Figure 1). We hypothesize that 1) a significant portion of adults with asthma will lack high asthma self-efficacy, 2) meaningful differences in asthma self-efficacy exist by race, ethnicity and income, and 3) these differences in asthma self-efficacy will be partly mediated by health status, levels of acculturation, health care access, use of asthma health care, and quality of asthma care in adults with asthma. Identifying disparities in self-efficacy and the role that modifiable factors play in asthma self-efficacy may be an important step for reducing the persistent health disparities seen in asthma management and outcomes.

Methods

Study Design

We conducted a secondary data analysis of the 2009 and 2011-2012 California Health Interview Survey (CHIS), a biennial population-based telephone survey conducted by the UCLA Center for Health Policy Research (36, 37). CHIS uses a multi-stage sampling design to collect health and demographic data on a representative sample of all non-institutionalized individuals living in households in California (38). The final sample (N = 7874) included only adults who reported: 1) having a diagnosis of asthma by a doctor or health professional, and 2) currently having asthma or having an episode of asthma or asthma attack in the past 12 months. Adults were excluded if they had missing data for measures used in the study (N=30). The University of Wisconsin—Madison Health Sciences Institutional Review Board considered this study exempt from review because the data were already collected and de-identified.

Measures

Primary Outcomes—Self-efficacy was determined using the disease-specific question: “How confident are you that you can control and manage your asthma?” This was asked of all respondents with self-reported asthma by the survey interviewers. Respondents reported their self-efficacy on a 4-point Likert scale ranging from “not at all confident” to “very confident”. For this analysis, we dichotomized the responses to represent high self-efficacy (those reporting that they were “very confident” in their ability to manage their disease) and low self-efficacy (those reporting that they were “somewhat confident,” “not too confident,” or “not at all confident” in their ability to manage their disease). As some adults with asthma may over-estimate their level of asthma control (39), we used the most stringent operationalization of high self-efficacy for this analysis (i.e., only those who were “very confident” in their ability to manage their asthma). We used sensitivity analysis to ensure major findings from the analysis were not dependent on the criteria for high versus low self-efficacy used.

Independent Variables

Sociodemographic Characteristics: The predictors of interest in this analysis were sociodemographic factors including: age, gender, race/ethnicity (Latino; non-Latino American Indian/Alaskan Native; non-Latino Asian/Pacific Islander; non-Latino African American; non-Latino white; and non-Latino other [including multiracial]), income (0-99%; 100-199%; 200-399%; and greater than 400% of the federal poverty level),¹ educational attainment (less than high school; high school/some college; college degree; post-graduate), marital status (currently married or cohabitating; separated/divorced/widowed; and never married), urbanicity (rural; urban), and survey year (2009; 2011/12).

Health Status: Asthma symptoms in the previous 12 months (including: coughing, wheezing, shortness of breath, chest tightness or phlegm) were categorized by frequency (daily; weekly; and greater than weekly). Comorbidities included diabetes (defined by having ever been told by a doctor that the individual had Type 1 or Type 2) and heart disease (defined by having ever been told by a doctor that the individual had heart disease). Smoking status was categorized as current smokers, former smokers, and never smokers.

Acculturation: We used English proficiency (defined as speaking English “very well” or “well” versus “not well” or “not at all”) and number of years lived in the US (lifetime (born/raised); greater or equal to 15 years; and less than 15 years) as proxy measures for acculturation. English language proficiency and number of years lived in the US are two measures frequently used to approximate the construct of acculturation (33).

Health Care Factors: Health insurance was categorized as having any private insurance, having public insurance only (including Medicaid and Medicare but no private insurance), and being uninsured. Those who reported that they had a place to go when sick or needing advice about health, which was not an emergency room, were considered to have a usual source of care. Use of asthma care included experience of delayed or forgone asthma medical care or asthma prescription care due to cost or lack of insurance in the past 12 months. Receiving a written asthma management plan was used to measure quality of care, and was categorized as follows: 1) discussed an asthma management plan with a health care provider *and* received a written/printed/electronic copy of an asthma management plan, 2) discussed an asthma management plan with a health care provider *without* receiving a written/printed/electronic copy of the plan, and 3) never discussed an asthma plan with a health care provider.

Data Analysis—SAS 9.3 (SAS Institute Inc., Cary NC) was used to construct analytic files and Stata 12 (StataCORP LP, College Station, TX) was used to perform analysis accounting for the complex sampling design of CHIS. We performed bivariate chi-square analysis on categorical variables and t-tests on continuous variables to test for preliminary associations between sociodemographic characteristics, acculturation, health experience,

¹The California Health Interview Survey (CHIS) creates a federal poverty level variable as a percentage of the previous year's US Census Bureau federal poverty thresholds using a household's total annual income, the family size of the household, and the number of children in the household (e.g., for 2009 CHIS the 100% federal poverty level corresponds to a total family income of \$10,991 for a one person household or \$21,834 total family income for a four person household that includes two children.)

health care factors, and high asthma self-efficacy. We then performed staged multivariable logistic regression to test the association between sociodemographic characteristics and self-efficacy, and to determine whether this relationship was attenuated after including health status, acculturation, and health care factors into the model. The first model included all sociodemographic variables, the second model incorporates health status variables, the third model further incorporates acculturation variables, and the fourth model adds health care factors.

In order to ensure that our results were not contingent on the operationalization of self-efficacy, we performed a sensitivity analysis utilizing multinomial regression to examine multiple categories of self-efficacy. Our results were consistent between the multinomial and logistic models.

We conducted a series of mediation analyses to investigate factors that were hypothesized to mediate disparities in self-efficacy. We used a Stata package developed by Tingley and Hicks for our mediation analysis (40). In each of our mediation models we independently tested whether the relationship between race/ethnicity or income and asthma self-efficacy was mediated through health experiences, acculturation, and health care factors.

Results

Overall, 69.8% of adults with current asthma had high asthma self-efficacy while 30.2% of adults with current asthma had low asthma self-efficacy. Adults with high asthma self-efficacy were *more* likely to: be white, be married/partnered, be born in the United States, and be privately insured (Table 1). They were also *more* likely to: have a college degree or beyond, have income above 200% federal poverty level (FPL), have less frequent asthma symptoms, have greater English proficiency, and have discussed an asthma management plan with their doctor. Adults with high asthma self-efficacy were *less* likely to: have a comorbid condition, have ever smoked, and have experienced delayed or forgone asthma care.

In the multivariable analyses, American Indian/Alaskan Natives, Asian/Pacific Islanders, and African-Americans had lower levels of self-efficacy compared to non-Latino Whites, even with adjustment for health experiences, levels of acculturation, and health care factors (Models 1-4, Table 2). Compared to non-Latino Whites, Latinos had lower levels of self-efficacy (Model 2, Table 2), however this relationship was attenuated when acculturation was included (Model 3, Table 2). Mediation analysis revealed that English proficiency was a significant mediator of disparities in asthma self-efficacy for Latinos and Asians/Pacific Islanders (Model 3, Table 3). Mediation analysis also indicated that racial/ethnic disparities in high asthma self-efficacy were significantly mediated by asthma symptom frequency, health insurance status, delayed or forgone asthma care, and lack of discussion of an asthma management plan (Table 3).

Individuals below 200% FPL were also less likely to have high self-efficacy compared to individuals living above 400% FPL (Model 1, Table 2); however, the relationship between income and asthma self-efficacy was substantially attenuated by health care factors and no

longer statistically significant (Model 4, Table 2). Specifically, being uninsured, experiencing delayed or forgone asthma care, and not discussing an asthma management plan all significantly mediated income-based disparities in self-efficacy (Model 4, Table 3).

Additional disparities in self-efficacy existed such that those with less than a high school degree, more frequent asthma symptoms, co-morbid conditions, low English proficiency, no insurance, delayed or forgone asthma care, and those without an asthma management plan had lower odds of high self-efficacy compared to their respective counterparts (Model 4, Table 2).

Discussion

We examined the association between high asthma self-efficacy and individual level sociodemographic characteristics, acculturation, health status, and health care factors using secondary data from a population-based sample of adults with asthma in California. We determined that nearly 70% of adults with asthma had high self-efficacy and identified persistent lower levels of asthma self-efficacy in racial/ethnic minorities and low income individuals. Importantly, we identified several health care factors (i.e., health insurance status, experiences of delayed or forgone asthma care, and receiving an asthma management plans) as significant mediators of the disparities in asthma self-efficacy by race/ethnicity and income, suggesting potential opportunities for interventions.

A considerable proportion (30.2%) of adults with asthma may have low self-efficacy in California. Low asthma self-efficacy has been previously associated with adverse asthma related outcomes and inappropriate health care use including asthma-related emergency department utilization (26, 41). Interventions to increase asthma self-efficacy in adults with asthma, such as asthma self-management education programs, could potentially improve asthma outcomes in adults. Moreover, increasing asthma self-efficacy in adults could have major societal implications by increased productivity due to a reduction in days missed of work and school due to asthma (42).

Consistent with existing studies of racial and ethnic disparities in how confident, skillful, and knowledgeable patients are about taking an active role in improving their health and health care (43), our findings suggest that racial and ethnic minorities tend to have lower asthma self-efficacy, even when controlling for asthma severity and comorbidities. However, we identified that English proficiency completely mediated self-efficacy disparities for Latinos and attenuated the disparity for Asians/Pacific Islanders, suggesting that acculturation, particularly English language proficiency, may be an important barrier for achieving high self-efficacy for some minority populations. In particular, patients with low English proficiency may feel less comfortable actively engaging with their providers and may be less likely to ask questions about their care or disease management (44), leading to lower disease self-efficacy and worse outcomes (45, 46). As evidence suggests that health inequalities may be diminished by improvements in shared-decision making between patients and providers (47), interventions that target improvements in shared-decision making and engagement between patients with low English proficiency and their providers may be an opportunity to improve self-efficacy and outcomes for this vulnerable group.

Interestingly, racial/ethnic disparities for non-Latino minority groups persisted even when adjusting for levels of acculturation and health care factors. This may be due to the cross sectional nature of the data, as we were unable to assess how the accumulation of experiences and challenges of managing asthma throughout the life course could impact asthma self-efficacy (48). It is possible that the accumulation of experiences such as perceived discrimination and receipt of culturally sensitive medical information (factors that our study is unable to capture), would explain the persistent disparities seen in asthma self-efficacy for certain race/ethnicity minorities. In addition, research suggests that there may be community or neighborhood effects that may influence self-efficacy, independent of individual socioeconomic status (49). These neighborhood effects could also contribute to the reported racial and ethnic differences. Ultimately, more research is needed to understand why racial and ethnic minorities have lower levels of asthma self-efficacy, and what factors may be the most important mediators of this pathway.

Socioeconomic disparities also existed, such that lower income individuals tended to have lower asthma self-efficacy; however, this relationship appeared to be completely mediated by health care factors. Namely, delayed/forgone asthma care, being uninsured, and never discussing an asthma management plan all mediated the relationship between income and asthma self-efficacy, suggesting that poor access to health care may be the most salient barrier to high self-efficacy for low income individuals. Ongoing and future health insurance reforms, including disallowing coverage denial due to pre-existing conditions (50) and provision of health insurance coverage for chronic care management (51), have the potential to improve access to health care and in turn, may lead to improvements in asthma self-efficacy among adults with asthma.

Evidence-based guidelines for the management and control of asthma emphasize the delivery of written asthma management plans to all adults with asthma as an important quality measure (4). Despite this fact, nearly 30% of adults with asthma in this study reported never discussing an asthma management plan with a health care provider and only 18% reported receiving a written asthma management plan. Of note, adults who did not discuss an asthma management plan with their provider were significantly less likely to have high self-efficacy. Further, not discussing an asthma management plan with a healthcare provider significantly mediated disparities in self-efficacy for African-Americans, Asians/ Pacific Islanders, Latinos, and low income individuals. While race/ ethnicity and income may be inherent factors, provision of high quality asthma care is a modifiable factor that can be influenced by providers. Given the importance of this quality measure in predicting individual self-efficacy in this study, it may be important that health care providers work to adhere to existing guidelines and provide a written management plan for their patients with asthma. Providing easy to access, actionable asthma management plans may be increasingly facilitated with the use of mobile health technology (52, 53), but care should be taken to ensure that novel distribution of management plans does not unintentionally exclude low income groups who may have more limited access to such technology.

There are several potential limitations to this analysis. First, given that self-efficacy likely changes over time, the use of cross sectional data limits the determination of any causal relationships. Additional longitudinal data is needed to further tease apart these

relationships. Second, we were unable to account for some additional factors that may be associated with asthma self-efficacy and health status, such as age of diagnosis, which could result in residual confounding. Third, the use of English language proficiency and years lived in the United States may not have fully captured the construct of acculturation. Fourth, self-efficacy is a multifaceted construct and the operationalization of self-efficacy using one survey question may limit our ability to identify nuances within this paradigm compared to multiple task-specific questions (54, 55). At present, to our knowledge, there are no existing data that assess validated measures of asthma self-efficacy on a population level. Fifth, our sample consists of adults who reported having a diagnosis of asthma or experiencing asthma symptoms without any validation from their medical records. However, self-report of asthma diagnosis has been shown to have high validity (56). Despite these limitations, using a population-based study to investigate social determinants of asthma self-efficacy provides insight into the underlying causes of asthma self-efficacy and can identify specific modifiable factors to improve self-efficacy in adults with asthma. In addition, examining asthma self-efficacy in racially and ethnically diverse sample of adults with asthma allowed us to obtain estimates for Asian/Pacific Islanders and Native American/Alaskan Natives, populations that are often unable to be studied due to small sample sizes.

Conclusions

We find evidence of important racial and ethnic and income-related disparities in asthma self-efficacy in a large, population-based study of adults with asthma, such that racial/ethnic minorities and individuals living in poverty have the lowest levels of asthma self-efficacy. These disparities appeared to be attenuated primarily by acculturation and health care factors, such as receiving an asthma management plan. However, persistent racial/ethnic disparities, not explained by acculturation and health factors still need to be addressed. Further, this study identified an independent association between low asthma self-efficacy and important health care access and quality factors, including being uninsured, reporting delayed/forgone asthma care, and not receiving an asthma management plan. As a first step, providers should follow existing asthma guidelines and provide asthma self-management education and written asthma management guidelines to all patients with asthma.

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Figure 1.

Conceptual Framework of Factors Influencing Asthma Self-Efficacy. We conceptualize that the relationship between sociodemographic characteristics, particularly race/ethnicity and income, and asthma self-efficacy to be mediated through health status, acculturation, and health care. Health status includes asthma severity as well as general health status and chronic condition status. Acculturation includes English language proficiency and years lived in the US. Health care factors include health care access (health insurance status, usual source of care), use of asthma care (experiences of delayed/forgone asthma medical care or prescription care), and asthma care quality (receipt of written asthma management plan).

Table 1
Sociodemographics, Health Status, Acculturation, and Health Care Factors by Asthma Self-Efficacy^a

	Total (n=7,874)	Asthma Self-Efficacy		p-value
		High (n=5,605)	Low (n=2,269)	
Weighted n (%)	4,257,588 (100%)	2,972,096 (69.8%)	1,285,493 (30.2%)	
Survey Year				0.98
2009	49.8%	69.8%	30.2%	
2011-2012	50.2%	69.8%	30.2%	
<i>Sociodemographics</i>				
Mean Age (Standard Deviation)	45.8 (17.8)	45.3 (18.1)	46.9 (17.2)	0.10
Gender				0.59
Male	37.8%	69.3%	30.7%	
Female	62.2%	70.6%	29.4%	
Race/Ethnicity				<0.01
White ^b	52.7%	76.2%	23.8%	
African-American ^b	9.3%	60.5%	39.5%	
Asian/Pacific Islander ^b	10.0%	59.2%	40.8%	
American Indian/Alaskan Native ^b	1.7%	59.9%	40.1%	
Other ^b	2.5%	64.3%	35.7%	
Latino	23.7%	65.0%	35.0%	
Marital Status				<0.01
Married/Living with Partner	55.6%	73.6%	26.4%	
Separated/Widowed/Divorced	17.8%	62.2%	37.8%	
Never Married	26.6%	67.0%	33.0%	
Educational Attainment				<0.01
< High School Degree	12.6%	51.0%	49.0%	
High School Graduate/Some College	46.2%	69.6%	30.5%	
College Degree	27.5%	73.7%	26.3%	
Post Graduate	13.8%	80.1%	19.9%	
Family Income as % of FPL				<0.01
0 - 99% FPL	16.8%	54.9%	45.1%	
100 - 199% FPL	19.0%	62.2%	37.8%	
200 - 399% FPL	23.4%	71.2%	28.8%	
400% FPL and above	40.8%	78.7%	21.4%	
Urbanicity				0.88
Urban	88.1%	69.9%	30.1%	
Rural	11.9%	69.4%	30.6%	
<i>Health Status</i>				
Frequency of Asthma Symptoms				<0.01
Greater than Weekly	56.2%	78.2%	21.8%	

	Total (n=7,874)	Asthma Self-Efficacy		p-value
		High (n=5,605)	Low (n=2,269)	
Weekly	33.2%	61.5%	38.5%	
Daily	10.6%	51.4%	48.6%	
Any Comorbidities				<0.01
No	81.2%	72.1%	27.9%	
Yes	18.8%	59.8%	40.2%	
Smoking Status				<0.01
Current Smoker	14.5%	61.7%	38.3%	
Former Smoker	25.4%	67.8%	32.2%	
Never Smoker	60.2%	72.6%	27.4%	
<u>Acculturation</u>				
English Proficiency				<0.01
Speak English well/very well	93.8%	71.7%	28.3%	
Speak English not well/not at all	6.2%	40.8%	59.2%	
Years Lived in the US				<0.01
Less than 15 years	4.5%	65.8%	34.2%	
15 years or more	14.2%	56.9%	43.1%	
Born/Raised	81.3%	72.3%	27.7%	
<u>Health Care Factors</u>				
Health Insurance Status				<0.01
None	13.9%	56.2%	43.8%	
Public	33.6%	63.3%	36.7%	
Private	52.5%	77.5%	22.5%	
Usual Source of Care				0.16
No	13.3%	65.1%	34.9%	
Yes	86.7%	70.5%	29.5%	
Delayed or Forgone Asthma Care				<0.01
No	93.0%	71.7%	28.3%	
Yes	7.0%	44.4%	55.6%	
Receipt of Asthma Management Plan				<0.01
Discussed plan, received written plan	18.4%	72.0%	28.0%	
Discussed plan, no written plan	51.7%	73.8%	26.2%	
Did not discuss plan	29.9%	61.5%	38.5%	

Abbreviations: FPL – Federal Poverty Level; US – United States

^aWeighted column percentages are displayed in the 'Total' column, while weighted row percentages are displayed in the other columns. Weighted means and standard deviations are displayed for continuous variables. Due to rounding, some percentages may not sum to exactly 100%.

^bnon-Latino

Table 2
Multivariable Logistic Regression Modeling the Odds of High (versus Low) Asthma Self-Efficacy

	Unadjusted	Model 1 ^a	Model 2 ^b	Model 3 ^c	Model 4 ^d
	OR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)	AOR (95% CI)
<i>Sociodemographics</i>					
Age (per 10 years) ^e	0.95 (0.90-1.01)	0.92 (0.86-0.99)	0.98 (0.91-1.06)	1.01 (0.93-1.09)	1.01 (0.93-1.10)
Gender					
Male	Reference	reference	reference	reference	reference
Female	0.94 (0.75-1.18)	0.99 (0.79-1.24)	0.89 (0.70-1.12)	0.89 (0.70-1.13)	0.84 (0.66-1.07)
Race/Ethnicity					
White ^f	Reference	reference	reference	reference	reference
African-American ^f	0.48 (0.31-0.73)	0.59 (0.36-0.96)	0.50 (0.29-0.83)	0.49 (0.30-0.82)	0.47 (0.29-0.78)
Asian/Pacific Islander ^f	0.45 (0.30-0.69)	0.47 (0.31-0.69)	0.34 (0.23-0.52)	0.39 (0.23-0.66)	0.36 (0.22-0.59)
American Indian/ Alaskan Native ^f	0.47 (0.27-0.80)	0.54 (0.29-0.98)	0.55 (0.31-0.98)	0.55 (0.31-0.96)	0.56 (0.32-0.97)
Other ^f	0.56 (0.36-0.87)	0.61 (0.39-0.94)	0.66 (0.43-1.01)	0.67 (0.44-1.01)	0.69 (0.45-1.04)
Latino	0.58 (0.45-0.74)	0.74 (0.57-0.96)	0.66 (0.51-0.86)	0.79 (0.59-1.06)	0.79 (0.59-1.05)
Marital Status					
Married/Living with Partner	Reference	reference	reference	reference	reference
Separated/Widowed/ Divorced	0.59 (0.47-0.74)	0.78 (0.60-1.02)	0.84 (0.64-1.11)	0.80 (0.61-1.05)	0.82 (0.62-1.09)
Never Married	0.73 (0.53-1.00)	0.80 (0.57-1.14)	0.84 (0.59-1.21)	0.80 (0.56-1.15)	0.87 (0.62-1.22)
Educational Attainment					
< High School Degree	0.26 (0.18-0.37)	0.46 (0.31-0.70)	0.52 (0.33-0.79)	0.62 (0.40-0.98)	0.62 (0.40-0.97)
High School/Some College	0.57 (0.42-0.76)	0.75 (0.54-1.03)	0.79 (0.56-1.11)	0.80 (0.57-1.12)	0.84 (0.59-1.18)
College Degree	0.69 (0.50-0.97)	0.79 (0.56-1.11)	0.83 (0.58-1.18)	0.84 (0.58-1.20)	0.86 (0.60-1.23)
Post Graduate	Reference	reference	reference	reference	reference
Family Income as % of FPL					
0 - 99% FPL	0.33 (0.25-0.43)	0.48 (0.35-0.66)	0.56 (0.40-0.78)	0.61 (0.43-0.85)	0.75 (0.52-1.08)
100 - 199% FPL	0.45 (0.34-0.59)	0.59 (0.41-0.84)	0.63 (0.43-0.92)	0.67 (0.46-0.97)	0.79 (0.54-1.14)
200 - 399% FPL	0.67 (0.50-0.89)	0.78 (0.58-1.04)	0.82 (0.61-1.12)	0.84 (0.62-1.13)	0.91 (0.67-1.23)
400% FPL and above	Reference	reference	reference	reference	reference

	Unadjusted OR (95% CI)	Model 1 ^a AOR (95% CI)	Model 2 ^b AOR (95% CI)	Model 3 ^c AOR (95% CI)	Model 4 ^d AOR (95% CI)
Urbanicity					
Urban	Reference	reference	reference	reference	reference
Rural	0.98 (0.71-1.34)	0.89 (0.64-1.25)	0.91 (0.62-1.33)	0.91 (0.62-1.32)	0.93 (0.64-1.36)
Health Status					
Frequency of Asthma Symptoms					
Greater than Weekly	reference		reference	reference	reference
Weekly	0.44 (0.36-0.56)		0.41 (0.33-0.50)	0.40 (0.33-0.50)	0.40 (0.32-0.49)
Daily	0.29 (0.22-0.39)		0.30 (0.23-0.40)	0.30 (0.23-0.39)	0.30 (0.23-0.40)
Any Comorbidities					
No	reference		reference	reference	reference
Yes	0.57 (0.45-0.74)		0.72 (0.54-0.96)	0.71 (0.53-0.95)	0.66 (0.49-0.87)
Smoking Status					
Current Smoker	0.61 (0.46-0.80)		0.78 (0.56-1.09)	0.76 (0.55-1.05)	0.81 (0.58-1.14)
Former Smoker	0.80 (0.63-1.01)		0.91 (0.72-1.14)	0.87 (0.70-1.09)	0.87 (0.70-1.08)
Never Smoker	reference		reference	reference	reference
Acculturation					
English Proficiency					
Speak English well/ very well	reference			reference	reference
Speak English not well/ not at all	0.27 (0.19-0.39)			0.45 (0.25-0.84)	0.48 (0.27-0.85)
Years Lived in the US					
Less than 15 years	0.74 (0.38-1.45)			1.19 (0.57-2.48)	1.40 (0.70-2.78)
15 years or more	0.51 (0.37-0.69)			0.81 (0.46-1.42)	0.94 (0.56-1.59)
Born/Raised	reference			reference	reference
Health Care Factors					
Health Insurance Status					
None	0.37 (0.26-0.53)				0.61 (0.42-0.90)
Public	0.50 (0.42-0.60)				0.87 (0.66-1.15)
Private	reference				reference
Usual Source of Care					
No	0.78 (0.55-1.10)				1.26 (0.85-1.87)

	Unadjusted OR (95% CI)	Model 1 ^a AOR (95% CI)	Model 2 ^b AOR (95% CI)	Model 3 ^c AOR (95% CI)	Model 4 ^d AOR (95% CI)
Yes	reference				reference
Delayed/Forgone Asthma Care					
No	reference				reference
Yes	0.32 (0.22-0.46)				0.37 (0.26-0.52)
Receipt of Asthma Management Plan					
Discussed plan, received written plan	reference				reference
Discussed plan, no written plan	1.10 (0.81-1.49)				0.93 (0.71-1.22)
Did not discuss plan	0.62 (0.44-0.87)				0.56 (0.40-0.78)

Abbreviations: AOR – Adjusted Odds Ratio; CI – Confidence Interval; FPL – Federal Poverty Level; US – United States

^aModel 1 includes: age, gender, race/ethnicity, marital status, educational attainment, family income, urbanicity and survey year.

^bModel 2 includes: age, gender, race/ethnicity, marital status, educational attainment, family income, urbanicity, survey year, frequency of asthma symptoms, comorbidities, and smoking status.

^cModel 3 includes: age, gender, race/ethnicity, marital status, educational attainment, family income, urbanicity, survey year, frequency of asthma symptoms, comorbidities, smoking status, English proficiency, and years lived in the US.

^dModel 4 includes: age, gender, race/ethnicity, marital status, educational attainment, family income, urbanicity, survey year, frequency of asthma symptoms, comorbidities, smoking status, English proficiency, years lived in the US, health insurance status, usual source of care, delayed or forgone asthma care, and receipt of asthma management plan.

^eOdds ratio corresponds to a 10 year increase in age.

^fnon-Latino

Z-Scores and p-values for Factors that Significantly Mediate the Association of Race/Ethnicity and Income with High Asthma Self-Efficacy

Table 3

<i>Treatment</i>	African-American ^a	Asian/ Pacific Islander ^a	American Indian/ Alaskan ^a	Other ^a	Latino	Family Income (% FPL)
<i>Mediator</i>	Z-score (p-value)	Z-score (p-value)	Z-score (p-value)	Z-score (p-value)	Z-score (p-value)	Z-score (p-value)
<i>Model 2^b</i>						
Frequency of Asthma Symptoms	2.97 (<0.01)	5.43 (<0.01)	-0.39 (0.35)	-1.37 (0.09)	1.82 (0.03)	-3.75 (<0.01)
<i>Model 3^c</i>						
English Proficiency	-	-2.59 (<0.01)	-	-	-2.55 (<0.01)	-2.43 (<0.01)
<i>Model 4^d</i>						
Health Insurance Status – Uninsured	-0.66 (0.25)	-0.82 (0.20)	-1.34 (0.09)	-1.00 (0.16)	-1.91 (0.03)	-2.05 (0.02)
Usual Source of Care	1.00 (0.16)	0.59 (0.28)	-0.86 (0.19)	0.53 (0.30)	1.11 (0.13)	1.22 (0.11)
Delayed or Forgone Asthma Care	0.14 (0.44)	2.02 (0.02)	0.32 (0.38)	0.11 (0.46)	-1.61 (0.05)	-3.15 (<0.01)
Asthma Management Plan – Did not discuss plan	-1.91 (0.03)	-2.18 (0.01)	1.34 (0.09)	-1.60 (0.06)	-2.58 (<0.01)	-2.59 (<0.01)

Abbreviations: FPL – Federal Poverty Level

^a non-Latino

^b Model 2 includes: age, gender, race/ethnicity, marital status, educational attainment, family income, urbanicity, survey year, frequency of asthma symptoms, comorbidities, and smoking status.

^c Model 3 includes: age, gender, race/ethnicity, marital status, educational attainment, family income, urbanicity, survey year, frequency of asthma symptoms, comorbidities, smoking status, English proficiency, and years lived in the US.

^d Model 4 includes: age, gender, race/ethnicity, marital status, educational attainment, family income, urbanicity, survey year, frequency of asthma symptoms, comorbidities, smoking status, English proficiency, years lived in the US, health insurance status, usual source of care, delayed or forgone asthma care, and receipt of asthma management plan.