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## Recruitment, Asthma Characteristics, and Medication Behaviors in Midwest Puerto Rican Youth: Data from Project CURA

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### Introduction

Puerto Rican children experience the highest asthma prevalence, morbidity, and mortality rates of any racial/ethnic group and these rates are increasing nationally.<sup>1–3</sup> Geography plays a role in these outcomes—Puerto Rican children living on the Island of Puerto Rico have milder asthma than Puerto Rican children living in Rhode Island.<sup>4</sup> These disparities in asthma prevalence and morbidity experienced by Puerto Rican children may be related to differential trigger exposure, healthcare systems, or behaviors<sup>4–7</sup> although such theories remain speculative because detailed descriptions of this population have been limited to youth on the island of Puerto Rico and the east coast of the United States (US).

US Census data from 2010 reported 102,703 Puerto Ricans living in the City of Chicago, making Chicago home to the third largest Puerto Rican population in the mainland US, behind only New York and Philadelphia.<sup>8</sup> The most recent asthma-specific surveillance data in Chicago by ethnicity were collected in a population-based health survey from 2002–2004 which documented an asthma prevalence in Puerto Rican children of 21%, with another 13% likely having asthma.<sup>9–10</sup> These data suggest Chicago Puerto Rican children have one of the highest reported asthma prevalence statistics in the nation, but the details of their asthma—such as risk factors and medication usage—have not been described.

When these data on prevalence were released in 2005, over 40 local agencies convened to address the health of their community.<sup>11</sup> The Greater Humboldt Park Community of Wellness was formed to implement a wellness strategy, setting asthma as one of their highest community priorities. They created an Asthma Task Force<sup>11</sup> and conducted focus groups and key informant interviews to better understand the community needs around asthma.<sup>12</sup> This formative and qualitative work led to the formation of Project CURA (*La Comunidad Unida Retando el Asma/The Community United to Challenge Asthma*). Project CURA is a behavioral randomized controlled trial to test the efficacy of a community health worker intervention to improve medication adherence and reduce home triggers in Puerto Rican children and adolescents. An extensive range of objective and self-reported asthma

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and psychosocial data were collected at the start of the trial. In this paper, we describe the asthma characteristics of this urban Midwest cohort of Puerto Rican youth, focusing on medication behaviors, and test if their asthma outcomes are associated with their demographic and psychosocial variables.

## Methods

### Study Design

The data used in this paper are a cross-sectional analysis of the baseline combined cohort for Project CURA. Funding resulted in the creation of two cohorts: one of children in elementary school (kindergarten through 8<sup>th</sup> grade) and one of adolescents in high school (9<sup>th</sup> through 12<sup>th</sup> grade). Methods and outcomes were coordinated across the two cohorts to allow for their analysis in combination as well as separately.

### Community-Based Participatory Research (CBPR) Approach

Community partner organizations played an influential role in all aspects of study implementation including the hiring of staff, design of instruments, recruitment, and interpretation of results. Partners included a local health coalition (The Greater Humboldt Park Community of Wellness, <http://ghpcommunityofwellness.org/>), a large social service organization (the Puerto Rican Cultural Center, ([www.prcc-chgo.org](http://www.prcc-chgo.org)), a parent-led service organization (Women Living with Hope), and a large Evangelical Christian church (New Life Covenant Church).

### Inclusion Criteria

The recruitment goal was to enroll 50 children in each of the two cohorts. In order to qualify, children had to meet the following criteria: 1) self-described Puerto Rican heritage, 2) child between the ages of 5–18, 3) child lives in same house as caregiver at least 5 days out of the week, and 4) child has persistent asthma and/or uncontrolled asthma. (The intention was to enroll children who would meet criteria for an inhaled corticosteroid prescription per the Expert Panel Report 3 National Asthma Education and Prevention Program guidelines.<sup>13</sup>) Persistent asthma was determined by any of the following: 1) had been prescribed inhaled corticosteroids in the last year, 2) had asthma symptoms (cough, wheezing, shortness of breath, chest tightness) > 2 days/week, nighttime symptoms 3–4 times/month, short acting beta2-agonist use for symptom control >2 days/week, some interference with normal activity, or 2 exacerbations requiring oral systemic corticosteroids in the past year.<sup>13</sup> Uncontrolled asthma was determined during screening by a score 1 on the Asthma Therapy Assessment Questionnaire (ATAQ).<sup>14</sup> Only one child per family was included in the study.

### Recruitment

The recruitment plan was designed to focus on two community areas with historically high Puerto Rican populations but due to gentrification, recruitment was not limited to these community areas alone. Recruitment was based on physician referral and community partner referral. A local private practice physician with a large Puerto Rican patient base and a local hospital emergency department agreed to refer patients to the study. Additionally, staff and volunteers at two community partner organizations planned to actively recruit in their programs. General community promotion of the study also was planned at local festivals, parades, and fairs. These sources were ultimately not sufficient due to funding and staffing issues, changes in patient demographics, and agency priority shifts.

New partnerships were formed. These included a foundation providing asthma services in mobile van units, another local clinic network, and two separate organizations that contained

parent organizers. Research staff began promoting the study at local festivals (two), parades (two) and health fairs (eight). Ads were taken out in community newspapers and list serves. A Project CURA website was created along with social network pages. The staff also collaborated with 40 community partners including principals, parent organizers, housing organizations, youth programs and neighborhood associations. Ultimately, staff connected with 11 high schools and 17 elementary schools. Schools were offered asthma education sessions and materials. Local churches were also brought in as partners, facilitating recruitment at four local churches.

People who expressed interest were called by bilingual research assistants who administered a screening form on the telephone. Those that passed the screener were visited in the home by the research assistants where written informed consent/assent was obtained and data were collected. Randomization occurred after the completion of the baseline data collection.

### Incentives

Families were told they would receive either four mailed newsletters with information about asthma or four community health worker visits for asthma education. All would receive a community resource binder. Everything was provided in English and Spanish. Enrolled children were offered free skin testing for environmental allergens. Upon completion of data collection, each caregiver (and high school participant) received twenty-five dollars.

### Outcomes

Data were collected by bilingual Puerto Rican research assistants in the home. Only the depression screening instrument was administered via paper; all other questions were asked verbally. Caregivers and children were asked together to report asthma symptoms and events; they were asked separately about other variables. All instruments were available in both English and Spanish. Validated Spanish translations were used when possible; non-validated instruments were professionally translated into Spanish. All instruments were then pilot tested with Puerto Rican Spanish- and English-speaking volunteers to ensure comprehension; feedback from these pilot tests was incorporated. Due to the complexity of the home trigger data, they are discussed in a separate publication (manuscript under review).

**Asthma Variables**—Asthma severity over the last 12 months was measured using the asthma functional severity scale (English  $\alpha=0.74$ , Spanish  $\alpha=0.72$ ).<sup>4,15-16</sup> Asthma control over the last four weeks was determined using four questions from the NHLBI guidelines regarding daytime symptoms, nighttime symptoms, quick-relief medication usage, and missed activities. An answer in the “not well controlled” range of any of these four questions resulted in an overall score of not controlled.<sup>13</sup> Participants were asked the number of hospitalizations, emergency department visits, and urgent care visits over the past 12 months, as well as number of days of school missed in the previous year.

**Medication Adherence**—The research assistant asked to see the child’s medication. No adherence was recorded for children who had not been prescribed an inhaled corticosteroid or did not have it in the house. Research assistants tried to ascertain specific physician dosing instructions but most participants did not have medication boxes with prescription labels and we were uncertain the accuracy of the caregiver/child self-report. Therefore, standard dosing regimens were assumed (2 doses per day for the combined fluticasone propionate/salmeterol discus, 4 doses per day for all others). For inhaled corticosteroids in a metered dose inhaler, a medication monitor was fitted on the inhaler to document the number of times the inhaler was actuated daily ([www.doser.com](http://www.doser.com)). If the medication adherence monitor could not be fitted to the inhaler, the medication counter number was

recorded. The research assistant then returned 21 days later to record the number on the counter or remove the medication adherence monitor. As true adherence can be distorted by either device malfunction or intentional overuse, adherence was truncated at 100% of the standard dose.

**Medication Technique**—Children were asked to demonstrate how they used their asthma medication. (Spacers, masks, or discus inhalers were used if the child had one and said they regularly use it.) If the child had no medication or preferred not to use their medication, a demonstration inhaler was provided. The scoring steps used to determine proper technique were adapted from the literature.<sup>17–18</sup>

**Psychosocial Variables**—Because significant associations have been shown between caregiver and child mental health and asthma in Puerto Rican youth,<sup>19–20</sup> depression and stress were measured. Depression severity was assessed in caregivers and high school cohort participants using the PHQ-9.<sup>21–23</sup> Caregiver stress was measured using the Perceived Stress Scale.<sup>24–26</sup> Children were asked the Life Events Checklist as a measure of their stress. This 21-item scale was developed specifically for Puerto Rican youth.<sup>27</sup> Events endorsed as negative were summed.

**Demographics**—Caregivers and children were asked about their age, sex, race/ethnicity, education, home ownership, and insurance. Acculturation was measured separately in caregivers and children using instruments that targeted Puerto Rican identity, language use, and cultural preferences. In caregivers, the possible range of scale was 11 (all Puerto Rican) to 55 (all non-Puerto Rican). In children, the range was 10 (all Puerto Rican) to 50 (all non-Puerto Rican).<sup>28</sup>

## Human Subjects

Written informed consent from the caregiver and child assent (for children with sufficient literacy) were obtained in the home by the research assistant. The study was approved by the Rush University Medical Center Institutional Review Board.

## Analysis

Basic summary statistics were calculated for demographics, covariates, and primary outcomes. In cases of small sample sizes or skewed distributions, medians are presented. Caregiver education was dichotomized from three categories (less than high school, high school grad/GED, more than high school) to two (at most high school/GED and more than high school). Asthma severity was dichotomized from four variables (low, mild, moderate, severe) to two (low/mild and moderate/severe). Inhaler technique was dichotomized to correct scores < 80% and ≥ 80%. Odds ratios were calculated from contingency tables for dichotomous predictors of insurance type, caregiver place of birth, caregiver depression and caregiver education. Odds ratios were calculated from univariate logistic regression for continuous predictors of caregiver acculturation, caregiver stress and number of child negative life events. The analysis was stratified by cohort. P values were calculated from a Pearson Chi-Square test or Fisher's exact test, where appropriate.

## Results

Recruitment and randomization of 101 families (51 into the elementary school cohort and 50 into the high school cohort) took 14 months. In total, 377 people expressed interest in the project, 229 completed the screener via telephone, 72 did not fulfill one or more of the inclusion criteria, 157 were eligible to participate, and 101 were randomized. The two main reasons for eligible families to not be randomized were lack of interest and difficulty in

scheduling a home assessment. The three largest recruitment sources for randomized participants were: schools (37%), parent organizations (12%) and a church (9%).

## Demographics

The sample demographics are shown in Table 1. In general, caregivers were not new migrants; only 30% were born in Puerto Rico and they had lived here for an average of 30 years (range 3–48 years). Most caregivers chose to complete the baseline home assessment in English (82%) and only one child chose Spanish. When asked directly during the screening “Is your child Puerto Rican?” all participants said yes. However, in the baseline interview when asked the open-ended question “What is your child’s race/ethnicity?”, only 75% of caregivers described their child’s race/ethnicity as Puerto Rican. Puerto Rican acculturation was in the mid-range for caregivers; the mean was 30 (SD 6) with a range of 15–45. Child acculturation ranges were similar. Caregivers reported educational attainment levels of “high school or more” similar to 2009 Census Bureau values for Puerto Ricans (76%).<sup>29</sup> Most families rented (79%), with low levels of ownership. The majority of children (71%) had public health insurance.

Children reported median values of 4 and 3 negative life events in the last year among the elementary school and high school cohorts respectively (range 0–12). In the high school cohort, 66% of teens reported signs of depression with 36% having signs of moderate to severe depression. Among the caregivers, 59% overall reported some depression with 33% having signs of moderate/severe depression. Caregiver perceived stress score means were similar to national averages.<sup>24–26</sup>

## Asthma Characteristics (Table 2)

Only 15% of participants fell into the low severity category of asthma symptoms. Asthma control using the ATAQ<sup>14</sup> yielded a mean score of 3.5 (SD 1.8, range 1–7), suggesting asthma management problems for all participants. Asthma control as estimated by the NHLBI guidelines<sup>13</sup> indicated that 31% of participants had controlled asthma symptoms over the last four weeks. Reported use of urgent care services over the past 12 months was very low.

Despite overall high asthma severity and poor control, the majority of participants did not have a controller medicine. In the elementary school cohort, 45% actually had a controller medicine (while 65% of the caregivers and 35% of children self-reported having a controller), 78% had a quick-relief medicine, and 54% had a spacer. In the high school cohort, only 12% had a controller medicine (28% of caregivers and 22% of adolescents self-reported having a controller), 82% had a quick-relief medicine, and 16% had a spacer. Measurements of inhaler technique indicated that in both cohorts, children could successfully complete at least half of the proper steps. For those with an inhaled corticosteroid, the combined median adherence was 1.0 doses/day (range 0–3.3), meaning about 25% adherent to standard metered dose inhaler regimens.

## Associations

Key demographic and psychosocial variables (child insurance, caregiver education, caregiver acculturation, caregiver place of birth, caregiver depression, child depression, caregiver stress, and child stress) were compared to the primary asthma outcomes (asthma severity, asthma control, had a controller medicine, had a reliever medicine, and inhaler technique) to test for associations. The results varied slightly between the cohorts (Table 3). In the elementary school cohort, lower caregiver education was associated with more controlled asthma (OR 6.75; 95% CI 1.29, 35.3). Increases in number of child negative life events were weakly associated with lower odds of good inhaler technique (OR 0.35; 95% CI

0.12, 1.01). In the high school cohort, caregiver depression was associated with a lower odds of controlled asthma (OR 0.25; 95% CI 0.07, 0.87). Having a caregiver born in the mainland US (compared to Puerto Rico) was weakly associated with lower odds of having a reliever medicine (OR 0.08; 95% CI 0.00, 1.49) while higher caregiver stress was associated with higher odds of having a reliever medicine (OR 1.09; 95% CI 1.00, 1.19).

To better explain medication usage, the dichotomous asthma severity and control variables were compared to had a controller medicine, had a reliever medicine, and inhaler technique. In the elementary cohort, having a controller was strongly associated with lower odds of controlled asthma (OR 0.09; 95% CI 0.01, 0.79). In the high school cohort, having a reliever medicine and proper inhaler technique were weakly associated with more severe asthma (reliever OR 4.31; 95% CI 0.93, 19.98. technique OR 7.11; 95% CI 0.80, 63.24).

## Discussion

In Project CURA, we set out to establish cohorts of Puerto Rican children and adolescents with persistent and/or uncontrolled asthma in an urban Midwest city in order to add to our understanding of social and geographic factors associated with asthma in this high risk population. Despite expected challenges related to trust, limited familiarity with research,<sup>30–32</sup> and a relatively intensive home visitation protocol, we successfully recruited these cohorts using a community-based participatory research approach. As intended, most children and adolescents had asthma in the higher severity categories and/or were uncontrolled.

The elementary school cohort showed similar asthma severity and slightly better control than comparably aged Puerto Rican children in Rhode Island (although severity and control were determined using different methods); both had worse asthma severity and control than children on the island of Puerto Rico and white children in Rhode Island.<sup>4</sup> Emergency room visits and hospitalizations were low overall, and comparable again to those reported from Rhode Island.<sup>4</sup> The high school cohort reported somewhat better control than the elementary school cohort and similarly low rates of emergency room visits and hospitalizations. The low rates of emergency usage are somewhat surprising considering the poor asthma control in this population. All participants had health insurance, although those with private insurance may have faced steep copayments for emergency care. It is possible participants self-medicated attacks at home, although some did not even have reliever medicines which suggests they may not be properly recognizing and responding to asthma symptoms.

Despite high severity and/or poor control, less than half of children in the elementary school cohort and only 12% of the high school cohort had an inhaled corticosteroid in the home. Alarming, 20% did not have any quick-relief medication in the home. Only 54% percent of elementary school participants and 16% of high school participants had a spacer. One explanation for this lack of medicines might be that families are not offered adequate prescriptions and equipment which is an issue on the island of Puerto Rico.<sup>33</sup> Another possibility is families are not following physician recommendations. Further research needs to be done to better clarify these issues. With the equipment they had, their medication technique was not ideal but on average they did get more than half of the steps correct. Those participants that did have inhaled corticosteroids had poor adherence with no participant achieving full adherence to the standard daily doses of medication (even with the added incentive of having a monitoring device on their inhaler). In the elementary school cohort, having a controller was associated with less controlled asthma which implies that just having a controller in the home does not ensure usage or asthma control. These issues of poor adherence, and discrepancies between self-reported and actual medication prescriptions filled, pose added challenges for clinicians who typically rely on self-report. The data on

adolescents are especially useful due to the lack of research on asthma in the adolescent population.<sup>34–36</sup>

Many Project CURA families faced significant psychosocial challenges. Caregiver depression rates and perceived stress levels were high. Not surprisingly, caregiver depression and stress showed some associations with worse asthma control and more reliever medications in the high school cohort. Child depression rates in the high school cohort were also disturbingly high (66% with symptoms of depression). The number of negative life events experienced by children was higher than previously reported in other Puerto Rican cohorts.<sup>27</sup> Addressing these mental health issues may be critical to achieving control of their asthma.<sup>19</sup>

Our sample and that of the Rhode Island–Puerto Rico Asthma Center (RIPRAC) study<sup>4</sup> are not population-based and therefore cannot be generalized to all Puerto Rican youth, and the focus on only one ethnic group limits comparison with other population groups. In addition, our sample was specifically intended to have high asthma morbidity making it less applicable to the population at large. It is likely that the requirement of in home visitation influenced participation; the recruiters reported that the families who refused had more chaos in their lives (unreliable phone access, difficult work schedules, changing living situations) and expressed apprehension at the home visit (especially for the adolescents). These baseline data are cross-sectional and therefore we cannot fully understand the role of depression, stress, and education status. Finally, while many of our data used objective measurements, severity and control were not assessed clinically—we did not obtain spirometry and relied on self-report for asthma symptoms and health care utilization.

Racial and ethnic healthcare disparities are associated with worse outcomes and higher societal costs,<sup>37</sup> but understanding these disparities in asthma is complicated.<sup>16,38</sup> Despite the stated limitations, the baseline data from Project CURA provide a detailed description of the asthma characteristics and medication usage in high risk Puerto Rican children and adolescents in a large Midwest city. Similar to other Puerto Rican populations, these youth bear a significant burden from asthma which adds to our understanding of the asthma disparities experienced by this population, especially the adolescents. The need for visual inspection of medications and equipment available to the children, the assessment of medication technique, and the objective measurement of adherence are critical issues for clinicians to consider since improvement of medication usage is essential in improving asthma outcomes in this high risk population.

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**Table 1**

## Demographic Characteristics of Project CURA Participants

	Elementary School Cohort	High School Cohort	Combined Cohort
	N=51	N=50	N=101
<i>Child</i>			
Age in years, mean (SD)	9 (3)	16 (1)	13 (4)
Female	20 (39%)	29 (58%)	49 (49%)
Place of birth			
Puerto Rico	5 (10%)	0	5 (5%)
Mainland US	46 (90%)	50 (100%)	96 (95%)
Puerto Rican acculturation, mean (SD) <sup>1</sup>	30 (3)	31 (4)	31 (4)
Grade in school, median (25%, 75%)	4 (1,6)	10 (9,11)	8 (4,10)
Type of insurance			
Public	34 (67%)	38 (76%)	72 (71%)
Private	17 (33%)	12 (24%)	29 (29%)
Child depression <sup>2</sup>			
None	Not measured	16 (34%)	
Mild		14 (30%)	
Moderate/Severe		17 (36%)	
Negative life events, median (25%, 75%) <sup>3</sup>	4 (1,5)	3 (1,5)	4 (1,5)
<i>Caregiver</i>			
Age in years, mean (SD)	37.7(7.5)	41.2(7.4)	39.4(7.6)
Female	48 (94%)	46 (92%)	94 (93%)
Education level			
Less than high school	11 (22%)	14 (28%)	25 (25%)
High school grad/GED	14 (27%)	14 (28%)	28 (28%)
More than high school	26 (51%)	22 (44%)	48 (47%)
Place of birth			
Puerto Rico	14 (27%)	16 (32%)	30 (30%)
Mainland US	33 (65%)	34 (68%)	67 (66%)
Other	4 (8%)	0	4 (4%)
Years living in mainland US, median (25%, 75%) <sup>4</sup>	30 (20,40)	32 (25,40)	30 (24,40)
Married/living with partner	29 (57%)	26 (52%)	55 (54%)
Home ownership			

	Elementary School Cohort	High School Cohort	Combined Cohort
	<b>N=51</b>	<b>N=50</b>	<b>N=101</b>
Own home	10 (20%)	9 (18%)	19 (19%)
Rent	40 (78%)	40 (80%)	80 (79%)
Live with family/friends	1 (2%)	1 (2%)	2 (2%)
Puerto Rican acculturation, mean (SD) <sup>5</sup>	30 (5)	30 (6)	30 (6)
Caregiver depression category 2			
None	26 (51%)	16 (32%)	42 (42%)
Mild	12 (24%)	14 (28%)	26 (26%)
Moderate/Severe	13 (25%)	20 (40%)	33 (33%)
Perceived stress, mean (SD) <sup>6</sup>	21.22 (8.81)	24.34 (10.77)	22.78(9.91)

SD = Standard deviation. GED = General Education Diploma. US = United States.

<sup>1</sup>Possible range 1–45, lower numbers indicate all Puerto Rican-focused responses, higher numbers indicate non-Puerto Rican responses.<sup>28</sup>  
Elementary school: N=43. High school: N=46.

<sup>2</sup>Measured using the PHQ-9. Possible range 0–27. A score of <5 indicates no depression, 5–9 is mild depression severity, 10 or higher is moderate to severe depression severity.<sup>21–23</sup> High school N=47.

<sup>3</sup>Elementary school: N=46.<sup>27</sup>

<sup>4</sup>Elementary school: N=18. High school: N=16.

<sup>5</sup>Possible range 1–55, lower numbers indicate all Puerto Rican-focused responses, higher numbers indicate non-Puerto Rican responses.<sup>28</sup>  
Elementary school: N=49. High school: N=46.

<sup>6</sup>Perceived Stress Scale.<sup>24–26</sup> Elementary school: N=50.

**Table 2**

## Asthma Characteristics of Project CURA Participants

	Elementary School Cohort	High School Cohort	Combined Cohort
	N=51	N=50	N=101
12 month severity score			
Low	8 (16%)	7 (14%)	15 (15%)
Mild	15 (29%)	12 (24%)	27 (27%)
Moderate	18 (35%)	25 (50%)	43 (43%)
Severe	10 (20%)	6 (12%)	16 (16%)
Controlled over past 4 weeks	11 (22%)	20 (40%)	31 (31%)
Over past 12 months, median (range)			
Hospitalizations	1 (0,3)	0 (0,0)	0 (0,1)
Emergency department visits	0 (0,0)	0 (0,0)	0 (0,0)
Prednisone use	1 (0,3)	0 (0,1)	0 (0,2)
Days of missed school	4 (1,10)	3 (0,11)	4 (0,10)
Has controller med <sup>1</sup>			
Yes	23 (45%)	6 (12%)	29 (29%)
No	28 (55%)	44 (88%)	72 (71%)
Has reliever medicine (albuterol)	40 (78%)	41 (82%)	81 (80%)
Has spacer <sup>2</sup>	14 (54%)	3 (16%)	17 (38%)
Inhaler Technique: % of steps correct, median (25%,75%) <sup>3</sup>			
Inhaler	50 (50,75)	63 (50,75)	63 (50,75)
Inhaler with holding chamber	75 (69,75)	63 (38,88)	75 (63,75)
Inhaler with holding chamber/mask	83 (83,100)	-	83 (83,100)
Dry powder inhaler	92 (83,100)	33	83 (33,100)
Adherence, average doses per day <sup>4</sup>			
Doser, median (25%,75%)	0.9 (0.2,1.5)	0.4 (0.4,1.0)	0.9 (0.3,1.5)
Counter only, median (25%,75%)	1.3 (0.7,1.7)	1.1	1.2 (0.9,1.5)
Combined, median (25%,75%)	1.0 (0.6,1.5)	0.7 (0.4,1.1)	1.0 (0.4,1.5)

<sup>1</sup>Controller meds: combined fluticasone propionate/salmeterol discus 100/50mcg and 250/50mcg, combined fluticasone propionate/salmeterol HFA 115/21mcg and 230/21mcg, fluticasone propionate 44mcg and 110mcg, beclomethasone 80mcg and combined budesonide/formoterol 80/4.5 mcg

<sup>2</sup>Elementary school: N=26, High school: N=19

<sup>3</sup>For Inhaler - Elementary school: N=33, High school: N=43. For inhaler with holding chamber - Elementary school: N=8, High school: N=2. For inhaler with holding chamber/mask - Elementary school: N=5. For dry powder inhaler - Elementary school: N=2, High school: N=1.

<sup>4</sup>A Doser is a medication monitoring device. Missing adherence data on 2 in Elementary school cohort due to error. For Doser - Elementary school: N=18, High school: N=5. For Counter only - Elementary school: N=3, High school: N=1.

Table 3

Associations between asthma characteristics and demographics

Elementary School Cohort: Odds Ratio (95% CI)						
	Asthma controlled	Have a controller medicine	Have a reliever medicine	Asthma severity moderate or severe	Inhaler technique correct	80% correct
Child public insurance	2.70 (0.51, 14.21)	0.79 (0.24, 2.60)	1.19 (0.29, 4.79)	1.61 (0.50, 5.19)	0.32 (0.04, 2.70)	
Caregiver born in US	0.94 (0.23, 3.78)	0.55 (0.17, 1.76)	0.63 (0.14, 2.72)	0.47 (0.14, 1.55)	1.35 (0.12, 14.82)	
Caregiver any depression	2.14 (0.54, 8.48)	0.62 (0.20, 1.89)	0.47 (0.12, 1.85)	1.09 (0.36, 3.29)	0.71 (0.09, 5.73)	
Caregiver less than high school education	0.77 (0.14, 4.20)	0.60 (0.15, 2.39)	1.31 (0.24, 7.17)	1.58 (0.40, 6.27)	0.28 (0.01, 5.80) <sup>‡</sup>	
Caregiver acculturation	0.98 (0.87, 1.11)	1.05 (0.94, 1.18)	0.98 (0.86, 1.11)	1.03 (0.93, 1.15)	0.96 (0.80, 1.16)	
Caregiver stress	1.04 (0.97, 1.14)	0.94 (0.88, 1.01)	1.01 (0.94, 1.10)	0.99 (0.93, 1.06)	0.99 (0.88, 1.12)	
Child negative life events	0.92 (0.66, 1.27)	0.77 (0.57, 1.03)	1.15 (0.80, 1.65)	1.06 (0.81, 1.38)	<b>0.35 (0.12, 1.01)*</b>	

  

High School Cohort: Odds Ratio (95% CI)						
	Asthma controlled	Have a controller medicine	Have a reliever medicine	Asthma severity moderate or severe	Inhaler technique correct	80% correct
Child public insurance	0.37 (0.10, 1.40)	0.59 (0.09, 1.40)	0.89 (0.16, 4.97)	3.03 (0.80, 11.54)	0.27 (0.06, 1.30)	
Caregiver born in US	1.17 (0.34, 3.96)	0.93 (0.15, 5.71)	<b>0.08 (0.00, 1.49)**<sup>‡</sup></b>	0.65 (0.18, 2.29)	0.83 (0.17, 4.01)	
Caregiver any depression	<b>0.25 (0.07, 0.87)**</b>	0.42 (0.07, 2.36)	1.07 (0.23, 4.99)	0.97 (0.28, 3.30)	0.38 (0.8, 1.79)	
Caregiver less than high school education	<b>0.17 (0.03, 0.85)**</b>	0.48 (0.05, 4.49)	1.44 (0.26, 8.00)	2.93 (0.70, 12.33)	1.20 (0.25, 5.77)	
Child any depression	2.06 (0.58, 7.35)	0.75 (0.11, 5.02)	1.73 (0.39, 7.63)	1.23 (0.36, 4.19)	1.95 (0.34, 11.18)	
Caregiver acculturation	0.98 (0.89, 1.09)	1.06 (0.91, 1.24)	1.03 (0.90, 1.20)	1.05 (0.95, 1.17)	0.99 (0.87, 1.13)	
Caregiver stress	0.96 (0.91, 1.02)	0.96 (0.88, 1.04)	<b>1.09 (1.00, 1.19)**</b>	1.02 (0.97, 1.08)	1.02 (0.95, 1.09)	
Child negative life events	1.06 (0.89, 1.26)	1.09 (0.85, 1.38)	1.15 (0.88, 1.49)	1.11 (0.92, 1.34)	1.20 (0.96, 1.51)	

\* P<0.10

\*\* P<0.05

<sup>‡</sup> Correction of 0.5 used because of cell with 0 count