

Identifying Athletes at Risk for Asthma: A Prevalence Study of an Urban, Athletic Adolescent Population

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Background and Objectives

- Asthma is a chronic inflammatory disease of the lungs that is characterized by symptoms of wheezing, breathlessness, chest tightness, and coughing.^{1,2}
- As of 2018, the Center for Disease Control and Prevention (CDC) reported 24.8 million people in the United States currently affected by asthma, with a national prevalence of 7.7% which has increased since 2001 (7.4%).^{3,4}
- Population health data have prompted concern over the economic, racial, and ethnic disparities of asthma, with a markedly higher prevalence amongst minority and low-income children.^{5,6,7}
- In the management of pediatric asthma, physical activity is a significant predictor of its course.^{8,9}
- With approximately 27 million children and adolescents participating in some form of organized sports in the United States, structured sports systems provide a unique opportunity to monitor and act on asthma prevalence.^{10,11}
- Prior to participation in organized sports, athletes must receive a preparticipation physical evaluation (PPE) and be cleared for competition.¹²
- The Athlete Health Organization (AHO) is a nonprofit student health initiative that provides a day of free comprehensive PPE to Philadelphia high school and middle school student athletes.¹³

Objectives

- To assess the prevalence of asthma in an urban, athletic adolescent population using PPE data**
- To identify social factors that place adolescent athletes at risk for developing asthma**

Research Question and Hypotheses

Research Question

- Do the social determinants of health such as race, ethnicity, and income influence the prevalence of asthma among adolescents participating in sports?**

Hypotheses

- Our previously described low-income, minority sample would convey a higher prevalence of asthma when compared to the general population
- Social factors race/ethnicity and income would be associated with asthma prevalence

Predictions:

- Athletes living in low-income communities would show higher rates of asthma compared to athletes living in higher income communities
- Athletes who are Black would show higher rates of asthma compared to athletes who are White

Methods

- June 2016-June 2019
- Cross-sectional retrospective cohort study
- Secondary data analyses using the AHO PPE data to determine asthma prevalence
- Asthma determined as any past or present diagnosis as described in the history or physical
- Chi-square tests were performed to characterize the relationship between asthma and social factors such as race/ethnicity and income
- Income was operationalized as either higher income or low income according to zip code
 - A community is considered a low-income community as defined by Internal Revenue Service Code Section 45D(e)
- Control variables such as age and sex were also collected

Results

- 1,400 athletes ranging 9-19 years old had completed PPEs (Table 1)
- 23.4% student-athletes were found to have asthma

- A majority of asthmatics (65.5%) identified as Black (Figure 1)

- A χ^2 test of dependence was used to assess relationship between asthma and race/ethnicity category
 - This test was significant, $\chi^2 = 6.49$ (1), $p < .05$, indicating a significant association (Figure 1)
 - Inspection of the proportions indicates this effect likely lies in the proportion of Black athletes with asthma vs the other race/ethnicity categories

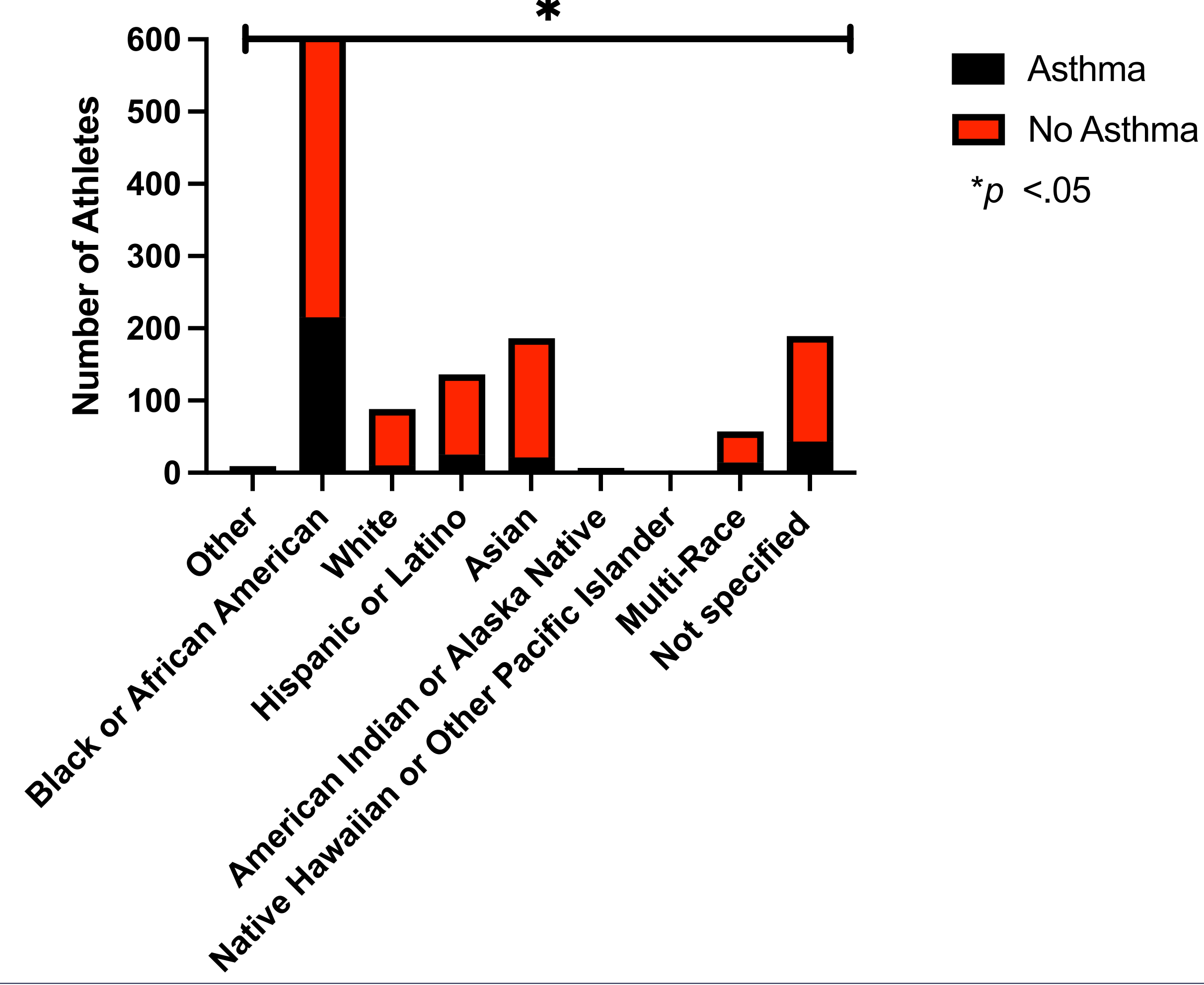
- While a majority of asthmatics (86.3%) resided in low-income zip-codes, χ^2 test of dependence showed no significant association between income level and asthma prevalence, $p > .05$

- Age and sex also were not significantly associated with asthma prevalence, $p > .05$

Table 1. Demographics by year				
	2016	2017	2018	2019
Total, N	381	378	361	279
Age, mean +/- SD	15.4+/-1.3 y	15.4+/-1.3 y	15.6+/-1.4 y	15.4+/- 1.4 y
Range	12-19 y	12-18 y	11-19y	9-19
Sex				
Female	149 (39.1%)	154 (40.7%)	160 (44.3%)	126 (45.0%)
Male	231 (61.6%)	219 (57.9%)	187 (51.8%)	144 (51.4%)
Other	0 (0.0%)	0 (0.0%)	2 (0.6%)	0 (0.0%)
Not Specified	1 (0.3%)	5 (1.3%)	12 (3.3%)	10 (3.6%)
Race				
Other	1 (0.3%)	3 (0.8%)	2 (0.6%)	3 (1.1%)
Black or African American	262 (68.8%)	200 (52.9%)	122 (33.8%)	144 (51.4%)
White	34 (8.9%)	24 (6.3%)	18 (5.0%)	12 (4.3%)
Hispanic or Latino	18 (4.7%)	47 (12.4%)	26 (7.2%)	45 (16.1%)
Asian	51 (13.4%)	67 (17.7%)	36 (10.0%)	32 (11.4%)
American Indian or Alaska Native	2 (0.5%)	4 (1.0%)	0 (0.0%)	0 (0.0%)
Native Hawaiian or Other Pacific Islander	1 (0.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Not Specified	7 (1.8%)	17 (4.5%)	148 (41.0%)	17 (6.0%)
Multi-Race	5 (1.3%)	16 (4.2%)	9 (2.5%)	27 (9.6%)
Income				
Higher Income	60 (15.7%)	64 (16.9%)	46 (12.7%)	18 (6.4%)
Low Income	321 (84.3%)	214 (83.1%)	315 (87.3%)	262 (93.6%)
Asthma				
Asthma	98 (25.8%)	86 (22.8%)	87 (24.1%)	57 (20.4%)
No Asthma	283 (74.2%)	292 (77.2%)	274 (75.9%)	223 (79.6%)

Results

Figure 1. Asthma Prevalence by Race/Ethnicity Category



Discussion

- In support of our hypothesis, our study group showed a higher prevalence of asthma when compared to the CDC's estimate for the general population.**
- Additionally, race/ethnicity was associated with asthma prevalence, supporting our second hypothesis that social factors play an important role in explaining health disparities.**

- Identifying these social factors that place adolescent athletes at risk of asthma is the first step to understanding the complex relationship between asthma and exercise.

- We hope that our research will provide the groundwork for establishing best practices when serving at-risk populations of children with asthma.

- Our study was limited by a conservative operationalization of asthma in a relatively small sample of student athletes.

- Future work should explore more methods for measuring/diagnosing asthma in the pediatric and adolescent population.

- Additional directions of research may explore multiple regression models that include past medical history, sports played, and other social factors.

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References

- Niimi A. Cough and Asthma. *Curr Respir Med Rev*. 2011;7(1):47-54. doi:10.2174/157339811794109327
- National Asthma Education and Prevention Program TEP on the D and M of A. Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma. 2007. <https://www.ncbi.nlm.nih.gov/books/NBK7232/>. Accessed February 28, 2021.
- Most Recent National Asthma Data | CDC. National Health Interview Survey, National Center for Health Statistics, CDC. https://www.cdc.gov/asthma/most_recent_national_asthma_data.htm. Published 2018. Accessed February 28, 2021.
- Moorman J, Akinbami L, Bailey C. National Surveillance of Asthma: United States, 2001-2010. *Natl Cent Heal Stat*. 2012;3(35).
- Measures to Identify and Track Racial Disparities in Childhood Asthma. Center for Disease Control, Standards Subcommittee of the Asthma Disparities. https://www.cdc.gov/asthma/asthma_disparities/default.htm. Published 2016. Accessed February 28, 2021.
- Korribli A, Cain A, Bauman LJ, Brown NM, Reznik M. Parental Perspectives of Barriers to Physical Activity in Urban Schoolchildren With Asthma. *Acad Pediatr*. 2018;18(3):310-316. doi:10.1016/j.acap.2017.12.011
- Coordinated Federal Action Plan to Reduce Racial and Ethnic Asthma Disparities. Washington, DC: 2012.
- Welsh L, Roberts RGD, Kemp JG. Fitness and physical activity in children with asthma. *Sport Med*. 2004;34(13):861-870. doi:10.2165/00007256-200434130-00001
- Fitch KD, Morton AR. Specificity of exercise in exercise-induced asthma. *Br Med J*. 1971;4(5787):577-581. doi:10.1136/bmj.4.5787.577
- Participation in sports teams or sports lessons after school or on weekends, Nationwide: Child and Adolescent Health Measurement Initiative. National Survey of Children's Health (NSCH) data query. Data Resource Center for Child and Adolescent Health supported by the U.S. Department of Health and Human Services, Health Resources and Services Administration (HRSA), Maternal and Child Health Bureau. <https://www.childhealthdata.org/browse/survey/results?c=794481+1>. Published 2018. Accessed February 27, 2021.
- Noel-London K, Breitbach A, Belue R. Filling the Gaps in Adolescent Care and School Health Policy-Tackling Health Disparities through Sports Medicine Integration. *Healthcare*. 2018;8(4):132. doi:10.3390/healthcare8040132
- Mirabelli MH, Devine M, Singh J, Mendoza OM. *The Preparticipation Sports Evaluation*. Vol 92.; 2015. www.aafp.org/afp/AmericanFamilyPhysician971. Accessed February 27, 2021.
- Athlete Health Organization. 2020. <http://athletehealth.org/#our-commitment>. Accessed March 1, 2021.