Summer 8-10-2019

The Impact of Racism on Asthma in Minority Pediatric Populations

Ashley Amick

Recommended Citation
Amick, Ashley, "The Impact of Racism on Asthma in Minority Pediatric Populations" (2019). School of Physician Assistant Studies. 687. 
https://commons.pacificu.edu/pa/687
The Impact of Racism on Asthma in Minority Pediatric Populations

Abstract

Background: Asthma is one of the most common chronic diseases diagnosed in children today, and some minority populations constitute a much higher incidence of asthma than others. Many factors are known to play into the development of asthma, including genetics, smoking history, and psychosocial stress. Experiencing childhood racism may be one type of stressor that contributes to the development of asthma and poor asthma outcomes. This study aims to identify the effect of experienced racism on asthma outcomes in minority children.

Methods: An exhaustive search of available medical literature was conducted using the databases MEDLINE – PubMed, CINAHL, and Web of Science. An age filter was applied in all databases encompassing children from birth to 21 years old. The key terms used were asthma and racism. Eligibility criteria included English language and human-only studies. Articles must also have included at least one measured asthma outcome and involved minority participants. Studies were assessed for quality using GRADE criteria.

Results: The search produced 2 available studies that met search criteria, both being case-control studies. Although measuring different asthma outcomes, the studies suggested that African American children who report experiencing racism to any degree have a higher incidence of asthma, and are more likely to have poorly controlled asthma. Data on other minorities showed mixed results. The overall quality of evidence provided is low for asthma incidence and very low for poor asthma control.

Conclusion: The data suggested that for African American children, those who reported experiencing racism were more likely to have asthma, more likely to have poorly controlled asthma, and had a higher bronchodilator (BDR) response. One study’s data on other minority children showed mixed results, and different asthma phenotypes may also play a role in susceptibility. Further studies are needed, particularly cohort studies, to further determine the effects of racism on asthma in different minority populations, and to increase our confidence in the results. This may help us understand if additional screening is needed for children who may be at risk for asthma and poor asthma outcomes, and to help aid in treatment plans.

Degree Type
Capstone Project

Degree Name
Master of Science in Physician Assistant Studies

Keywords
asthma, bronchodilator response, children, discrimination, youth, racism

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The Impact of Racism on Asthma in Minority Pediatric Populations

Ashley K. Amick

A Clinical Graduate Project Submitted to the Faculty of the
School of Physician Assistant Studies
Pacific University
Hillsboro, OR

For the Masters of Science Degree, August 10th, 2019

Faculty Advisor: Saje Davis-Risen, MS, PA-C
Clinical Graduate Project Coordinator: Annjanette Sommers, PA-C, MS
Biography

Ashley Amick was born in El Paso, Texas and has spent the last 11 years making Oregon her home. She graduated with a BS in Exercise and Sports Science from Oregon State University, while also obtaining a minor in Chemistry and a certificate in Medical Humanities. During her years there she spent time abroad studying Australia’s Universal Health Care system. After completion of her undergraduate degree, Ashley became a Chiropractic Assistant in Hillsboro before working as a Certified Nursing Assistant at OHSU. Ashley has a passion for pediatrics and has spent time volunteering in a pediatric Emergency Department, in addition to being a former gymnastics coach for local youth and assisting with the Oregon Special Olympics. As a former competitive gymnast and professional stunt team member, she takes great pride in helping her community stay physically active and healthy.
Abstract

Background: Asthma is one of the most common chronic diseases diagnosed in children today, and some minority populations constitute a much higher incidence of asthma than others. Many factors are known to play into the development of asthma, including genetics, smoking history, and psychosocial stress. Experiencing childhood racism may be one type of stressor that contributes to the development of asthma and poor asthma outcomes. This study aims to identify the effect of experienced racism on asthma outcomes in minority children.

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Results: The search produced 2 available studies that met search criteria, both being case-control studies. Although measuring different asthma outcomes, the studies suggested that African American children who report experiencing racism to any degree have a higher incidence of asthma, and are more likely to have poorly controlled asthma. Data on other minorities showed mixed results. The overall quality of evidence provided is low for asthma incidence and very low for poor asthma control.

Conclusion: The data suggested that for African American children, those who reported experiencing racism were more likely to have asthma, more likely to have poorly controlled asthma, and had a higher bronchodilator (BDR) response. One study’s data on other minority children showed mixed results, and different asthma phenotypes may also play a role in susceptibility. Further studies are needed, particularly cohort studies, to further determine the effects of racism on asthma in different minority populations, and to increase our confidence in the results. This may help us understand if additional screening is needed for children who may be at risk for asthma and poor asthma outcomes, and to help aid in treatment plans.
Keywords: asthma, bronchodilator response, children, discrimination, minority, racism, youth
Acknowledgements

To Khrystian Clark: Thank you for believing in me every time I failed to believe in myself, and for supporting my dreams every step of the way. Your unconditional love for me has made my PA journey even greater. You are my definition of strength and growth.

To Lesley and Michael Amick: Thank you for raising me to be person I am today, and helping me build a beautiful life. You have given me the confidence to achieve every goal I have ever set for myself. I would not be where I am today without your never-ending love and patience in all aspects of life.
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List of Abbreviations

BDR  Bronchodilator Response  
CDC  Centers for Disease Control and Prevention  
EOD  Experiences of Discrimination  
ED  Emergency Department  
FEV\textsubscript{1}  Forced Expiratory Volume in One Second  
GALA  Genes-Environments and Admixutre in Latino Americans Study  
GRADE  Grading of Recommendations Assessment, Development and Evaluation  
ICS  Inhaled Corticosteroid  
LABA  Long Acting Beta Agonist  
NHLBI  National Heart, Lung, and Blood Institute  
RCT  Randomized Controlled Trial  
SAGE  Study of African Americans, Asthma, Genes, and Environments  
SES  Socioeconomic Status
The Impact of Racism on Asthma in Minority Pediatric Populations

BACKGROUND

The Development of Asthma

Asthma, a chronic inflammatory lung disease, has become a common childhood illness in the United States, with prevalence increasing over the past several decades.\(^1\) A variety of factors may relate to asthma development including genetics, race, socioeconomic status (SES), and smoke exposure. One other risk factor that has shown to play a role in asthma in both the adult and pediatric populations is that of psychosocial stress.\(^2\) Recent evidence\(^3\) demonstrates that psychosocial stress can predispose individuals to asthma through modulation of the immune system and genetic changes. One type of psychosocial stress that minority populations are commonly faced with in today’s social climate is that of experiencing racism.

The CDC\(^4\) reports that the incidence of childhood asthma is highest in the African American population, with 15.7% of those children affected. Second to this is the Puerto Rican population, with a childhood asthma incidence of 12.7%. Both of these are higher than the asthma rate in Caucasian populations (7.1%).\(^4\) Data from one
study\textsuperscript{5} demonstrated that at one point between 2001-2010, African American children under 17 years old were twice as likely as Caucasian children to develop asthma. The exact reason for this increased incidence in not precisely known, though many of the aforementioned risk factors may play a role.

**Racism’s Impact on Health**

Racism, the act of treating one differently or having a bias based on an individual’s race, ethnicity, or skin color, is one type of psychosocial stress that children can be exposed to. Evidence shows it is also a determinant of health.\textsuperscript{6,7} Experiencing racism has been associated with obesity\textsuperscript{8} and poor mental health\textsuperscript{6} in adults; however, it’s effects on physical health in the pediatric population are less known. While any child can be affected by racism or discrimination, minorities are largely more affected.\textsuperscript{7} Thus, exposure to the psychosocial stress of racism may play a negative role in asthma development, particularly in the pediatric population.

**Asthma and Racism in Children**

In addition to an increase in asthma incidence and prevalence, it is important to identify trends in asthma control. Poor asthma control leads to an increased number of ED visits and hospital stays, increased medical costs, a greater number of school and work days missed,
increased stress among children and families alike. Poor control can also lead to decreased lung development and lung function that may persist into adulthood. If racism exposure can lead to increased rates of other mental and physical diseases in adults, then perhaps this same concept could be applied to children. The aim of this study is to evaluate whether racism had a negative impact on asthma in minority pediatric populations, particularly in regards to prevalence and control.

METHODS

An exhaustive literature search using the MEDLINE-PubMed, CINAHL, and Web of Science databases was completed. The search terms of racism and asthma were used, including a filter applied to each search relating to age. On MEDLINE, the additional filter of child: birth-18 years was used. When using the CINAHL database, the filter all child was placed, which included children up to the age of 19. No additional age filter was used on Web of Science.

Additional eligibility criteria for articles was English language and human-only studies. Articles included studied at least one measure of asthma (incidence, prevalence, control, severity, or medication response) and measured racism or discrimination. Additional criteria included studies which used youth participants under the age of 21.

Exclusion criteria included studies that did not include data on minority populations, or where racism was not the primary variable
used to identify a relationship between psychosocial stress and asthma (articles that only measured SES, etc.). Studies were also excluded if the participants with asthma were not provider-diagnosed, or were not randomized controlled trials, cohort studies, or case-control studies. Selected articles which met the aforementioned criteria were assessed for quality using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) Working Group guidelines.¹⁰

**RESULTS**

The search of the aforementioned 3 databases resulted in an initial 69 articles to be reviewed for relevancy. After removing duplicate articles and excluding those which did not meet the eligibility criteria listed above, a total of two articles remained. Both of these articles¹¹,¹² were case-control studies (See Tables I-III). Several articles were considered but excluded based on a lack of quantifying the racism experienced or broadened to only relate psychosocial stress to asthma.¹³ Others were excluded due to the asthma being self-reported.¹⁴

These are two case-control studies that aimed to study the relationship between race, socio-environmental factors, and asthma measures including prevalence, control, and severity.¹² The participants recruited for the original studies and used in the Thakur et al study¹¹ were from urban areas in the San Francisco Bay Area,
Houston, Chicago, New York, and Puerto Rico. They also had to have all four grandparents of the same ethnicity (either African American (SAGE II) or Latino (GALA II).

**Thakur et al (2017)**

This case-control study\(^\text{11}\) involved 1086 Mexican American participants, 1025 Puerto Rican Islanders, 954 African Americans and 522 Latinos. All participants were recruited between 2006-2014 and were between 8-21 years old. These children were recruited from the Study of African Americans, Asthma, Genes, and Environments (SAGE II) and the Genes-Environments and Admixture in Latino Americans study (GALA II).\(^\text{11}\)

Children recruited were matched accordingly into case and control groups depending on if they had asthma or not. For those with asthma, the disease had to be physician-diagnosed with information supplied on past medication and symptom use from the 2 years prior. Control subjects were matched to case subjects by the hospital or clinic site that recruited them, which demonstrates that those matched with and without asthma came from similar environments (air pollution levels, etc.). Asthma control was measured by obtaining a score from the National Heart, Lung, and Blood institute’s standard of measurement. This was done by collecting information through a questionnaire discussing symptom severity, its interference with daily
life and medication use. In this study, it was defined as controlled, partially controlled, or poorly controlled.11

Perceived racism was measured in these participants by the completion of the Experiences of Discrimination (EOD) questionnaire. The parent/caretakers were allowed to give input at this point, which is a potential for bias discussed later below. The study questions related to past experiences of discrimination in 4 places: at school, during medical care, when receiving services, or in public. The results were defined as none or any, and then sub categorized as never, rarely, and often.11

Patients were excluded from the study if they were missing info on discrimination, their ancestry, or the other variables listed. According to the study, the excluded participants tended to be older, have more smoke exposure, and have higher incidences of asthma compared to those participants who were included.11

Several other confounders were considered in the analyses, based on information obtained from the original GALA II and SAGE II studies. These were current and in utero smoke exposure, sex, age, if they had been breast fed, early-life daycare attendance, and reports of visible water damage or mold in the home. SES was also looked at in these participants, and was measured based on several factors
including maternal education, reported annual household income, and whether or not the participant in question had health insurance.\textsuperscript{11}

The primary outcomes measured in this article that were of relevance to the intended question were the odds of experiencing asthma and level of disease control in relation to the presence or absence of perceived racism. This study showed that after adjusting for all of the confounders listed in the previous paragraph including SES, African American children reportedly experiencing any amount of racism had a 78\% greater odds of having asthma. Also, as the amount of perceived racism increased, so did the odds of asthma. This same relationship was not observed in Latino participants, and varied widely in the Mexican American and Latino participants based on SES. Only Mexican-American children who had experienced racism and had a low SES demonstrated an increased incidence of asthma (65\%), while only Latino children with a high SES showed an increased incidence.\textsuperscript{11}

After adjusting for all aforementioned confounders, the African American youth who had experienced racism of any amount demonstrated a 97\% greater odds of having poorly controlled asthma. This relationship was further analyzed with the racism categorized into never, rarely, or often categories, and demonstrated a positive dose-response relationship. As the level of perceived racism increased for
these children, the more likely they were to be scored as having poor asthma control.\textsuperscript{11}

**Carlson et al (2017)**

This study\textsuperscript{12} also used participants who were in the original SAGE II study. These 576 children were also between the ages of 8-21 years old, but the participants selected were all from the San Francisco Bay Area. As in the Thakur et al study,\textsuperscript{11} asthma in this study\textsuperscript{12} was defined in the same way – physician diagnosis, and list of symptoms/medication use within the 2 years prior to their involvement in the study. The children also had to have all 4 grandparents who were African American. However, this study excluded participants who were pregnant, current smokers, or those children who had a \textgreater 10 pack year smoking history. It also excluded participants that were missing data on included variables such as pulmonary function, race/ethnicity, SES, and daycare or smoking exposure. The children excluded were more likely to be older, report greater smoke exposure and have mothers without higher education.\textsuperscript{12}

This study also used the EOD questionnaire to measure racism, asking questions on the same 4 topics as the previous study\textsuperscript{11} (racism at school, in public, during medical care, while receiving public services). The answers were classified as *none* or *any*.\textsuperscript{12}
The same confounders were used in this study as the Thakur et al study\textsuperscript{11}: sex, age, in utero smoke exposure, SES, etc. with the addition of BMI. However, in this study, SES was measured by only 1 factor: maternal education.\textsuperscript{12}

This study aimed to measure the relationship between perceived racism and bronchodilator response (BDR) in African American children using the bronchodilator albuterol. This study used positive BDR response $\geq 12$ as an indicator of poor asthma control. It also looked at whether these children had a particular endotype of asthma; however, this review will not be analyzing that data. These researchers began by obtaining an FEV1 value from spirometry on the participants in order to evaluate baseline lung function. Obtaining the NHLBI composite score for asthma through a questionnaire was used to measure control (the same measure of control used in the Thakur et al study\textsuperscript{11}) and was graded as controlled, partially controlled, or poorly controlled. A report of controller medication use in the 2 weeks prior to study involvement was also documented, including use of inhaled corticosteroids (ICS), leukotriene inhibitors, or long acting beta agonist (LABA) use.\textsuperscript{12}

Spirometry was performed to measure FEV1 before the intervention, 15 minutes after the first albuterol dose ($4$ puffs of 90 $\mu$g each), and then a final time after the second albuterol dose. This
second dose was 4 puffs again for anyone ≥ 16, but reduced to 2 puffs if the child was < 16 years old. The percentage change in FEV1 was used to calculate the BDR.\textsuperscript{12}

After adjusting for the aforementioned confounders, the data showed that African American children who reported experiencing racism were more likely to have poorly controlled asthma (50.2%) than their counterparts who reported not experiencing racism (33.9%). Also, there was a 1.7 larger mean calculated BDR in those children who had reported experiencing any amount of racism. This number was even higher (2.78) for a particular endotype of asthma called TNF-alpha, although that is not the focus of this study.\textsuperscript{12}

**DISCUSSION**

**Asthma’s Impact**

Asthma is a chronic disease with a high burden financially, socially, physically, and emotionally. It has significant impacts on quality of life and physical health, ranging from missed school days and ED visits to impaired lung function and even death. In children, this appears to be an even more pertinent issue. One study\textsuperscript{15} stated that the prevalence of asthma-related hospitalization in children is twice that of the adult population. According to the CDC,\textsuperscript{4} in 2010 there were 136 669 hospital asthma discharges involving children less than 18 years old. Out of the 3518 people who reportedly died from
asthma in the U.S. in 2010, 41% of them were non-white and 209 of them were children under the age of 18.\textsuperscript{4} We are in need of a better screening tool for minority children to understand the risk factors that relate to asthma so that we may improve diagnostic accuracy, level of control, and pulmonary health in these children. This will lead to not only a decreased health care burden, but can significantly impact quality of life in these children, leaving positive impacts that will extend into adulthood.

**Primary vs Secondary Outcomes**

The primary outcome in both studies measured the level of asthma control in children who had perceived racism compared to those who had not.\textsuperscript{11,12} In addition, Carlson et al\textsuperscript{12} measured the relationship between racism and BDR response, which was a secondary outcome measure relating to asthma control. Thakur et al\textsuperscript{11} measured odds of experiencing asthma in relationship to reported perceived racism, though it was the only study to do this. Also, Thakur et al\textsuperscript{11} was the only study included that discussed more than one minority group.

**Racism and Odds of Experiencing Asthma**

**Clinical Relevance**– The Thakur et al study\textsuperscript{11} was the only study found that described an increased relationship between
perceived racism in children and odds of experiencing asthma (OR 1.97; 95% CI 1.42-2.76) (See Table II). It also showed a positive association between an increased amount of perceived racism and an even greater odds of experiencing asthma, but this was only seen in African American children. The P-value for this trend was < 0.001. However, this same association was not found in the other minority groups studied. A positive relationship between perceived racism and increased odds of having asthma was only found among Latino children with a high SES, and only among Mexican-American with a low SES. It is evident from these statistics that more research is needed to understand why these results vary between ethnic groups. Racism experienced by African American children seems to play a larger role as an asthma risk-factor than other minority children, and is thus an area where screening may lead to improved monitoring of asthma and more positive health care outcomes for these children. There is currently no screening that could be found involving experiences of racism or discrimination in the diagnosis, screening, or treatment of asthma in the United States. Further research is needed to identify the extent of the relationship between racism and odds of experiencing asthma. Thakur et al stated that they believed their study was the first to show an association between perceived racism and a diagnosis of asthma for African American or Latino children.
Limitations– The limitations to this outcome begin with the fact that only one study\(^\text{11}\) included in this review looked at the relationship between racism and odds of experiencing asthma in minority youth. Therefore, there is no other data for children with similar criteria to compare this to. Also, the study\(^\text{11}\) is a case-control, which does not lead to as strong of quality data as a cohort study or RCT would. This particular relationship cannot be measured by an RCT however, as we cannot choose to give or withhold asthma or racism from test subjects, nor would it be ethical to do so.

Several study limitations were found in relation to this particular outcome measure. Thakur et al\(^\text{11}\) described their QOD questionnaire process as involving parent/caregiver input, which could potentially be a source of bias in the results of perceived racism. In general, these types of questionnaires are at risk for recall bias. Also, the QOD questionnaire, which was used in both studies,\(^\text{11,12}\) has been validated in adults but not in children. This could lead to a potential of inaccurate data if the questions did not elicit true experiences of racism in certain youth, or missed certain experiences that would qualify as racism. However, neither of these limitations were perceived as great enough to warrant a downgrade in the Study Limitations category of GRADE\(^\text{10}\) (see Table I). There were no limitations noted for indirectness, inconsistency, nor imprecision for this outcome. Although
there were inconsistencies in the data relating to odds of experiencing asthma with SES between minority populations, SES was not the primary focus of this research question. Publication bias was considered to be highly unlikely as all relevant outcomes appear to have been discussed, including the discrepancy between SES and the Mexican American/Latino populations when looking at asthma prevalence and racism. A suggestion was also offered from the study as to why this might be the case. Although there was a dose-response gradient present between racism and the odds of experiencing asthma in African American children, this characteristic was not observed amongst the other minority groups studied, and there was no other study to compare information to. Due to this fact, an upgrade of quality was not warranted for the dose-response relationship, leaving us with a Low grade quality of evidence for the outcome of racism and odds of experiencing asthma.

**Racism and Poor Asthma Control**

**Clinical Relevance**—The 2 studies found both demonstrated an increased rate of having poorly controlled asthma in those African American children who had perceived racism to any degree. In the Carlson et al study, data showed that participants who had reported experiencing racial discrimination were 10.3% more likely to have
poorly controlled asthma compared to their counterparts who did not have those experiences. The mean percent BDR was also higher for those children who had perceived racism, further indicating an association between racism and poor asthma control.\textsuperscript{12} The data from Thakur et al\textsuperscript{11} showed that African American children with asthma who had reported experiencing any amount of racism had a 97% greater odds of having poorly controlled asthma. This relationship was not found with any of the other minority subgroups. As the amount of perceived racism increased, the association of having poor asthma control became stronger as well for African American children. (See Table II). Comparing this outcome measure between studies was limited to African American participants because the Carlson et al study\textsuperscript{12} used African American participants only. This suggests the need for further research on this association between racism and asthma control involving other minorities as well as larger numbers of participants. As this data suggests that African American children are more likely to have poor asthma control if they have experienced racism,\textsuperscript{11,12} it gives us a useful tool as clinicians to screen children for this risk factor. If we can identify children at risk for poor asthma control, we can create additional guidelines and better monitor their disease, which could reduce healthcare costs and improve asthma morbidity and mortality.
**Limitations**— Both of the studies used to measure this outcome were case-control studies, which as discussed above, indicates the need for different study types for higher quality research. Although RCTs are not possible with this particular question, cohort studies would be of higher value in terms of quality of evidence given. Several limitations in the studies relating to this outcome were observed. The QOD not being validated in children and the risk for recall bias is still present in this outcome as well for both studies, however it was not deemed a serious problem. Asthma diagnosis by a physician and the NHLBI grading of asthma control is considered the standard for measuring level of control and these are considered trustworthy ways to qualify asthma. Other limitations were that all of the participants in the Carlson et al study\textsuperscript{12} were from the San Francisco Bay area, so further research is needed to expand the living environments covered when looking at this outcome. Another factor to consider is the fact that the Carlson et al study\textsuperscript{12} only measured perceived racism as “none” or “any” and did not quantify it further, as the Thakur et al study\textsuperscript{11} did. Had they done so, we could have perhaps seen additional data on if the association between perceived racism and poor asthma control strengthened with increasing amounts of racism in both studies. Another limitation relating to the Carlson et al study\textsuperscript{12} was the fact that a previous related study showed the opposite outcome. A
study of psychosocial stress and BDR response showed a decreased BDR response with increased exposure to psychosocial stress.\textsuperscript{16} Carlson et al\textsuperscript{12} offered a potential reason as to why, stating that the differing endotypes of asthma may relate to this different response. A final limitation in this outcome between the studies is that of recruitment bias. Both of these studies\textsuperscript{11,12} measured this outcome using participants from the SAGE II study, so this is essentially a comparison of this outcome between 2 studies, but with the same potential group of participants. Lacking is data on if these participants participated in both studies, or how many did so, but it seems likely that it may be possible. For these reasons, when evaluating the level these limitations played in the study results, it deemed worth a downgrade of quality according to the GRADE criteria. No downgrade was deemed necessary for indirectness. Although the focus of the Carlson et al study\textsuperscript{12} was a surrogate outcome (BDR response), they also included the data associating perceived racism to a measurement of poor asthma control (a primary outcome). For this reason, no downgrade was deemed necessary in that category. There was 1 downgrade issued for this evidence in the imprecision category. This was because the Carlson et al study\textsuperscript{12} had an OR of 1.7, with a CI that crossed 1 (0.36-3.03) for the association between perceived racism and having a higher BDR (see Table III). That led to us being less
confident that there was an actual effect there, and this was the primary focus of this study. However, the P-value for the measurement showing an increase in poor asthma control in those who had perceived racism was $P < 0.001$. If this study had further delineated the results based on amount of racism experienced and possibly seen a dose-response gradient, then it would have increased confidence about the quality of that evidence. Publication bias was deemed unlikely in this outcome. The Carlson et al study\textsuperscript{12} mentioned a competing interest where one of it’s authors was the CEO of a company who helped fund the study (Center for Youth Wellness). This company only paid for biomarker assays and supplies, which still defined them as adhering to the PLOS ONE policies regarding this issue. There was a dose-response gradient present for the Thakur et al\textsuperscript{11} data demonstrating increased odds of poor asthma control with increased amounts of perceived racism in African American children. However, this relationship was not shown with other minority subgroups and it was not measured in the Carlson et al study\textsuperscript{12}, so it was not deemed eligible for upgrade. After a complete and thorough Quality Assessment, this second outcome of racism and poor asthma control was granted a “Very Low” Grade Quality of Evidence, indicating that further research is needed to improve our certainty in these outcomes.
CONCLUSION

A review of the available literature suggests that experiencing racism impacts asthma outcomes in minority children, particularly African Americans. The data demonstrates that African American children who experience racism are more likely to have asthma and have a greater likelihood of having asthma that is poorly controlled. There is an unclear relationship between asthma outcomes, racism, and other minority groups, as SES seems to play a significant role. When diagnosing and treating children with asthma, clinicians should consider screening for experiences of racism to determine risk factors for poor asthma outcomes.

Additional cohort and case-control studies are needed to further demonstrate the relationship between racism and asthma outcomes in children of all minority groups. Children from a greater variety of geographical areas who are not previous GALA II/SAGE II study participants would further increase our confidence in the effect of racism on asthma outcomes.
References


<table>
<thead>
<tr>
<th>Outcome</th>
<th>Number of studies</th>
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<td>Not Serious</td>
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^a Both studies^11,12 used participants from the same data pool (SAGE II)

^b The Carlson et al study^12 had an OR of 1.7 with a CI that crosses 1 (0.36-3.03)

^c In the Thakur et al study^11 the odds of experiencing asthma increased as amount of perceived racism increased (OR 1.78), but only for one minority group, and there was only one study that demonstrated this

^d The Thakur et al study^11 had an OR of 1.97 showing increased odds of poor asthma control with increased perceived racism
<table>
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<tr>
<th>Minority Group</th>
<th>% Experienced Racism (any)</th>
<th>% Racism severity</th>
<th>% Asthma Control</th>
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</tr>
<tr>
<td>Case (Asthma)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>African American</td>
<td>49.0</td>
<td>51.0</td>
<td>38.6</td>
</tr>
<tr>
<td>Control (No Asthma)</td>
<td></td>
<td>42.2</td>
<td>57.8</td>
</tr>
<tr>
<td>Case (Asthma)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mexican American</td>
<td>26.3</td>
<td>73.7</td>
<td>23.6</td>
</tr>
<tr>
<td>Control (No Asthma)</td>
<td></td>
<td>29.1</td>
<td>70.9</td>
</tr>
<tr>
<td>Case (Asthma)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Latino</td>
<td>27.7</td>
<td>72.3</td>
<td>25.5</td>
</tr>
<tr>
<td>Control (No Asthma)</td>
<td></td>
<td>27.0</td>
<td>73.0</td>
</tr>
<tr>
<td>Case (Asthma)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Islander Puerto Rican</td>
<td>9.9</td>
<td>90.1</td>
<td>9.1</td>
</tr>
<tr>
<td>Control (No Asthma)</td>
<td></td>
<td>6.7</td>
<td>93.3</td>
</tr>
</tbody>
</table>

Values are reported as percent of participants in each given category. Only bolded values are statistically significant (P ≤ 0.05).

Racism severity score was ranked as never if the participant answered 'no' to all four questions, rarely if they answered 'yes' to one question, and often if they answered 'yes' to at least two questions from the EOD questionnaire. Total number of participants for each category are as follows: African American (n= 954), Mexican American (n=1 086), Other Latino (n=522), and Islander Puerto Rican (n=1 025).
### Table III. Summary of Findings – Carlson et al (2017)\textsuperscript{12}

<table>
<thead>
<tr>
<th>Study Characteristic</th>
<th>% Experienced Racism</th>
<th>Summary of Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>None</td>
<td>Any</td>
</tr>
<tr>
<td><strong>Prevalence</strong></td>
<td>51.2</td>
<td>48.8</td>
</tr>
<tr>
<td><strong>Asthma Control</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Controlled\textsuperscript{a}</td>
<td>37.3</td>
<td>21.0</td>
</tr>
<tr>
<td>Not Well Controlled</td>
<td>28.8</td>
<td>28.8</td>
</tr>
<tr>
<td>Very Poorly Controlled</td>
<td>33.9</td>
<td>50.2</td>
</tr>
<tr>
<td><strong>% Mean BDR (SD)\textsuperscript{b}</strong></td>
<td>8.9 (7.8)</td>
<td>10.8 (9.4)</td>
</tr>
</tbody>
</table>

*This study\textsuperscript{12} included African American participants only with a current asthma diagnosis (n=576)*

Racism severity score was ranked as never if the participant answered ‘no’ to all four questions, or any if the participants answered ‘yes’ to at least one question on the EOD questionnaire.\textsuperscript{12}

\textsuperscript{a}p = <0.001 for the statistics of Controlled Asthma

\textsuperscript{b}p<0.006 for the statistics of % Mean BDR (SD)