Published in final edited form as:

Curr Opin Pulm Med. 2014 March ; 20(2): 180–185. doi:10.1097/MCP.000000000000025.

Obstructive Airway Disease in Urban Populations

M. Bradley Drummond, MD, MHS

Division of Pulmonary and Critical Care Medicine, Department of Medicine, Johns Hopkins University, Baltimore, MD

Abstract

Purpose of Review—Obstructive lung disease (OLD), including asthma and chronic obstructive pulmonary disease (COPD), have a more substantial prevalence and morbidity in urban populations. This review highlights recent publications examining the epidemiology, risk factors and interventions concerning OLD in urban populations.

Recent Findings—Using a variety of approaches, estimates of asthma prevalence in urban populations range from 5–25%. Early life exposures including *in utero* cigarette smoke, postnatal bisphenol A, home and school particulates and environmental air pollution contribute to increased OLD prevalence and symptom manifestations. Individuals with increased exposure to traffic-related pollution demonstrate abnormal inflammatory and lung function profiles. Obesity, more common in urban populations, is likely both a risk factor for asthma as well as contributor to poor control. Interventions targeted at home-based education and assessments are efficacious and cost-effective in improving outcomes of OLD in urban settings.

Summary—The burden of OLD in urban populations is driven by maternal, environmental and acquired factors. There are few recent data regarding risk factors and interventions for urban cohorts with COPD. The complex interplay of race, socioeconomic status, environmental exposures and healthcare access in the urban population require continued research efforts.

Keywords

obstructive lung disease; asthma; chronic obstructive pulmonary disease; urban; inner city

INTRODUCTION

The obstructive lung diseases (OLDs), characterized by variable or fixed expiratory airflow limitation, include asthma and chronic obstructive pulmonary disease (COPD). Asthma and COPD are prevalent conditions both nationally [1] and globally, [2] with substantial impact on morbidity and mortality. It has been well established that OLDs, with most research emphasis on asthma, disproportionately impact urban populations in relation to prevalence, disease severity and complications.[3, 4] The concept of “urban” is multifaceted, and

Corresponding Author/Reprint Request: M. Bradley Drummond, MD, MHS, Division of Pulmonary and Critical Care Medicine, 5501 Hopkins Bay view Circle, JHAAC 4B.74, Baltimore, MD 21224, mdrummo3@jhmi.edu, Phone: 410-550-6431, Fax: 410-550-2612.

No relevant conflicts of interest exist related to this manuscript.

Disclosures of Funding: Dr. Drummond is supported in part by a grant from the National Institutes of Health-National Heart, Lung and Blood Institute [K23HL103192]. There was no specific funding received for this work.

includes the complex interplay of race, socioeconomic status, environmental exposures and healthcare access among other issues. The aim of this review is to highlight recent publications in the prior year advancing the current understanding of the epidemiology, risk factors and treatments for OLDs in the urban population.

EPIDEMIOLOGY OF URBAN OLDs

Unique aspects of the epidemiology of urban OLDs have been the focus of several recent studies. Beyond simply reporting prevalence and mortality estimates, authors have described different methods to approach the study of prevalence in the urban population.

The Methodological Approaches to Prevalence Estimates

One of the challenges of understanding the burden of OLDs in the urban population is appropriate methodology to ascertain prevalence estimates. Several recent studies have attempted to determine the most optimal method to estimate the asthma prevalence in urban children. In one study, door-to-door screening of disadvantaged neighborhoods in Philadelphia was compared to school-based screening in the same target area.[5] After screening approximately 7800 children, the prevalence of asthma was found to be 27.5% in school-based screening compared to 21.7% in door-to-door screening. Moreover, a greater proportion of children lacking an asthma diagnosis had symptoms indicative of asthma using school-based screening compared to door-to-door screening. Page and colleagues took advantage of the CDC Youth Risk Behavior Surveillance System as well as surveys of school nurses and parents of schoolchildren to determine asthma prevalence in Miami, Florida.[6] With these approaches asthma prevalence ranged from 21% using CDC data, 4.9% from nursing surveys and 25% from parental reporting. Wendt and colleagues were able to demonstrate that state-level Medicaid claims could effectively estimate age-adjusted incidence of asthma among low income children in Texas.[7] The observed incidence rate using this methodology was 4.26/100 person-years, higher than noted in other populations. Interestingly, the authors of the Medicaid study noted a higher incidence in rural compared to urban populations, a finding described in two additional publications.[8, 9] These studies highlight the feasibility of different methods to obtain asthma prevalence, and the importance of assessing the methodological approach used to reach prevalence estimates.

Mortality from OLDs in the Urban Population

The factors contributing to asthma deaths in the urban population are of continued interest. In an analysis of 22 out-of-hospital asthma deaths from an urban Milwaukee community, the majority of decedents were African-American, more likely to die during the night or early morning and have a history of illicit drug, alcohol or tobacco use.[10] Over 90% were using or overusing short-acting beta agonists, while only 10% were using inhaled corticosteroid-containing regimens. This study gives insight into the phenotype of the urban asthmatic dying outside the hospital. One of the few recent studies to examine the role of urban residence on COPD mortality reported lower mortality in large metropolitan areas compared to rural areas.[11] Specifically, for individuals older than 65 years the death rate was 255/100,000 for large central metropolitan areas compared with 324/100,000 in rural

counties. It can be seen from these limited data that it is necessary to separate COPD from asthma when considering OLD-related mortality in urban settings.

FACTORS IMPACTING OLDs IN THE URBAN POPULATION

Several studies have expanded our understanding of the factors which impact the development and manifestations of OLD in the urban population. These reports span the spectrum of the life course from prenatal life events to early environmental exposures through risk factors identified involved later in life (Figure 1).

Early Life Events

The factors contributing to lung function impairment associated with OLDs may begin as early as before birth. Using data from case-control studies of Latino and black individuals with asthma from the United States and Puerto Rico, Oh and colleagues estimated the effective *in utero* smoking on asthma outcomes among children 8 to 17 years of age.[12] *In utero* smoking was independently associated with a 50% increase in the odds of poor asthma control, 70% increase in early-onset asthma and 60% increase in asthma-related limitation in activities ($p<0.05$ for all outcomes). In a systematic review of nine studies including 6498 urban individuals, six studies observed a reduced prevalence of allergic disease with perinatal exposure to dogs or cats.[13] Maternal urinary levels of bisphenol A (BPA), a diphenylmethane derivative used in the synthesis of plastics found in baby bottles, has previously been associated with wheezing in their children.[14] Donohue and colleagues investigated this association among inner-city children.[15] Urinary BPA concentrations were measured in mothers during the third trimester and in children at ages three, five and seven. The authors found that prenatal urinary BPA levels were inversely associated with wheezing at age five. However, BPA levels in children were positively associated with wheezing and physician diagnosis of asthma, with urinary levels at age 3 increasing the odds of wheezing or asthma diagnosis at age 5 by 40%. This is the first study to describe in association between postnatal BPA levels and asthma in an urban pediatric population.

In-home and School Environments

It is well-established that the home environment can significantly impact the risk and severity of obstructive lung disease. In the last year greater focus has turned to the urban school environment, as schools represent an important exposure site of potential allergens for children with asthma. When comparing settled dust and airborne samples from schools and bedrooms of students with asthma, significantly higher levels of mouse, cat and dog settled dust allergens were observed in schools compared with homes.[16] In a separate study, endotoxin concentrations were measured in 12 urban elementary schools and compared to the bedrooms of students with asthma.[17] The median endotoxin concentration for school samples was 13.4 EU/mg compared with 7.0 EU/mg at home. When comparing matched classroom and bedrooms samples, a statistically higher concentration of endotoxin was found in students' classrooms ($p=0.04$). While these studies cannot directly link school exposures to asthma control, they serve to highlight the importance of evaluating the school environment as a cofactor in urban asthma morbidity.

One of the few studies focusing on the impact of in-home air pollution on respiratory morbidity for individuals with COPD living in a peri-urban environment confirm the importance of indoor pollution in this subgroup of urban OLDs.[18] In longitudinal analysis of 84 individuals with moderate or severe COPD, the authors found that increases in fine particles [particulate matter (PM) 2.5] concentrations increased respiratory symptoms, need for rescue medications and risk of severe COPD exacerbation. Increases in bedroom nitrogen dioxide levels were also associated with worsening nocturnal symptoms and exacerbation risk.

Environmental Air Pollution

There has been continued interest in understanding how environmental air pollution interacts with the presence and manifestations of OLDs. In the last year, advances have been made in the understanding of the impact of air pollution on OLD symptoms, lung function, hospitalization and mortality. Urban air pollution has been shown across several studies to worsen respiratory symptoms in urban individuals with OLD.[19–22] In children from a Brazilian urban cohort, of whom 26% had a diagnosis of asthma, levels of nitrogen dioxide and ozone were independently associated with cases of asthma and wheezing.[19] Increasing level of fine particulate matter (PM)2.5 was also associated with an increase in new wheezing in 5–7 year old children.[20] The associations between urban air pollutants and respiratory symptoms were also in adult populations with increased COPD prevalence. Higher ambient levels of nitrogen dioxide were associated with subsequent 9.1% and 4.2% increases in doctor visits for COPD and chronic bronchitis, respectively.[22] These increases exceeded those observed in a healthy subgroup without OLD.

Air pollution levels have been shown to worsen respiratory outcomes beyond symptoms. In asthmatic children from Mexico City, increased ozone levels were associated with a lower forced expiratory flow from 25% to 75% of the forced vital capacity (FEF₂₅₋₇₅) (–91.2 ml/s per 60 ppb increase in ozone; p=0.06).[23] This association was worsened in the presence of asthma risk alleles and low vitamin C intake (–97.2 ml/s; p=0.03). Higher levels of nitrogen oxides, nitrogen dioxide, PM10 and PM2.5 were all significantly associated with more hospital admissions for asthma in children less than 18 years old.[24] Finally, a multicity project examining the association between outdoor air pollution and mortality in nine Latin American cities, demonstrated a significant association between PM10 and respiratory mortality, with this risk larger among people with lower socioeconomic status and those with COPD.[25] Considering these data together, it is clear that the association between OLD prevalence and manifestations in the urban population are impacted by air pollution, further reinforcing the need for better environmental health policies aimed at pollution reduction and subsequent respiratory morbidity.

The Role of Traffic Pollution

Recent studies have reinforced the specific-role of traffic-related pollution in asthma control, and offered some insight into underlying mechanisms of disease impact. Longitudinal data from a birth cohort of 700 infants in Cincinnati has shown that exposure to stop-and-go traffic at age one year was associated with increased wheezing during infancy, and this association was increased among African-American children.[26] Asthmatic and non-

asthmatic individuals with exposure to traffic-related pollutants demonstrate higher exhaled nitric oxide levels, reductions in lung function, greater airway hyper-responsiveness, decreased exhaled breath condensate and increased 8-isoprostane levels.[27–29] These biomarkers and lung function changes reflect acute alterations in airway inflammation and oxidative stress, offering insight into the mechanisms with which traffic-related pollution impacts OLD in urban populations.

Genetic Risk Factors for OLD

The conceptual model of “urban populations” does not directly identify a particular ethnic or racial group. However, African-American race and Hispanic ethnicity are over-represented in many urban cohorts. In this context, a brief summary of recent insights into the genetic risk factors for asthma in African-American and Hispanic populations is warranted. Four recent publications have identified novel asthma-associated risk alleles in these populations.[30–33] Each of these reports observed an association between increased African ancestry and asthma-related outcomes including asthma diagnosis or exacerbation severity. In a cohort of Puerto Rican children with asthma, each 20% increment in African ancestry was associated with 105–152 ml lower pre- and post-bronchodilator spirometry measures.[32] Higher proportion of African ancestry was also associated with a more substantial lung function decrement in the setting of smoking, suggesting a gene-by-environment interaction leading to increased risk of tobacco-related OLD.[34]

Obesity in the Urban Population

Obesity plays an important role in the presence and manifestations of asthma in general populations. The prevalence of obesity is also higher in urban populations. The causal relationship between obesity and asthma in urban populations remains poorly characterized. In a retrospective study of 246 adult asthmatics from New York City, asthma and obesity were tightly linked.[35] Asthmatics had higher body mass index than non-asthmatics (30.5 vs. 27.8 kg/m²; $p < 0.01$). More severe obesity was associated with increased asthma diagnosis, severity and exacerbation frequency as well as greater reductions in spirometry measurements. Vo and colleagues offer an alternative explanation for the link between obesity and asthma in minority populations.[36] A total of 980 asthmatic children underwent spirometry testing and weight assessment. When compared to normal-weight ethnic counterparts, the percent FEV1/FVC of African American and Hispanic patients was lower in both overweight and obese individuals, while this ratio was only reduced in obese Caucasians. The authors conclude that more severe airflow obstruction occurs with smaller weight increases in minority children compared with Caucasian children. To evaluate a potential mechanism for this association, Lu and colleagues examined the impact of weight on the correlation between indoor particulate matter exposure and asthma control.[37] The authors followed 148 urban minority asthmatics aged 5–17 years for one year while assessing indoor air pollutants every three months. Compared to normal-weight asthmatics, overweight and obese asthmatics had worsening asthma symptoms in response to PM_{2.5} or nitrogen dioxide, but not larger particles between 2.5 and 10 micrometers. These results offer an interesting hypothesis regarding ways to improve asthma control in urban asthmatics with obesity: targeting particulate matter reduction and obesity may have a synergistic improvement on asthma control. These data regarding urban asthmatics

implicates obesity as likely both a risk factor for asthma as well as contributor to poor control.

Other Risk Factors for OLD in Urban Populations

Several recent studies have identified other risk factors in urban populations associated with increased asthma prevalence and worsening disease control. Urban injection drug users represent a population at increased risk for OLDs. In an analysis of 1077 urban current and former injection drug users, uncontrolled HIV infection (defined as HIV viral load >200,000 copies/mL) was independently associated with a 3.4-fold increase in the odds of spirometry-defined airflow obstruction.[38] Higher reports of missed sleep in urban children with asthma were related to poorer school attendance and worse quality of life.[39] Among urban Latino families, higher level of familial connectedness was associated with less functional status attributable to asthma.[40]

INTERVENTION TARGETED FOR URBAN POPULATIONS WITH OLD

Given the unique set of complexities highlighted in the review thus far, special interventions targeting individuals with OLD in the urban population are necessary. Trained community health workers act as liaisons between families and medical providers. In a pilot study of 70 children with asthma from underserved Chicago, community health worker interventions four times over six months resulted in reductions in symptom frequency and health care utilization.[41] In a separate study, nurse care management and home visits over a year reduced asthma visits to the emergency department, missed school and parental missed work days.[42] Families randomized to a home based family interventions including asthma education and stress reduction over 6 months resulted in lower asthma-related hospitalization compared to an enhanced usual care intervention.[43] Urban walking circuits have been shown to improve physical activity in COPD patients with severe airflow obstruction.[44] Importantly, the studies which evaluated cost effectiveness demonstrated considerable cost savings, with \$1.46 to \$5.58 dollars saved per dollar spent. These studies demonstrate that there are effective interventions to improve outcomes related to OLD in the urban population. However, these effective interventions occur outside of the medical system, focusing instead on the home and community environment so important in these diseases.

CONCLUSIONS

The urban population with OLD represents an understudied group at risk for significant morbidity and mortality. Recent publications have advanced our understanding of the epidemiology, risk factors, modifying traits and unique interventions for urban populations with OLD. Maternal factors, home and school environments, ambient and traffic pollution, obesity and genetic characteristics all interact to contribute to the manifestation of OLD in the urban population. Asthma has been the focus of most research in this area, highlighting the lack of data regarding COPD in the urban population. Further interventions to characterize non-asthmatic OLD as well as targeted interventions for the urban population are needed in the future.

Acknowledgments

The author would like to thank Carrie Price, MLS for her assistance in the literature search for this manuscript. The author is supported by a grant from the National Institutes of Health-National Heart, Lung and Blood Institute [K23HL103192].

Abbreviations

BPA	bisphenol A
COPD	chronic obstructive pulmonary disease
FEF₂₅₋₇₅	Forced expiratory flow from 25% to 75% forced vital capacity
OLDs	obstructive lung diseases
PM	particulate matter

References

1. National Institutes of Health; National Heart LaBI. Morbidity & Mortality: 2012 Chart Book on Cardiovascular, Lung and Blood Diseases.
2. To T, Stanojevic S, Moores G, et al. Global asthma prevalence in adults: findings from the cross-sectional world health survey. *BMC public health*. 2012; 12:204. [PubMed: 22429515]
3. Wisnow LS, Gittelsohn AM, Szklo M, et al. Poverty, race, and hospitalization for childhood asthma. *American journal of public health*. 1988; 78:777–782. [PubMed: 3381951]
4. Togias A, Fenton MJ, Gergen PJ, et al. Asthma in the inner city: the perspective of the National Institute of Allergy and Infectious Diseases. *The Journal of allergy and clinical immunology*. 2010; 125:540–544. [PubMed: 20226290]
- 5*. Bryant-Stephens T, West C, Dirl C, et al. Asthma prevalence in Philadelphia: description of two community-based methodologies to assess asthma prevalence in an inner-city population. *The Journal of asthma: official journal of the Association for the Care of Asthma*. 2012; 49:581–585. This study demonstrated that asthma prevalence is higher using door-to-door screening in urban communities compared with school-based screening. [PubMed: 22747076]
6. Page TF, Beck-Sague CM, Pinzon-Iregui MC, et al. Asthma in underserved schoolchildren in Miami, Florida: results of a school- and community-based needs assessment. *The Journal of asthma: official journal of the Association for the Care of Asthma*. 2013; 50:480–487. [PubMed: 23544421]
7. Wendt JK, Symanski E, Du XL. Estimation of asthma incidence among low-income children in Texas: a novel approach using Medicaid claims data. *American journal of epidemiology*. 2012; 176:744–750. [PubMed: 23024134]
8. Frazier JC, Loveland KM, Zimmerman HJ, et al. Prevalence of asthma among adults in metropolitan versus nonmetropolitan areas in Montana, 2008. *Preventing chronic disease*. 2012; 9:E09. [PubMed: 22172176]
9. Ekici A, Ekici M, Kocyigit P, Karlidag A. Prevalence of self-reported asthma in urban and rural areas of Turkey. *The Journal of asthma: official journal of the Association for the Care of Asthma*. 2012; 49:522–526. [PubMed: 22502860]
10. Mohiuddin M, Zacharisen MC, Poulos C, Levy MB. Asthma deaths outside the hospital in an urban community from 2004 to 2008. *Annals of allergy, asthma & immunology: official publication of the American College of Allergy, Asthma, & Immunology*. 2012; 108:412–417.
- 11*. Zhang X, Holt J, Wheaton A, et al. Geographic disparities in U.S. COPD mortality (2000–2007). *Chest*. 2012; 142 This study is the most recent study to report on the association between urban environment and COPD mortality. Urban populations were associated with lower COPD mortality compared to rural populations. This observation is counter to the majority of urban asthma mortality studies, where mortality was higher in the urban environments.

- 12*. Oh SS, Tcheurekdjian H, Roth LA, et al. Effect of secondhand smoke on asthma control among black and Latino children. *The Journal of allergy and clinical immunology*. 2012; 129:1478–1483. e1477. This study identifies *in utero* smoking as being independently associated with early-asthma onset, poor asthma control and asthma-related functional limitations in children 8 to 17 years of age. These findings highlight the importance of smoking cessation counseling in pregnant women. [PubMed: 22552109]
- 13*. Lodge CJ, Allen KJ, Lowe AJ, et al. Perinatal cat and dog exposure and the risk of asthma and allergy in the urban environment: a systematic review of longitudinal studies. *Clinical & developmental immunology*. 2012; 2012:176484. Perinatal pet exposure, especially dogs, may reduce the development of asthma. [PubMed: 22235226]
14. Spanier AJ, Kahn RS, Kunselman AR, et al. Prenatal exposure to bisphenol A and child wheeze from birth to 3 years of age. *Environmental health perspectives*. 2012; 120:916–920. [PubMed: 22334053]
- 15*. Donohue KM, Miller RL, Perzanowski MS, et al. Prenatal and postnatal bisphenol A exposure and asthma development among inner-city children. *The Journal of allergy and clinical immunology*. 2013; 131:736–742. This is the first study to describe in association between postnatal bisphenol A levels and asthma in an urban pediatric population. BPA levels in children were positively associated with wheezing and physician diagnosis of asthma, with urinary levels at age 3 increasing odds of asthma diagnosis at age 5. [PubMed: 23452902]
- 16*. Permaul P, Hoffman E, Fu C, et al. Allergens in urban schools and homes of children with asthma. *Pediatric allergy and immunology: official publication of the European Society of Pediatric Allergy and Immunology*. 2012; 23:543–549. In this study, mouse, cat and dog allergens were found to be higher in airborne samples from urban schools compared to bedrooms of asthmatic children. [PubMed: 22672325]
17. Sheehan WJ, Hoffman EB, Fu C, et al. Endotoxin exposure in inner-city schools and homes of children with asthma. *Annals of allergy, asthma & immunology: official publication of the American College of Allergy, Asthma, & Immunology*. 2012; 108:418–422.
- 18*. Hansel NN, McCormack MC, Belli AJ, et al. In-Home Air Pollution Is Linked to Respiratory Morbidity in Former Smokers with Chronic Obstructive Pulmonary Disease. *American journal of respiratory and critical care medicine*. 2013; 187:1085–1090. This study represents one of the few studies to rigorously evaluate the impact of in-home air pollution on respiratory morbidity for urban individuals with COPD. It was shown that indoor pollutant exposure was associated with worse respiratory symptoms and risk of COPD exacerbations. [PubMed: 23525930]
19. Vieira SE, Stein RT, Ferraro AA, et al. Urban air pollutants are significant risk factors for asthma and pneumonia in children: the influence of location on the measurement of pollutants. *Archivos de bronconeumologia*. 2012; 48:389–395. [PubMed: 22763046]
- 20*. Jung KH, Hsu SI, Yan B, et al. Childhood exposure to fine particulate matter and black carbon and the development of new wheeze between ages 5 and 7 in an urban prospective cohort. *Environment international*. 2012; 45:44–50. This study demonstrated that childhood exposure to fine particulate matter is associated with incident symptoms of wheezing in urban children. [PubMed: 22572116]
21. Kosti RI, Priftis KN, Anthracopoulos MB, et al. The association between leisure-time physical activities and asthma symptoms among 10- to 12-year-old children: the effect of living environment in the PANACEA study. *The Journal of asthma: official journal of the Association for the Care of Asthma*. 2012; 49:342–348. [PubMed: 22300140]
22. Mehta AJ, Schindler C, Perez L, et al. Acute respiratory health effects of urban air pollutants in adults with different patterns of underlying respiratory disease. *Swiss medical weekly*. 2012; 142:w13681. [PubMed: 23076649]
- 23*. Moreno-Macias H, Dockery DW, Schwartz J, et al. Ozone exposure, vitamin C intake, and genetic susceptibility of asthmatic children in Mexico City: a cohort study. *Respiratory research*. 2013; 14:14. In asthmatic children from Mexico City, increased ozone levels were associated with a lower FEF₂₅₋₇₅, and this association was worsened with low vitamin C intake. [PubMed: 23379631]

24. Iskandar A, Andersen ZJ, Bonnelykke K, et al. Coarse and fine particles but not ultrafine particles in urban air trigger hospital admission for asthma in children. *Thorax*. 2012; 67:252–257. [PubMed: 22156960]
- 25*. Romieu I, Gouveia N, Cifuentes LA, et al. Multicity study of air pollution and mortality in Latin America (the ESCALA study). Research report (Health Effects Institute). 2012:5–86. The ESCALA project is a large multinational study of the relationship between outdoor air pollution and mortality in Latin American cities. The authors found that particulate matter was associated with increased respiratory mortality, and this risk was higher in populations with lower socioeconomic status. [PubMed: 23311234]
- 26*. Bernstein DI. Traffic-related pollutants and wheezing in children. *The Journal of asthma: official journal of the Association for the Care of Asthma*. 2012; 49:5–7. High exposure to traffic-related pollution was associated with early wheezing in infants, demonstrating the importance of the urban environment on asthma incidence. [PubMed: 22211400]
27. Newcomb P, Hunt A, Rast P, et al. Acute effects of walking environment and GSTM1 variants in children with asthma. *Biological research for nursing*. 2012; 14:55–64. [PubMed: 21196426]
28. Patel MM, Chillrud SN, Deepti KC, et al. Traffic-related air pollutants and exhaled markers of airway inflammation and oxidative stress in New York City adolescents. *Environmental research*. 2013; 121:71–78. [PubMed: 23177171]
29. Riley S, Wallace J, Nair P. Proximity to major roadways is a risk factor for airway hyper-responsiveness in adults. *Canadian respiratory journal: journal of the Canadian Thoracic Society*. 2012; 19:89–95. [PubMed: 22536577]
30. Torgerson DG, Capurso D, Ampleford EJ, et al. Genome-wide ancestry association testing identifies a common European variant on 6q14.1 as a risk factor for asthma in African American subjects. *The Journal of allergy and clinical immunology*. 2012; 130:622–629. e629. [PubMed: 22607992]
31. Flores C, Ma SF, Pino-Yanes M, et al. African ancestry is associated with asthma risk in African Americans. *PloS one*. 2012; 7:e26807. [PubMed: 22235241]
32. Brehm JM, Acosta-Perez E, Klei L, et al. African ancestry and lung function in Puerto Rican children. *The Journal of allergy and clinical immunology*. 2012; 129:1484–1490. e1486. [PubMed: 22560959]
33. Rumpel JA, Ahmedani BK, Peterson EL, et al. Genetic ancestry and its association with asthma exacerbations among African American subjects with asthma. *The Journal of allergy and clinical immunology*. 2012; 130:1302–1306. [PubMed: 23069492]
34. Aldrich MC, Kumar R, Colangelo LA, et al. Genetic ancestry-smoking interactions and lung function in African Americans: A cohort Study. *PloS one*. 2012:7.
- 35*. Fitzpatrick S, Joks R, Silverberg JI. Obesity is associated with increased asthma severity and exacerbations, and increased serum immunoglobulin E in inner-city adults. *Clinical and experimental allergy: journal of the British Society for Allergy and Clinical Immunology*. 2012; 42:747–759. In this study, smokers with genetic markers of African ancestry had worse lung function than smokers with lower African ancestry, suggesting a genes-by-environment interaction. [PubMed: 22092883]
36. Vo P, Makker K, Matta-Arroyo E, et al. The association of overweight and obesity with spirometric values in minority children referred for asthma evaluation. *The Journal of asthma: official journal of the Association for the Care of Asthma*. 2013; 50:56–63. [PubMed: 23189981]
- 37*. Lu KD, Breyse PN, Diette GB, et al. Being overweight increases susceptibility to indoor pollutants among urban children with asthma. *The Journal of allergy and clinical immunology*. 2013; 131:1017–1023. 1023 e1011–1013. This study showed that in urban children with asthma, obesity is associated with worsening asthma symptoms in response to small particulate matter and nitrogen dioxide, suggesting that targeting particulate matter reduction and obesity may have a synergistic improvement on asthma control. [PubMed: 23403052]
38. Drummond MB, Kirk GD, Astemborski J, et al. Association between obstructive lung disease and markers of HIV infection in a high-risk cohort. *Thorax*. 2012; 67:309–314. [PubMed: 22090038]
39. Daniel LC, Boergers J, Kopel SJ, Koinis-Mitchell D. Missed sleep and asthma morbidity in urban children. *Annals of allergy, asthma & immunology: official publication of the American College of Allergy, Asthma, & Immunology*. 2012; 109:41–46.

40. Koinis-Mitchell D, McQuaid EL, Jandasek B, et al. Identifying individual, cultural and asthma-related risk and protective factors associated with resilient asthma outcomes in urban children and families. *Journal of pediatric psychology*. 2012; 37:424–437. [PubMed: 22408053]
41. Margellos-Anast H, Gutierrez MA, Whitman S. Improving asthma management among African-American children via a community health worker model: findings from a Chicago-based pilot intervention. *The Journal of asthma: official journal of the Association for the Care of Asthma*. 2012; 49:380–389. [PubMed: 22348448]
- 42*. Woods ER, Bhaumik U, Sommer SJ, et al. Community asthma initiative: evaluation of a quality improvement program for comprehensive asthma care. *Pediatrics*. 2012; 129:465–472. A program of case management and home visits over a year in urban asthmatics improved hospital encounters for asthma, missed school and parental missed work days. [PubMed: 22351890]
43. Celano MP, Holsey CN, Kobrynski LJ. Home-based family intervention for low-income children with asthma: a randomized controlled pilot study. *Journal of family psychology: JFP: journal of the Division of Family Psychology of the American Psychological Association (Division 43)*. 2012; 26:171–178.
44. Pleguezuelos E, Perez ME, Guirao L, et al. Improving physical activity in patients with COPD with urban walking circuits. *Respiratory medicine*. 2013

KEY POINTS

- Early life events, including *in utero* smoking and perinatal exposure to bisphenol A, are associated with a 40–7% increase in early-onset asthma in urban cohorts
- In-home particulate matter and environmental air pollution has a substantial impact on urban asthma and COPD disease manifestations including incident disease, respiratory symptoms and severity of exacerbations
- Obesity and asthma are tightly integrated in the urban population, with evidence suggesting that obesity may directly alter responses to specific respiratory irritants
- Effective interventions to control OLD manifestations in urban populations often require home-based methodologies occurring outside the medical system

Figure 1.

Overview of the factors recently studied to impact the risk and manifestations of obstructive lung disease in urban cohorts. Exposures contribute to OLD in urban cohorts spanning the life course from the pre-natal time through adulthood. While shown as discrete exposures over time, these factors likely overlap and interact to contribute to OLD throughout life. (PM= particulate matter)