

Title: The association between socioeconomic status and asthma inpatient hospitalizations and emergency department visits among World Trade Center rescue workers and survivors

Jennifer Brite, DrPh, Howard Alper, MPH, James Cone, MD, MPH, Stephen Friedman, MD, Erin Takemoto, PhD

Abstract:

Aim: To determine the association between socioeconomic status (SES) and the need for acute asthma care in the World Trade Center Health Registry.

Methods: This cohort comprises more than 70,000 rescue workers and community members affected by the 9/11 disaster. Data was matched to an administrative database of inpatient (IP) stays and emergency department (ED) visits up until 2016. Those who experienced an asthma-related hospital visit and those that didn't were compared by chi-squared test. Future methods to be used include a Poisson regression analysis of number of IP and ED encounters and a mediation analysis of the role of barriers to care.

Results: Those of lower SES were more likely to need asthma-related acute medical care.

Conclusion: The identification of vulnerable subpopulations is an important goal in order to reduce the burden of asthma-related hospital care.

## Hypothesis:

Lower socioeconomic status (SES) will be associated with an increased need for acute asthma care in the form of at least one emergency department visit or hospital stay, which may be a marker of first-time asthma but is often associated with poor asthma control. This relationship will be mediated by barriers to routine care.

## Introduction:

The fundamental cause theory (FCT) states that SES influences morbidity through a changing variety of risk factors so that those with higher SES will always be able to use their resources to achieve better health, regardless of the causal pathway for a particular disease [1]. Moreover FCT posits that intervening on proximal causes of a disease rather than inherent societal inequality can actually exacerbate health disparities. The World Trade Center Health Program (WTCHP) provides specialized medical monitoring and treatment for responders and survivors of the September 11, 2001, attack. The program is not means tested and provides eligible participants with no-cost asthma treatment and medications.

Inpatient hospital stays and emergency department visits are strongly associated with both asthma severity and poor control. It is not known whether hurdles to care, such as delays in program participation, long waiting times for appointments, and lack of coverage for comorbid conditions may differentially impact those with fewer resources and thereby lead to a greater need for acute asthma care in the form of increased numbers of inpatient hospital stays and emergency department visits.

The proposed analysis will build on the publication by Miller-Archie et al [2], which found race and education were associated with asthma-related inpatient stays among persons exposed to the 9/11 disaster, by providing a more in-depth analysis of SES including income and using a novel dataset (New York State emergency visits and inpatient stays) spanning a greater number of years (2000-2016).

## Methods:

The World Trade Center Health Registry is comprised of 71,430 enrollees who lived, worked, or were passing through lower Manhattan on September 11, 2001 or who conducted clean-up work in the months that followed. The prospective cohort is made up of four waves spanning 2003 to 2016 in which enrollees describe both their exposure to the terrorist attack as well as their health conditions before and after 9/11. Many Registry enrollees are eligible for health benefits through the WTCHP. The current study was limited to enrollees aged 25 or older on 9/11 who resided in New York State and included self-reported asthmatics and non-asthmatics. Registry data were matched via a linkage to the New York State Department of Health's Statewide Planning and Research Cooperative System (SPARCS) database. SPARCS is made up of all hospital discharges in New York except those that occur in federal and psychiatric hospitals. Records were matched based on an algorithm using parts of the first and last names, as well as date of birth, social security number, and zip code in hierarchical rounds (Figure 1). In the case of more than one match, the match on the highest round was retained. Records with more than 3 matches were discarded. Asthma-related hospital stays and emergency department visits were determined via ICD-9 and ICD-10 codes.

Bivariate analyses were conducted using the chi-square test to compare the distribution of sociodemographic factors between those who were hospitalized for asthma or who visited an

emergency department and the rest of the WTCHR cohort. Additional analyses will include Poisson regression, as well as an analysis to determine whether the relationship is mediated by barriers to care, such as lack of health insurance, lack of knowledge about the WTC health program, and inability to pay non-covered costs.

#### Preliminary Results:

Race, gender, income, and educational attainment were associated with having at least one inpatient stay or emergency department visit ( $p < 0.0001$ ) in bivariate analyses. For example, only 1% of non-Hispanic whites had at least one ED visit, compared to 4% of non-Hispanic blacks. Similarly, among those with the highest income ( $\geq \$200,000$ ) and education (those with a postgraduate degree) less than 1% had any emergency department visits. Among those with the lowest income ( $\leq \$10,000$ ) and education (less than high school) 4.5% and 1% had at least one emergency department visit, respectively. Patterns were similar for inpatient stays (Table 1).

#### Conclusion:

These data demonstrate that health disparities exist in acute health-care utilization, even in populations with covered medical care. These differences may be driven by a few factors: increased asthma incidence or severity or decreased asthma control or a combination of all three in those of lower SES. Many Registry enrollees are potentially eligible for no out-of-pocket-cost health care for 9/11-related conditions, such as asthma, and there is some evidence that those with lower income may actually apply at higher rates [3]. However, qualitative data show that even among those covered, barriers to treatment exist that may impact those of low SES more [3]. Health equity is an important goal at the New York City Department of Health and Mental Hygiene. It is therefore vital that public health officials identify vulnerable subpopulations and provide additional resources to those who most need them.

Table 1. Demographic characteristics of the World Trade Center Health Registry enrolled 25 years or older stratified by ever having an inpatient hospital stay (IP) or emergency department visit (ED) for asthma in New York State.

|                                  | No IP asthma admit # (%) | Any IP asthma admit # (%) | p value   | No ED asthma visit # (%) | Any ED asthma visit # (%) | p value   |
|----------------------------------|--------------------------|---------------------------|-----------|--------------------------|---------------------------|-----------|
| <b>Race</b>                      |                          |                           | <0.0001 * |                          |                           | <0.0001 * |
| Non-Hispanic white               | 27021 (60.83)            | 187 (40.65)               |           | 26936 (61.19)            | 272 (31.59)               |           |
| Non-Hispanic black               | 6388 (14.38)             | 118 (25.65)               |           | 6247 (14.19)             | 259 (30.08)               |           |
| Hispanic                         | 6549 (14.74)             | 117 (25.43)               |           | 6399 (14.54)             | 267 (31.01)               |           |
| Asian                            | 3196 (7.2)               | 19 (4.13)                 |           | 3200 (7.27)              | 15 (1.74)                 |           |
| Multiracial                      | 806 (1.81)               | 8 (1.74)                  |           | 785 (1.78)               | 29 (3.37)                 |           |
| Other                            | 459 (1.03)               | 11 (2.39)                 |           | 451 (1.02)               | 19 (2.21)                 |           |
| <b>Gender</b>                    |                          |                           | <0.0001 * |                          |                           | <0.0001 * |
| Males                            | 26862 (60.47)            | 200 (43.48)               |           | 29901 (59.94)            | 421 (43.72)               |           |
| Females                          | 17557 (39.53)            | 260 (56.52)               |           | 19988 (40.06)            | 542 (56.28)               |           |
| <b>Education</b>                 |                          |                           | <0.0001 * |                          |                           | <0.0001 * |
| Never attended                   | 90 (0.2)                 | 3 (0.65)                  |           | 92 (0.21)                | 1 (0.12)                  |           |
| Elementary only                  | 1001 (2.25)              | 31 (6.74)                 |           | 1004 (2.28)              | 28 (3.25)                 |           |
| Some high school                 | 1583 (3.56)              | 36 (7.83)                 |           | 1552 (3.53)              | 67 (7.78)                 |           |
| High school graduate             | 9072 (20.42)             | 131 (28.48)               |           | 8966 (20.37)             | 237 (27.53)               |           |
| Some college                     | 11020 (24.81)            | 149 (32.39)               |           | 10870 (24.69)            | 299 (34.73)               |           |
| College graduate                 | 13181 (29.67)            | 74 (16.09)                |           | 13095 (29.75)            | 160 (18.58)               |           |
| Postgraduate                     | 8472 (19.07)             | 36 (7.83)                 |           | 8439 (19.17)             | 69 (8.01)                 |           |
| <b>Income</b>                    |                          |                           | <0.0001 * |                          |                           | <0.0001 * |
| Less than \$10,000               | 1684 (3.79)              | 57 (12.39)                |           | 1662 (3.78)              | 79 (9.18)                 |           |
| \$10,000 to less than \$15,000   | 1044 (2.35)              | 19 (4.13)                 |           | 1027 (2.33)              | 36 (4.18)                 |           |
| \$15,000 to less than \$25,000   | 1980 (4.46)              | 47 (10.22)                |           | 1949 (4.43)              | 78 (9.06)                 |           |
| \$25,000 to less than \$35,000   | 3457 (7.78)              | 61 (13.26)                |           | 3386 (7.69)              | 132 (15.33)               |           |
| \$35,000 to less than \$50,000   | 6125 (13.79)             | 59 (12.83)                |           | 6029 (13.7)              | 155 (18)                  |           |
| \$50,000 to less than \$75,000   | 9619 (21.66)             | 96 (20.87)                |           | 9542 (21.68)             | 173 (20.09)               |           |
| \$75,000 to less than \$100,000  | 8315 (18.72)             | 68 (14.78)                |           | 8269 (18.79)             | 114 (13.24)               |           |
| \$100,000 to less than \$150,000 | 7045 (15.86)             | 40 (8.7)                  |           | 7017 (15.94)             | 68 (7.9)                  |           |
| \$150,000 to less than \$200,000 | 2231 (5.02)              | 9 (1.96)                  |           | 2223 (5.05)              | 17 (1.97)                 |           |
| \$200,000 or more                | 2919 (6.57)              | 4 (0.87)                  |           | 2914 (6.62)              | 9 (1.05)                  |           |

Figure 1. Steps to match World Trade Center Health Registry data with SPARCS hospital admissions and ED visits.

% of dataset  
matched at each  
round

## Matching steps

\* HIV and abortion visits removed  
before matching



## References

1. Link, B.G. and J. Phelan, *Social conditions as fundamental causes of disease*. Journal of health and social behavior, 1995: p. 80-94.
2. Miller-Archie, S.A., et al., *Hospitalizations for asthma among adults exposed to the September 11, 2001 World Trade Center terrorist attack*. Journal of Asthma, 2018. **55**(4): p. 354-363.
3. Petrusic, L., et al., *Considerations for future disaster registries: Effectiveness of treatment referral outreach in addressing long-term unmet 9/11 disaster needs*. Disaster Prevention and Management: An International Journal, 2018. **27**(3): p. 321-333.