

Health Effects of World Trade Center Site Workers

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KEY WORDS: *WTC health effects; RADS; PTSD*

INTRODUCTION

The attack on the World Trade Center (WTC) site and the subsequent collapse of the towers on September 11 generated an aerosol containing a wide range of toxic and irritant agents. A partial list of these materials includes pulverized concrete, gypsum, pulverized glass, asbestos, silica, fibrous glass, heavy metals, soot, volatile organic compounds, acid mists and organic products of combustion, among them polycyclic aromatic hydrocarbons (PAHs). A recurring theme with regard to exposure conditions at the “Ground Zero” site was the uneven provision and use of adequate respiratory protection, the clinical consequences of which became apparent over the ensuing several months.

The populations at risk for adverse health consequences, in decreasing intensity of exposure, included those who were caught in the blackout (then “greyout”) of the collapse cloud; the Ground Zero first responders and workers and volunteers involved in the rescue and recovery effort over the first few days; those involved in restoration of essential services and infrastructure (electric, gas, transportation, etc.), debris removal crews and their support services, building clean up teams, persons who eventually reoccupied offices, commercial and school buildings near the WTC site, and community residents. The extent of the clean-up effort, now 8 months in duration, and the necessity of moving truckloads of debris through public streets to the barge-loading operation at the Hudson River for transport to Staten Island increased the number of persons at risk for exposure.

By October 2001, the Mount Sinai-Irving J. Selikoff Center for Occupational and Environmental Medicine (COEM) began evaluating individuals, who presented with respiratory complaints, related to their exposure to airborne irritants. Exposure-related factors (when they were at or near “Ground Zero,” performing what tasks, over what time period, with what level of respiratory protection) appeared to be significant determinants of the severity of respiratory reactions; but host biological factors appeared to play a role as well, with some exhibiting greater susceptibility to the irritant-induced effects.

Health effects among the individuals seen in the Clinical Center included new-onset (i.e., post-9/11) sinusitis, laryngitis, tracheitis, reactive upper airways dysfunction (RUDS), bronchitis, and reactive airways dysfunction syndrome (RADS) and irritant-induced asthma. Those who had sinusitis or asthma prior to 9/11 experienced a marked worsening of their symptoms. Symptoms of upper and/or lower airway irritation were frequently reported to be worsened or provoked by re-exposure to airborne irritants (tobacco smoke, vehicle exhaust, cleaning solutions, etc.), by exercise, and by cold air.

While initially respiratory complaints and illnesses were identified primarily among workers and volunteers at or near the WTC site, over the ensuing months, similar problems were found among office reoccupants and community residents, especially those situated downwind (South and East) of Ground Zero.

While there was initial concern about persistent sequelae of acute musculoskeletal injuries sustained by workers and volunteers at the site, relatively fewer such injuries occurred during rescue and recovery and debris removal than would be expected for a project of this magnitude.

A particularly prominent clinical finding was the prevalence of persistent psychological distress among those who initially presented with respiratory conditions. Symptoms consistent with the classical picture of post-traumatic stress disorder and major depression were persistent among many

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Accepted 6 September 2002

DOI 10.1002/ajim.10154. Published online in Wiley InterScience
(www.interscience.wiley.com)

of our patients up to 7 months after exposure to the initial stressors.

Factors likely to have contributed to these psychological sequelae included fear of personal harm during the initial fires and building collapse while working on the pile. Visibility on the pile at night was poor; there was a recurrent threat of additional collapse of buildings, and fire flareups were constant as debris was moved. Some rescue workers and volunteers had seen people fall or leap from the towers, had witnessed acute, and at times fatal injury to individuals nearby, and had no ability to exert control over the dangers they and others faced. Many dealt with shattered bodies and human remains for the first time, and many rescue and recovery workers lost family and friends in the collapse. Despite remarkably heroic efforts by so many, few survivors were rescued, which took a significant toll on the psychological well-being of those involved. Their susceptibility to these stressors was likely to have been exacerbated by persistent fatigue and minimal sleep.

Commonly reported symptoms were persistent tearfulness, uncontrollable painful images and memories, nightmares, sweating, heart racing, trembling, the need to avoid settings which reminded them of the WTC experience, feeling distant from others, feeling on edge, and persistent anxiety. Many found themselves unable to enjoy those activities and pursuits, which usually brought them pleasure.

PILOT STUDY

In February 2002, the COEM organized a pilot study of 97 ironworkers in cooperation with Mount Sinai's Division of Pulmonary Medicine. The criteria for inclusion in this study required that ironworkers had been present at Ground Zero for at least 1 day from 9/11–9/14 and had worked at least 3 days at Ground Zero in total. International Ironworkers Union Local 40 played an essential role in identifying individuals who had worked or volunteered at the WTC site, distributing questionnaires to collect exposure-related information.

The focus of this limited study, drawing on the experience of our Clinical Center, was on respiratory and psychological health. Detailed exposure and occupational histories, medical and symptom histories (pre- and post-9/11), physical examination, chest X-ray, and pulmonary function testing (pre- and post-bronchodilator, when warranted) were performed.

PRELIMINARY RESULTS OF PILOT STUDY

A description of reported symptoms and findings is presented in Table I. Overall, high rates of persistent respiratory and psychological symptoms were found, 5 months after the initial exposure. Pulmonary function data are

TABLE I. Preliminary Findings in a Pilot Study of Ironworkers Exposed at the World Trade Center Site (N = 97)

	(%)
Smoking	
Current	33
Ex-smoker	32
Never	35
Pre-existing asthma	7
Pre-existing sinusitis	1
Persistent symptoms	
Rhinitis/sinusitis	52
Cough	64
Dyspnea on exertion	51
Chest tightness	45
Wheezing	45
"Provocable" symptoms	55
Physical examination findings	
Nasal mucosal inflammation	30
Swollen nasal turbinates	16
Rhonchi	4
Wheezing	5
Prolonged expiratory phase	5

currently being analyzed at the time of this presentation, but suggest a high prevalence of hyperactive airways. Only 26% of the subjects had consulted a physician during the prior 5 months, and many were treated with antibiotics only (9), bronchodilators only (7). Inhaled steroids and bronchodilators, the standard of care, had been prescribed for only eight individuals.

Sixty-eight ironworkers had persistence of one or more indicators of psychological distress. Only 13 had received counseling or psychiatric intervention.

LESSONS LEARNED

While, a thorough analysis of the clinical, preventive, and other public health issues that emerged in the aftermath of the WTC disaster remains to be carried out, some questions/policies already suggest themselves as warranting attention.

- The importance of an advisory to health care providers ASAP to assist with their evaluation and clinical management of the physical and psychological problems WTC-related patients experienced.
- Immediate capture of registry (contact) information for volunteers and workers.
- Rapid distribution of appropriate respiratory protection and a peer-based structure for encouraging consistent use.
- Rapid mobilization of resources for pro-active medical evaluation/treatment—respiratory, musculoskeletal, and

psychological—during the weeks following exposure at the disaster site.

- Testing of indoor settings, including analysis of settled dust and aggressive air monitoring, to establish a gradient of exposure with distance from Ground Zero to guide recommendations regarding clean-up and reoccupancy.
- Communication by public health agencies regarding exposure hazards in lay language, with focus not only on long-term cancer risks, but on short-term health consequences as well.
- Greater attention to human health experience, rather than exclusive focus on air monitoring for the usual suspects.

ACKNOWLEDGMENTS

The following persons contributed their time and efforts to establishing this program in record time. The staff members are Rosalind Bryant, Nancy Clark, Alyson Cozzolina, Sharon Crichlow-Perkins, Judith DeJesus, Maria Del Pilar, Jonathan Dropkin, Shona Fang, Sharon Gluck, Jennifer Hanlin, Ann Kochman, Paul Landsbergis, Karen Leitson, Diane Monahan, Leta Mora, Deborah Nagin, Heidi Norbis, Susan Nobel, Shanin Thigpen, Nishy Thottam, Tomomi Uetani, Nury Vasconcellos, and Jean Weiner.