Advances in the Screening and Treatment of WTC Responders and Survivors

Presenter

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Learning Objectives

- Identify types of environmental exposures that can affect health following a disaster or terrorist attack
- Summarize ways in which environmental exposure science can inform public health policy before and after a disaster
- Identify immediate and long-term health needs of exposed populations following a disaster, using lessons learned from the World Trade Center Health Program population

Types of Environmental Exposures

- Environmental disasters may occur from natural disasters or events precipitated by humans (eg, corporate/government negligence or terrorism)
- Natural
  - Earthquake, hurricane
- Man-made, resulting in exposure to chemicals, biological agents, or radiation
  - Corporate/government negligence
    - Indian Bhopal gas disaster
  - Terrorism
    - World Trade Center 9/11 disaster

WTC Dust

Known Health Effects

Source	Air Pollution Constituent	Health Effect
Structural Collapse		
Cement, ceiling tiles, drywall	Calcium carbonate/gypsum/vitreous fibers	Airway and pulmonary irritation
	Calcium sulfate	
Windows	Glass fibers, silicates	
Fire retardant	Asbestos	Cancer
Combustion		
Incomplete combustion, plastics	Organic hydrocarbons, furans/dioxins	Cancer
Diesel-powered rescue equipment	Diesel exhaust	Airway irritation, cancer

Banauch GI, et al. *Curr Opin Pulm Med*. 2005;11:160-168.[1]

Lessons Learned From Prior Disasters

- Medical and psychological surveillance
- Exposure assessment
- Mental health

Example: Man-made Disaster Goals of WTC Surveillance Programs

- Screening/monitoring program
  - Designed to identify responders with possible WTC-related health effects and provide appropriate referral for follow-up diagnostic testing and treatment
- Treatment programs: Develop and integrate physical and mental health treatment
  - Limits on the coverage for care can be challenging for both provider and patient

Establishment of Medical Programs to Follow WTC Responders

- April 2002: World Trade Center Worker and Volunteer Medical Screening Program starts
  - Initially a 1-year program, extended to 2 years because of demand
- March 2004: World Trade Center Medical Monitoring Program starts
  - Funding for 5 years, extended 2 additional years
  - Federal funding for treatment of WTC conditions starts in 2006
  - Program is renamed the WTC Medical Monitoring and Treatment Program in 2006
- 2005: Predecessor program administered by NYC Health and Hospitals Corp., WTC Environmental Center; now serves the survivor population under the WTC Health Program

WTC Health Program Participation by State

Every State Has Enrolled WTC Health Program Responders and/or Survivors

State	Responders	Survivors	Total
Alabama	52	1-9	53-61
Alaska	29		29
Arizona	176	1-9	177-185
Arkansas	24	1-9	25-33
California	475	30	505
Colorado	132	1-9	133-141
Connecticut	381	48	429
Delaware	56	1-9	57-65
District of Columbia	32	1-9	33-41
Florida	2070	113	2,183
Georgia	268	28	296
Hawaii	23	1-9	24-32

State	Responders	Survivors	Total
Idaho	13		13
Illinois	159	11	170
Indiana	62	1-9	53-71
Iowa	19	1-9	20-28
Kansas	23	1-9	24-32
Kentucky	38	1-9	39-47
Louisiana	27	1-9	28-36
Maine	44	1-9	45-53
Maryland	213	10	223
Massachusetts	274	1-9	275-283
Michigan	69	1-9	28-36
Minnesota	27	1-9	28-36
Mississippi	19		19

Renew 911 Health website.[2]

WTC Health Program Participation by State

Every State Has Enrolled WTC Health Program Responders and/or Survivors (cont)

State	Responders	Survivors	Total
Missouri	54	1-9	55-63
Montana	17		17
Nebraska	32	1-9	33-41
Nevada	92	1-9	93-101
New Hampshire	59	1-9	60-68
New Jersey	4402	503	4905
New Mexico	54	1-9	55-63
New York	47,462	6764	54,226
North Carolina	520	27	547
North Dakota	1-9		1-9
Ohio	188	1-9	189-197
Oklahoma	23	1-9	189-197
Oregon	65	1-9	189-197

State	Responders	Survivors	Total
Pennsylvania	956	88	1044
Rhode Island	49	1-9	60-68
South Carolina	263	23	286
Tennessee	83	1-9	84-92
Texas	234	20	254
Utah	53	1-9	54-62
Vermont	37	1-9	38-46
Virginia	427	22	449
Washington	91	1-9	92-100
West Virginia	37		37
Wisconsin	33	1-9	34-42
Wyoming	1-9		1-9
TOTAL	**60,360**	**7,782**	**68,142**

Renew 911 Health website.[2]

Medical and Psychological Screening Components

- Self and interviewer-administered medical questionnaires
- Physician-administered examination
- Interviewer-administered exposure assessment questionnaire
- Psychological screening and evaluation
- Spirometry pre- and post-bronchodilator
- Chest x-ray
- Routine blood work

Exposure Assessment

Unmet Public Health Need for WTC

- Earlier testing of ambient exposures at the site and nearby
- More focus on toxicants other than asbestos
- Testing of indoor settings to establish a gradient of exposure with respect to distance from Ground Zero to guide recommendations
  - Settled dust
  - Aggressive air monitoring
- Consistent messaging on cleanup procedures

Exposure Assessment
Unmet Public Health Need for WTC (cont)

- Access to follow-up medical and mental health care was difficult:
  - For WTC-related problems
    - Workers compensation delays, few occupational medicine specialists
  - For WTC-related mental and behavioral health problems
    - Heterogeneous population
    - Few psychiatrists or other mental health providers familiar with nuances of WTC experience
    - Need for mental health experts that speak Polish, Mandarin, Spanish, and other languages
  - For other medical problems
    - Many workers and community members were medically indigent

Surveillance and Environmental Exposure Science, Informing Public Policy

- Recommendation 1
  - Medical surveillance to identify exposures and/or early symptoms of disease, and to link those findings to individual care and preventive interventions
  - The overall goals of surveillance
    - To prevent and mitigate adverse physical and mental/behavioral health outcomes
    - To assess and maintain worker functionality
- Recommendation 2
  - Mental health surveillance
    - To assess and maintain worker functionality
    - To prevent and mitigate adverse mental health outcomes

Shubert J, et al. *Int J Emerg Ment Health*. 2007;9:201-213.[3]

Surveillance and Environmental Exposure Science, Informing Public Policy (cont)

- Recommendation 3
  - Creation of a registry of workers at the site
- Recommendation 4
  - Centralized mechanism to capture data related to individual and collective exposure in order to facilitate individual treatment, preventive interventions, and future long-term public health needs

Shubert J, et al. *Int J Emerg Ment Health*. 2007;9:201-213.[3]

Surveillance and Environmental Exposure Science, Informing Public Policy (cont)

- Recommendation 5
  - Exposure assessment strategies should be developed and implemented under the Incident Command System (ICS) as a way to protect workers on the job, and should also be *integrated with medical/psychological surveillance* to help guide interventions
- Recommendation 6
  - Each individual worker should receive detailed and interpreted biomedical and exposure data; all deidentified surveillance and exposure data should be publicly available, provided to all workers, and interpreted appropriately
- Recommendation 7
  - Risk communication an integral part of the entire worker protection program, including surveillance

Shubert J, et al. *Int J Emerg Ment Health*. 2007;9:201-213.[3]

What Are the Health Needs Over Time?

WTC Example

Immediate Needs	Short term	Long term
• Cough • Congestion • Chest tightening • Eye irritations • Musculoskeletal injuries	• Asthma • Throat and sinus/nasal irritation • GERD • PTSD	• WTC cough syndrome • Asthma, COPD, rhinosinusitis, GERD • PTSD • Cancer • Autoimmune disorders

Common Disorders

- Common physical illnesses/complaints
  - Respiratory problems
    - Asthma
    - Shortness of breath
    - Chronic cough
  - GERD
    - Acid and nonacid reflux
  - Allergies
  - Skin problems
  - Select cancers
- Common mental health disorders
  - PTSD
  - Anxiety
  - Depression
  - Substance abuse (esp. tobacco, alcohol, cannabis, opiates)
  - Other common symptoms: insomnia, headaches, memory/attention problems, interpersonal difficulties, chronic pain

WTC Health Registry

Risk Factors and Self-Report Event Exposures

- A total of 71,437 people enrolled in the WTCHR, for 17.4% coverage of the estimated eligible exposed population of nearly 410,000 including:
  - Building occupants
  - Persons on the street/in transit in lower Manhattan on 9/11
  - Local residents
  - Rescue and recovery workers/volunteers
  - School children and staff
- Frequently reported concerns
  - Being in the dust cloud from the collapsing WTC towers (51%)
  - Witnessing traumatic events (70%)
  - Sustaining an injury (13%)

Farfel M, et al. *J Urban Health*. 2008;85:880-909.[4]

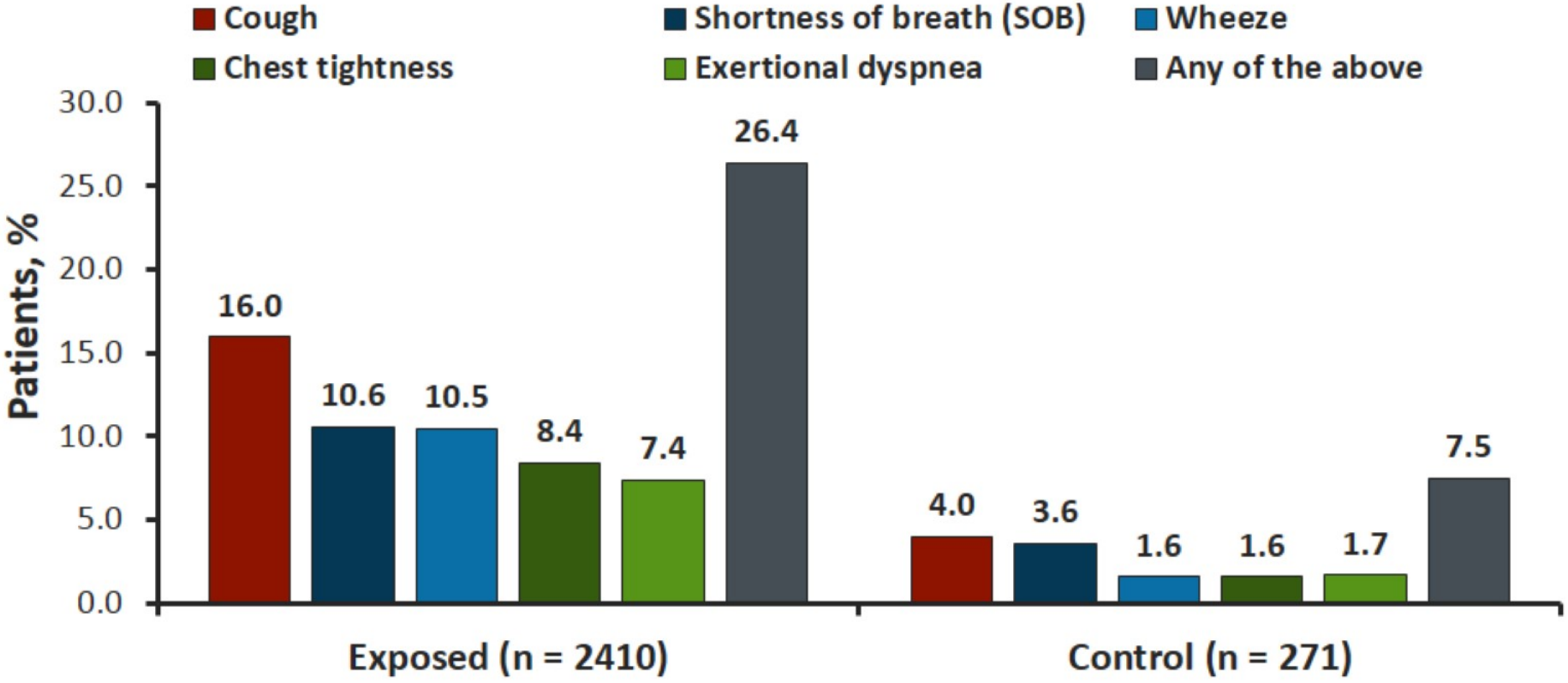
WTC Health Registry

Risk Factors and Self-Report Event Exposures (cont)

- After 9/11, 67% of adult enrollees reported new or worsening respiratory symptoms, 3% reported newly diagnosed asthma
- Newly diagnosed asthma most common among rescue and recovery workers who worked on the debris pile (4.1%)
- 16% screened positive for probable posttraumatic stress disorder (PTSD), and 8% for serious psychological distress. PTSD was higher among the following individuals:
  - Those who reported Hispanic ethnicity (30%)
  - Those with a household income < $25,000 (31%)
  - Those who were injured (35%).
- Estimated that between 3800 and 12,600 adults experienced newly diagnosed asthma and 34,600 to 70,200 adults experienced PTSD following the attacks

Farfel M, et al. *J Urban Health*. 2008;85:880-909.[4]

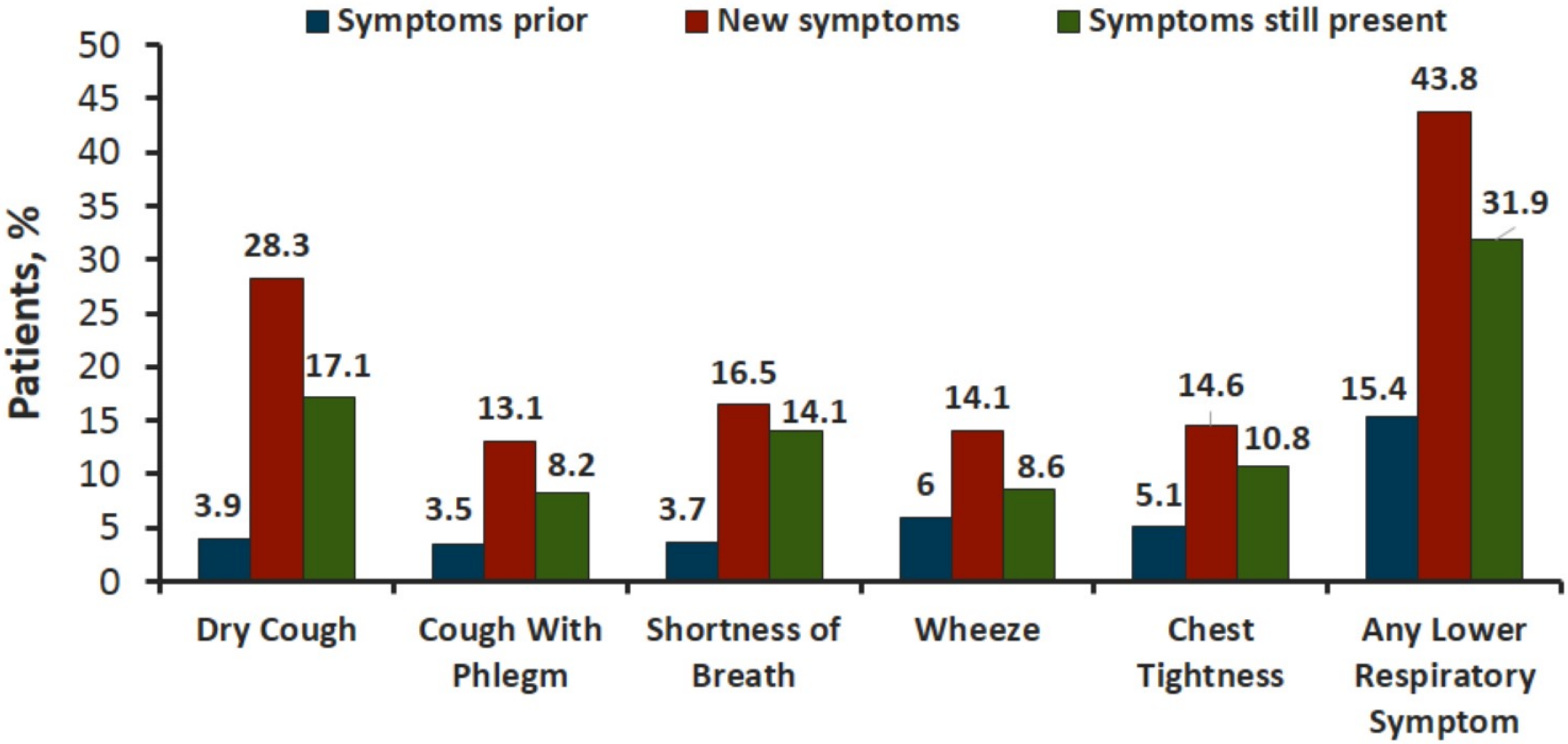
New-Onset Respiratory Symptoms Increased in Previously Normal Exposed Residents



Symptom frequency > 2 days per week in the past 4 weeks.

Reibman J, et al. *Environ Health Perspect*. 2005;113:406-411.[5]

Prevalence of Lower Respiratory Symptoms Among the WTC Monitoring and Screening Responder Population



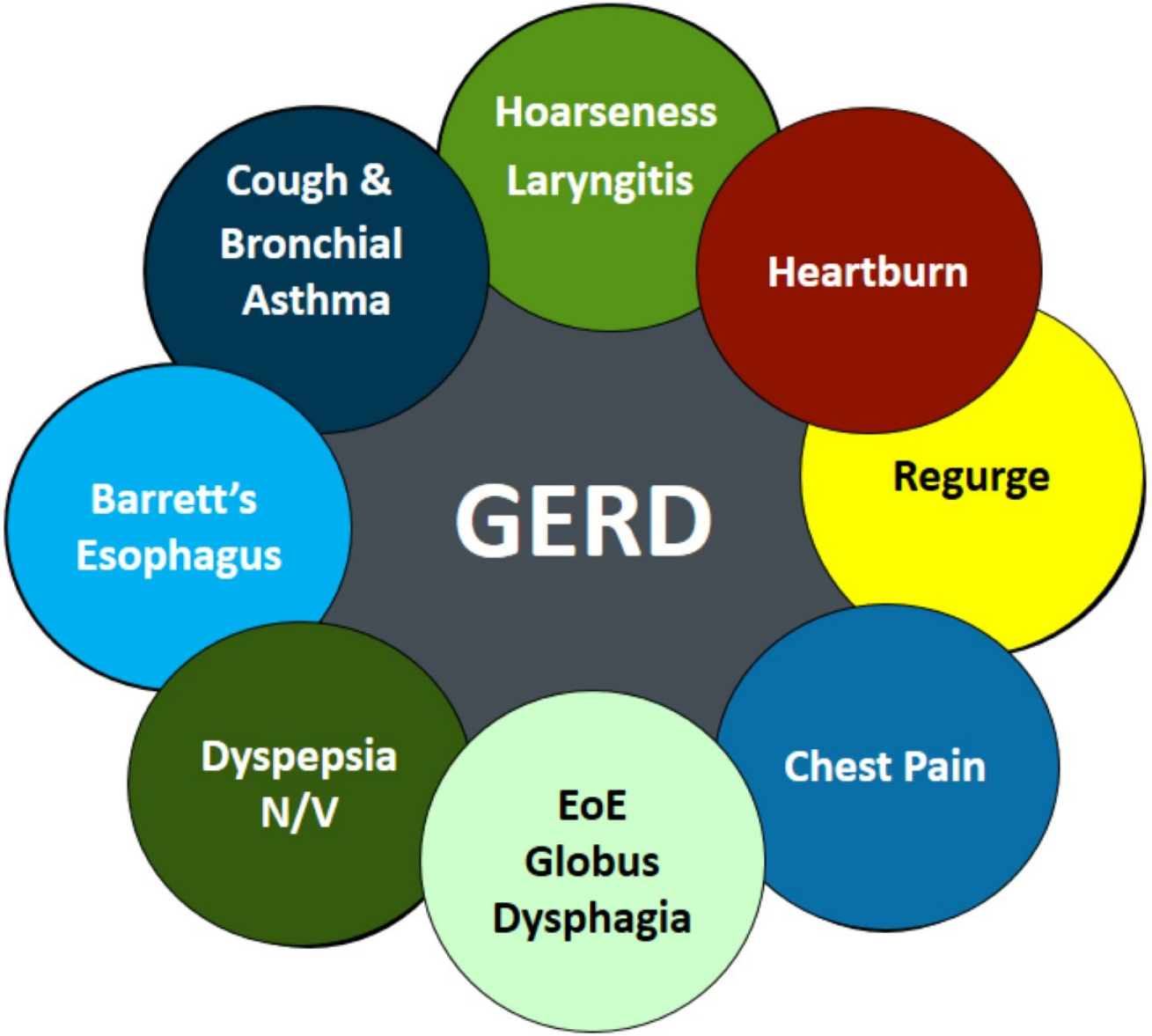
Herbert R, et al. *Environ Health Perspect*. 2006;114:1853-1858.[6]

9-Year Cumulative Incidence of Illnesses in WTC Rescue and Recovery Workers (N = 27,449)

- Asthma: 27.6%
- Sinusitis: 42.3%
- GERD: 39.3%
- Abnormal spirometry: 41.8% (low FVC in 75%)
- PTSD: police 9.3%; others 31.9%
- Panic disorder: police 8.4%; others 21.2%
- Depression: police 7%; others 27.5%

Wisnivesky JP, et al. *Lancet*. 2011;378:888-897.[7]

GERD in WTC Exposed Population



"Sarcoid-like" Granulomatous Pulmonary Disease

- Sarcoidosis annual incidence rates of FDNY compared: 15 years prior vs 5 years post disaster
- 5 years after WTC exposure, 26 FDNY firefighters presented with new-onset sarcoidosis, 13 of which were diagnosed in the first year
  - 18 of the 26 had findings consistent with asthma
  - 8 of 21 (consenting to challenge testing) had airway hyperreactivity
    - Neither seen in pre-WTC FDNY sarcoidosis cases
- Incidence rates
  - 15 years prior incidence = 15/100,000
  - 1 year post incidence = 86/100,000
  - 2-5 years post average incidence = 22/100,000

Izbicki G, et al. *Chest*. 2007;131:1414-1423.[8]

Assessment of Responder Health Consequences

Mental Health

- 10,132 WTC workers completed a self-administered mental health questionnaire 10-61 months after the WTC attack.
  - 11.1% met criteria for probable PTSD
  - 8.8% met criteria for probable depression
  - 5.0% met criteria for probable panic disorder
  - 62% met criteria for substantial stress reaction
- Extensive comorbidity was observed, including high risk of impairment of social function.
- Chronic impairment of mental health and social functioning is associated with workers' service in 9/11 recovery operations.

Stellman JM, et al. *Environ Health Perspect*. 2008;116:1248-1253.[9]

Exposure, Probable PTSD and Lower Respiratory Illness Among WTC Rescue, Recovery, and Cleanup Workers

- 8505 police and 12,333 nontraditional responders examined at WTC Medical Monitoring and Treatment Program
- Examined patterns of association among exposures, other risk factors, probable WTC related PTSD, physician-associated respiratory symptoms arising after 9-11 and present at examination, abnormal PFT defined by low FVC
- Fewer police than nontraditional responders with probable PTSD (5.9% vs 23%) and respiratory symptoms (22.5% vs 28.4%), whereas pulmonary function was similar
- PTSD and respiratory symptoms moderately correlated in both groups
- Exposure more strongly associated with respiratory symptoms than PTSD or lung function

Luft et al. *Psychol Med*. 2012;42:1069-1079.[10]

WTC Health Program

"Responders" WTC Workers Monitoring and Treatment Program

- Those involved in rescue, recovery, debris removal ("Responders"), and volunteers
- Medical/mental health **screening, monitoring, and treatment** program
- Presence of symptom **is not** necessary to be program eligible

"Survivors" WTC Environmental Health Center

- "Survivors" include community members (local workers, residents, students, cleanup workers)
- Medical/mental **treatment** program for WTC-related medical and mental health symptoms and cancers
- Medical and mental health monitoring program for those certified in the program
- Presence of symptom or cancer **is** necessary to be program eligible

CDC/Agency for Toxic Substances and Diseases Registry

Exposure and Health Registries

- Exposure and Health Registries
  - World Trade Center Health Registry
    A comprehensive and confidential health survey of those most directly exposed to the events of 9/11/01
  - Katrina and Rita Exposures (KARE) Registry
    Survey of people who lived or stayed in trailers furnished by the Federal Emergency Management Agency (FEMA) after Hurricanes Katrina and Rita
  - National Amyotrophic Lateral Sclerosis (ALS) Registry
    Congressionally mandated registry for persons in the US with ALS; the only population-based registry in the US that collects information to help scientists learn more about who gets ALS and its causes
  - Rapid Response Registry
    Helps local, state, and federal public health and disaster response agencies rapidly establish registries of persons who are exposed or potentially exposed to chemicals or other harmful agents during catastrophic events

CDC website.[11]

Lessons Learned

- Environmental disasters can be natural or man-made.
- There are high rates of comorbid medical and mental health conditions in rescue workers and survivors with environmental disaster exposure.
- There is a need for integrated mental and physical health care.
  - Must account for psychological burden of chronic medical illness in those impacted by the disaster
- Importance of ongoing surveillance, even decades after a disaster, is clear.

Lessons Learned (cont)

- Perform a comprehensive safety and health risk assessment at the outset of the incident.
- Sampling results should be reported in a methodical, diligent manner.
- Use a variety of methods to protect workers and those exposed.
- Provide safety and health training to affected workers, employers, and other agencies.
- Multidisciplinary approach is needed for disaster programs.
- Referrals to WTC Health Program can and should still be made

Abbreviations

ALS = National Amyotrophic Lateral Sclerosis

COPD = chronic obstructive pulmonary disease

EoE = eosinophilic esophagitis

FDNY = New York City Fire Department

FVC = forced vital capacity

GERD = gastroesophageal reflux disease

KARE = Katrina and Rita Exposures

NYPD = New York City Police Department

PFT = peak flow test

PTSD = posttraumatic stress disorder

SOB = shortness of breath

WTC = World Trade Center

WTCHR = World Trade Center Health Registry

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