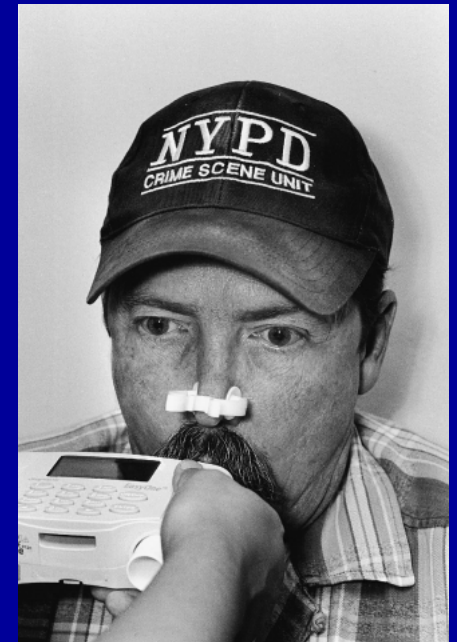


# From Shock to Public Health Response: Coming to Understand the Impact of the World Trade Center Disaster on Responder Health



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# Exposures

The attacks on the World Trade Center of September 11, 2001 produced the largest acute environmental disaster to ever occur in New York City

- What were the exposures?
  - Pulverized cement, gypsum, & glass
  - Asbestos
  - Silica
  - Fibrous glass
  - Heavy metals
  - Acid mists
  - Products of combustion
    - Volatile organic compounds including benzene, PAHs



# Responders

- An estimated 50,000+ individuals worked on Ground Zero and at the Staten Island landfill in rescue, recovery, debris removal and disposal, and restoration of services
- Traditional disaster responders:
  - FDNY Firefighters
  - NYPD Officers
  - Paramedics
- Non-Traditional disaster responders:
  - Ironworkers
  - Electricians
  - Sanitation Workers
  - Construction Laborers
  - Transportation Workers
  - Cleaning and Maintenance Personnel



# Initial Services Established

## CDC (NIOSH and ATSDR) Federally Funded Programs

- FDNY Bureau of Health Services
- World Trade Center Worker and Volunteer Medical Screening Program (WTC WVMSP)
- WTC Health Registry

# Fire Department of New York Bureau of Health Services

- Began providing comprehensive WTC medical screening examinations in 10/2001, with research component, to FDNY WTC rescue workers; continues to provide periodic surveillance examinations.
- 14,319 examinees (as of 6/30/07)
- Began to provide federally funded treatment in 2006
- Unique strengths: pre-existing infrastructure
  - robust systems for data capture
  - pre- 9/11 data from annual examinations
  - integration of examinations into annual fitness for duty  
→ high participation rates



# The WTC Worker and Volunteer Screening/Monitoring Program Consortium

- Established in 2002 with funding from CDC/NIOSH
- Multi-center clinical consortium provides free standardized periodic medical & mental health exams to non-FDNY WTC responders involved in rescue, recovery, restoration of services & cleanup in the NY/NJ area (& nationwide)
- Federally funded treatment began 2006
- Unique strengths:
  - provided standardized comprehensive examinations to the largest population of WTC responders (22,506 by 9/30/07)
  - responders: an occupationally, culturally & ethnically diverse group
  - new responders continue to enroll at rate of 300-500 per month

# WTC Health Registry

- Launched in 2002 as collaborative effort between NYC DOHMH & federal ATSDR with initial 5-yr funding from FEMA & ATSDR
- Periodic (every 2-3 yrs) confidential surveillance surveys to assess the physical & mental health impact of 9/11
- In-depth studies of particular groups of enrollees by Registry & external researchers
- Unique strengths:
  - largest effort ever in U.S. to monitor health after a disaster when 71,437 persons enrolled & completed a 30-min telephone interview on health & location on 9/11 (2003-4)
  - captured data on populations not being followed systematically by other groups (children, tower evacuees, residents)

# Update on Studies of Responder Health Fall 2006- Fall 2007:What's New?

Ability to compare persistence of respiratory symptoms in different groups (responders and others)

- WTC responders seen in NY/NJ WTCMMTP: elevated rates of spirometry abnormalities (low FVC) compared to national population <sup>1</sup>
- Increased incidence of sarcoid-like granulomatous disease among FDNY responders post 9/11 <sup>2</sup>
- High rate of newly diagnosed asthma in responders, associated with both time of arrival & duration of exposure <sup>3</sup>
- PTSD risk greater in workers from occupations least likely to have had disaster training/experience <sup>4</sup>

*1. Herbert R, Moline J, Skloot G, et al. Environ Health Perspec, Dec 2006.*

*2. Izbicki G, Chavko R, Banauch G, et al. Chest, May 2007.*

*3. Wheeler K, McKelvey W, Thorpe L, et al. Environ Health Perspec, Nov 2007*

*4. Perrin M, DiGrande L, Wheeler K, et al, Am J Psychiatry September 2007*



# Rates of Persistent Respiratory Symptoms Among WTC Responders and other WTC-exposed groups

Reference	Population	Time Examined after 9/11/01	Range of Occupations	Lower Respiratory					Upper Respiratory		Dose Response/Findings
				Cough	Phlegm	Shortness of Breath	Wheezing	Chest Tightness	Sinus or Nasal Congestion	Sore Throat	
Herbert, 2006 (1)*	9,442 heterogeneous responders	10-30 months	laborers, ironworkers, building and construction trades, telecommunication workers, sanitation workers, public and private sector workers and	25.30%	-	14.10%	8.60%	10.80%	-	28.80%	Early arrival significantly associated with increased reporting of newly incident and worsened respiratory problems
Buyantseva, 2007 (2)	1,588 New York Police Officers	19 months	NYPD	43.50%	30.70%	43.60%	25.90%	-	-	-	Exposure based on location police were stationed; frequency of cough was associated with 9/11 exposure intensity
Brackbill, 2006 (3)	8,418 survivors of damaged buildings	24-36 months		27.00%	-	35.10%	28.50%	-	38.10%	-	Time of evacuation and building type were associated with self-reported respiratory symptoms; survivors caught in the dust and debris cloud were more likely to report symptoms and injuries.
Kelly, 2007 (4)	Firefighters	13-47 months		31.00%	-	28%	20%	-	32%	22%	Estimated arrival times at the WTC site; correlation between earlier arrival and an increase in lower respiratory symptoms
NYC DOHMH World Trade Center Health Registry (5)	57,359 Lower Manhattan Residents, adults	24-37 months		37%	-	42%	38%	-	47%	38%	does not take into account specific exposure impacts on health conditions (e.g. exposure to the dust/debris cloud, proximity to the disaster, or working at the WTC site)
Tao, 2007 (6)	1,114 workers identified as being at WTC site	20 months	3 NYC Local Labor Unions, and NYC Department of Sanitation	Compared with those never at WTC site, WTC workers were more than three times as likely to report any lower respiratory symptoms (rate ratio = 3.40, 95% confidence interval: 2.33-4.94)							Increase in reporting of lower respiratory symptoms with volunteer location closer to WTC site, and longer duration of exposure

\* A unique feature of the Herbert/Mt Sinai study is that the statistics pertain only to those responders who had no symptoms prior to 9/11. All of the other studies produced data on the entire group, irrespective of prior health status.

1. Herbert R, Moline J, Skloot G, et al. *Environ Health Perspec*, Dec 2006.
2. Buyantseva LV, Tulchinsky M, Kapalka GM, et al. *Journal of Occ and Environ Med*, Mar 2007
3. Brackbill RM, Thorpe LE, DiGrande L, et al. *MMWR Surveill Summ*. Apr 7, 2006
4. Kelly KJ, Niles J, McLaughlin MT, et al. [www.nyc.gov/html/fdny/html/publications/wtc\\_assessments/2007/wtc\\_2007.shtml](http://www.nyc.gov/html/fdny/html/publications/wtc_assessments/2007/wtc_2007.shtml)
5. NYC Department of Health and Mental Hygiene, *WTC Health Registry*, Nov 2004.
6. Tao G, Massa J, Ashwell L, et al. *Journal of Occupation and Environ Med*, Oct 2007.

# Respiratory Health: Key Findings to Date

## Dose- Response Relationships

Condition	Reference	Population	Dose Response			Finding
			Time of Arrival	Duration	Location	
Increased prevalence of respiratory symptoms/Increased prevalence of abnormal spirometry	Herbert, 2006 (1)*	9,442 heterogeneous responders	yes		yes	Early arrival significantly associated with increased reporting of newly incident and worsened respiratory problems; prevalence of low FVC was higher in responders who arrived closer to time of collapse of twin towers than 10/1/01
Increased prevalence of respiratory symptoms	Tao, 2007 (6)	1,114 from 3 NYC Local Labor Unions, and NYC Department of Sanitation	no	yes	yes	Increase in reporting of lower respiratory symptoms with volunteer location closer to WTC site, and longer duration of exposure
Increased rates of sarcoidosis	Izbicki, 2007 (7)**	26 patients diagnosed with Sarcoidosis				Patient numbers too low to determine if arrival time or mask use were significant predictive factors/had significant correlation; however, did review time of arrival
Accelerated decline in lung function	Banauch, 2006 (8)	Firefighters	yes			exposure intensity assessed by initial arrival time at the World Trade Center site correlated linearly with FEV1 reduction in an exposure intensity–response gradient
Increased prevalence of asthma	Wheeler, 2007 (9)	25,748 workers who did not have asthma prior to 9/11	yes	yes		Rate of self-reported newly diagnosed asthma was high and significantly associated with increased exposure to the WTC disaster site. Among workers who arrived on 11 September, delays in initial use of masks/respirators associated with increased risk of a

\* Low FVC the most common abnormality (Mt. Sinai study): rate among non-smokers 5 x expected rate reported for NHANES

\*\* 0-5 FDNY rescue workers diagnosed with sarcoidosis in 15 years pre-9/11 (incidence rate: 13/100,000)

13 new cases diagnosed between 9/11/01 – 9/11/02 (incidence rate: 86/100,000)

13 new cases diagnosed between 9/11/02 – 9/11/06 (incidence rate: 22/100,000)

1. Herbert R, Moline J, Skloot G, et al. *Environ Health Perspec*, Dec 2006.
6. Tao G, Massa J, Ashwell L, et al. *Journal of Occupation and Environ Med*, Oct 2007.
7. Izbicki G, Chavko R, Banauch G, et al. *Chest*, May 2007.
8. Banauch G, Hall C, Weiden M, et al. *Am Journal of Resp and Critical Care Med*, 2006.
9. Wheeler K, McKelvey W, Thorpe L, et al. *Environ Health Perspec*, Nov 2007.

# Mental Health: Key Findings to Date

Rescue & recovery workers interviewed by the WTC Health Registry (N=28,962) 2–3 years after the disaster<sup>1</sup>:

- PTSD prevalence = 12.4%
  - 6.2% for police to 21.2% for unaffiliated volunteers
- Greatest risk of developing PTSD:
  - construction/engineering & sanitation workers, unaffiliated volunteers
- Dose-response: Earlier start date & longer duration of time at WTC site significant risk factors for current “probable” PTSD among all occupations other than police.
- Prevalence of PTSD higher among those who performed tasks uncommon to their regular occupation.

<sup>1</sup> Perrin MA, DiGrande L, Wheeler K, et al. Am J Psychiatry, August 2007.

# Mental Health: Key Findings to Date

“Mental Health Status of World Trade Center Rescue and Recovery Workers and Volunteers — New York City, July 2002–August 2004”<sup>2</sup>

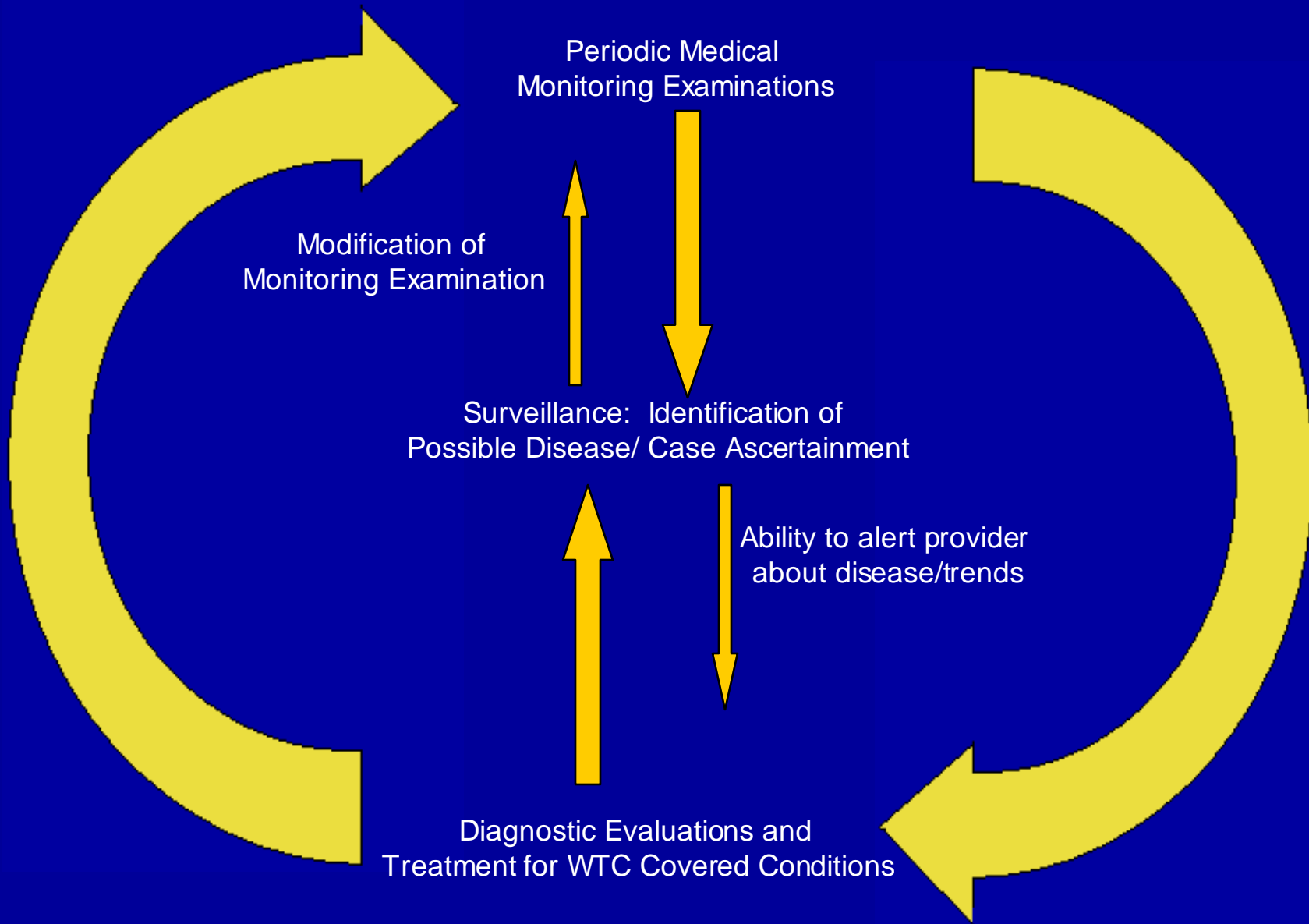
- Among the first 1,138 responders screened, 51% met pre-determined criteria for risk of mental health problems
- Responders' risk for PTSD was 4 times the rate of PTSD in the general male population

<sup>2</sup> Smith RP, Katz CL, Holmes A et al. MMWR Surveillance Summ, 10 Sept 2004.

# Federally Funded Treatment for WTC Responders

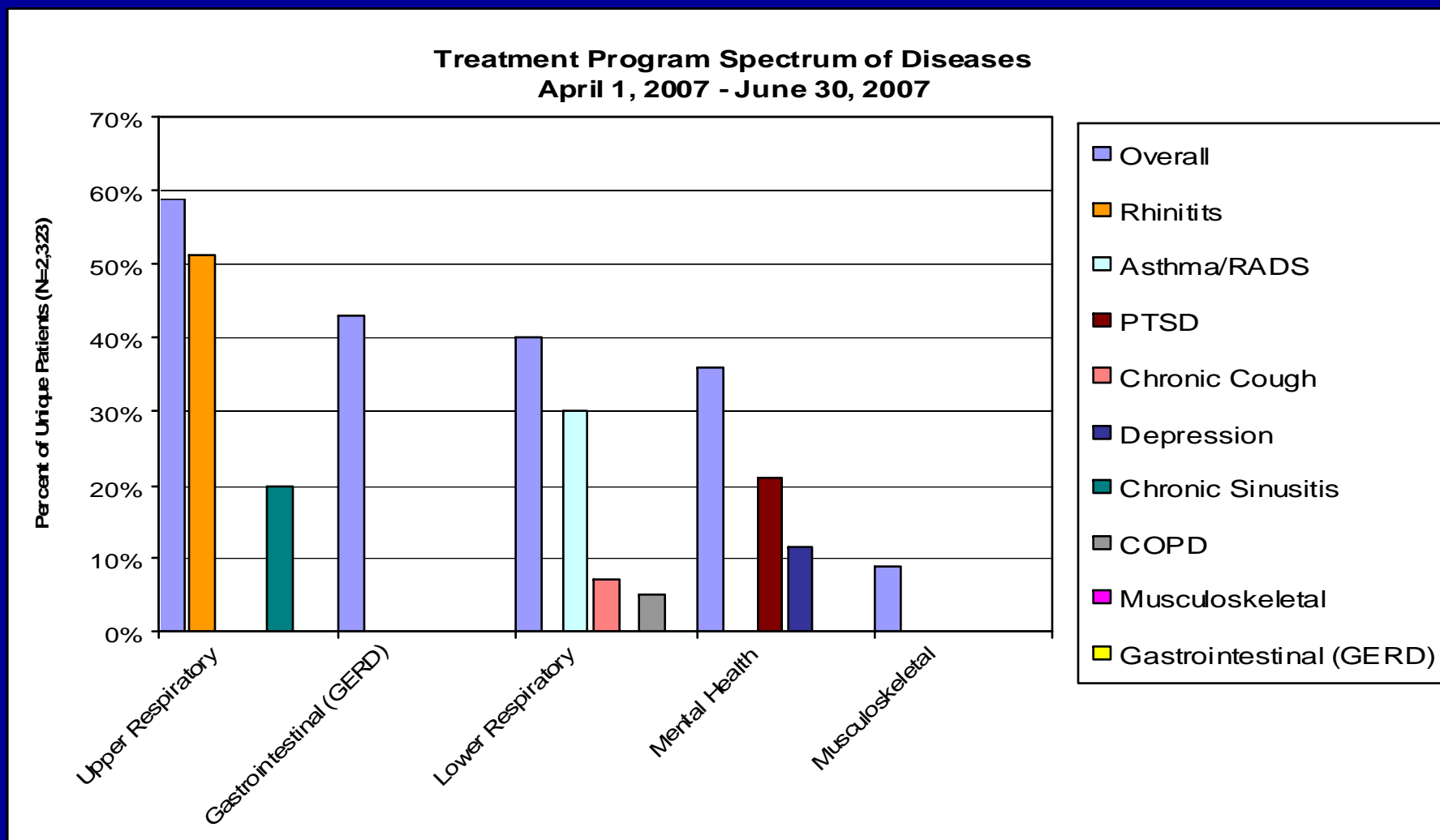
- In addition to Monitoring Programs & the WTC Registry, federally funded treatment programs linked to the WTC Monitoring Programs began in Fall 2006
- Goals:
  - To provide free medical & mental health treatment for all responders with WTC related illnesses, regardless of ability to pay
  - To enhance the ability to track the health status of responders over time
  - To enhance identification & documentation of diseases possibly related to exposures sustained at the World Trade Center

# Current Initiatives: MMTP Model





# Treatment Program: Spectrum of Diseases Seen in NY/NJ Consortium (2,323 patients seen in 4,693 visits (4/1/07-6/30/07))



# Future Health Risks & Unanswered Questions

- Will the respiratory, gastrointestinal & mental health problems we are currently observing in responders persist?
  - For how long?
  - What degree of severity & associated disability?
- Will new health problems emerge in responders as a result of their exposures to a uniquely complex mix of chemical compounds that contaminated the air, soil & dust of New York City after 9/11?
  - Responders were exposed to carcinogens, neurotoxins, & chemicals toxic to the respiratory tract in concentrations and in combinations never before encountered.
  - Long-term consequences of these unique exposures not yet known

# Acknowledgements

- Our funders: NIOSH/CDC, American Red Cross Liberty Fund/Recovery Grant Program, September 11th Fund, Bear Stearns Charitable Trust, Robin Hood Relief Fund
- The entire staffs of the World Trade Center Medical Monitoring and Treatment Programs at Mount Sinai Medical Center, Bellevue/NYU Occupational & Environmental Medicine Clinic, Center for the Biology of Natural Systems at Queens College, SUNY Stony Brook/Long Island Occupational & Environmental Health Clinic, Environmental & Occupational Health Sciences Institute at UMDNJ-Robert Wood Johnson Medical School/New Jersey, the Association of Occupational & Environmental Clinics
- Our colleagues at the FDNY, Bellevue WTC Environmental Health Center, & the NYC Department of Health and Mental Hygiene
- THE WTC RESPONDERS !

# Extra slides

# Current Number of Responders Served

- **WTC MMTP (FDNY and NY/NJ/National Consortium):**
- **36,825 +** WTC responders have been examined at least once in longitudinal medical monitoring and treatment program
  - NY/NJ Consortium and National Program (as of 9/30/07): **22,506** examinees
  - FDNY (as of 6/30/07): **14,319** examinees
  - New responders continue to enroll at a rate of 300-500 per month
- **WTC Health Registry: 71,000** entire population, approximately **29,000** responders interviewed at least once

# Initial Services Established

## CDC (NIOSH and ATSDR) Federally Funded Programs

- **FDNY Bureau of Health Services**
  - Comprehensive medical screenings with research component for FDNY WTC rescue workers beginning in October 2001
- **World Trade Center Worker and Volunteer Medical Screening Program (WTC WVMSP)**
  - Multi-center clinical consortium providing baseline screening examinations for workers & volunteers involved in rescue, recovery, restoration of services & cleanup efforts (non-FDNY responders)
- **WTC Health Registry**
  - Comprehensive and confidential health survey of those most directly exposed to the events of 9/11/01. Those enrolled answered a 30-minute telephone survey about where they were on 9/11/01, and were asked to report the status of their health.



# Treatment Program: Spectrum of Diseases Seen in NY/NJ Consortium (2,323 patients seen in 4,693 visits (4/1/07-6/30/07))

40% treated for lower respiratory conditions

- Asthma and/or RADS (30%)
- Chronic cough (7%)
- Chronic obstructive pulmonary disease (5%)

59% treated for upper respiratory conditions

- Rhinitis (chronic nasal irritation or “runny nose”) (51%)
- Chronic sinusitis (20%)
- Chronic laryngitis (5%)

43% treated for gastrointestinal conditions (mostly GERD)

36% treated for mental health problems

- PTSD (21%)
- Depression (11.6%)