World Trade Center Health Program Nearly 25 Years Later:

Michael Crane, MD
Director Mt. Sinai's WTC Clinical Center of Excellence
and
Professor of Medicine
Mt. Sinai School of Medicine

World Trade Center Attack – Never Forget

September 11th 2001 attack:

- Roughly 30,000 people successfully evacuated
- Over 3,000 people murdered that day
- First responders lost their lives that day
  - 343 Fire Department of the City of New York (FDNY) firefighters and emergency medical service providers (EMS) died that day
  - 60 law enforcement member died that day
- Massive dust cloud followed by fires that burned for months
- Tens of thousands of responders (rescue/recovery/cleanup) exposed to dust, fires, and other hazardous conditions
- To date, more FDNY WTC-exposed members (>350) have died from WTC-related diseases (Cancers & Pulmonary) than on 9/11
- As terrible as that is, later in this presentation I will show you that many more are alive today because of the WTC Health Program

What happened after the Towers collapsed

The collapse of the Towers created a massive dust cloud
- Blackout conditions

Nearest air quality monitoring station destroyed on 9/11

Personal level monitoring not available

Fires burned through December 2001

Rescue/Recovery work continued for almost a year

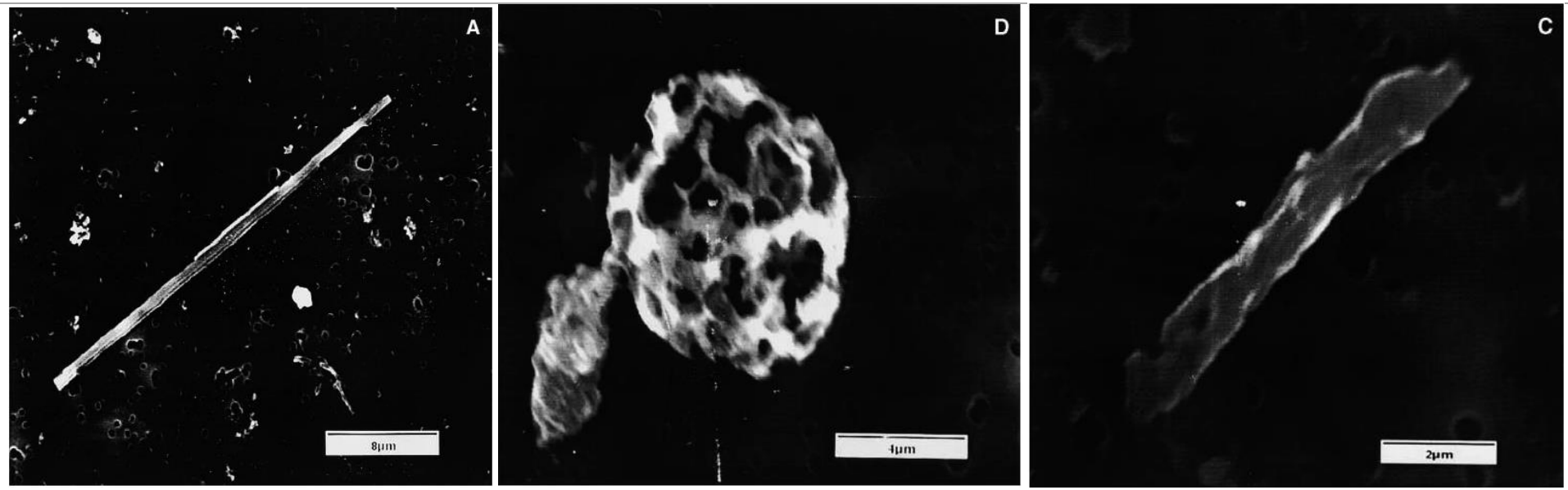
The Exposed:
- ~15,000 FDNY rescue/recovery workers
- ~70,000 Other Responders (rescue/recovery/cleanup)
- >100,000 area workers, residents, commuters, students

Estimated that 100,000 to 300,000 people (responders, workers, residents, commuters & students) were exposed to WTC Dust

Dust covered responders & survivors (area workers, residents, commuters & students). It coated buildings, seeped into ventilation systems. It consisted of:

- Aerosolized particles, gases, vapors
- Combustion byproducts
- Silicates,
- Freon,
- PCBs, PVCs
- Polyaromatic hydrocarbons
- Asbestos, Lead, Antimony
- Pulverized concrete

A Responder's Lung Lavage: Exposure was Real. Particles did reach lower airways & alveoli



(*A*) Amosite asbestos fiber (uncoated)

(B) Fly ash particle

(*C*) Degraded fibrous glass.

Large particles penetrated deep into the lung

Am J Respir Crit Care Med. 2002 Sep 15;166(6):797-800.

Legislation

- **James Zadroga 9/11 Health and Compensation Act of 2010**
  - Informally called "the Zadroga Act"
- Amends Public Health Service Act
- Extends and improves protections and services to individuals directly impacted by the terrorist attacks on 9/11/01
- Reauthorized: 12/18/15 for 75 years (until 2090)
- Administered by the Director of the National Institute for Occupational Safety and Health (NIOSH), which is part of the Centers for Disease Control and Prevention (CDC) under the U.S. Department of Health and Human Services (HHS)

Clinical Centers of Excellence (CCEs) & Nationwide Provider Network (NPN)

Responder Clinics

- FDNY – Fire Department of the City of New York – Brooklyn (HQ)
- ISMMS/MSSM – Icahn School of Medicine at Mount Sinai - Selikoff Centers for Occupational Health – Manhattan, Suffern (Rockland County) and Staten Island, NY
- SUNY - State University of New York – Stony Brook Medical Center -Commack and Mineola, LI
- Northwell – Northwell Health (used to be LIJMC) – Queens, NY
- Rutgers – Environmental and Occupational Health Sciences Institute at Rutgers University (UMDNJ) – Piscataway, NJ
- NYU – New York University School of Medicine – Manhattan, NY

Survivor Clinics

- H+H – NYC Health + Hospitals System: Bellevue, Gouverneur & Elmhurst - NYC
- William Street – OptumServe (used to be LHI) – Manhattan

Nationwide Provider Network (NPN)

- MCA-Sedgwick – Managed Care Advisors-Sedgwick, Washington, DC

CCE/NPN Services

- CCEs provide on-site treatment and monitoring services for members such as:
  - Initial Health Evaluation
  - Annual Monitoring Exam
  - Cancer Screening
  - Certification Requests
  - Case Management and Care Coordination
  - Treatment of WTC-related and medically-associated conditions
  - Pharmacy Benefits
  - Social Benefits Counseling
  - Member Services
- NPN oversees these functions for members who are located outside of the NY/NJ area, throughout the US, and also does provider network management and claims adjudication for NPN members
- **Responders**: receive an initial health evaluation and annual monitoring exams, receive treatment for all certified conditions
- **Survivors**: receive one initial health evaluation and treatment for all certified conditions, and receive annual monitoring exam once certified

WTC Health Program “Annual” Medical Monitoring:

- Computerized Questionnaires
  - Exposure, Physical and
  - Mental Health /Stress
- Physician Evaluation
- PFT – Spirometry for all
  - Full PFT & Methacholine Challenge for selected groups
- Chest Radiographs for everyone
  - Chest CT for selected groups
- Bloods/Urine Bio-Monitoring
- ECG & Audiometry for selected groups
- Cancer Screening c/w USPSTF

WTC Health Program Cancer Screening:

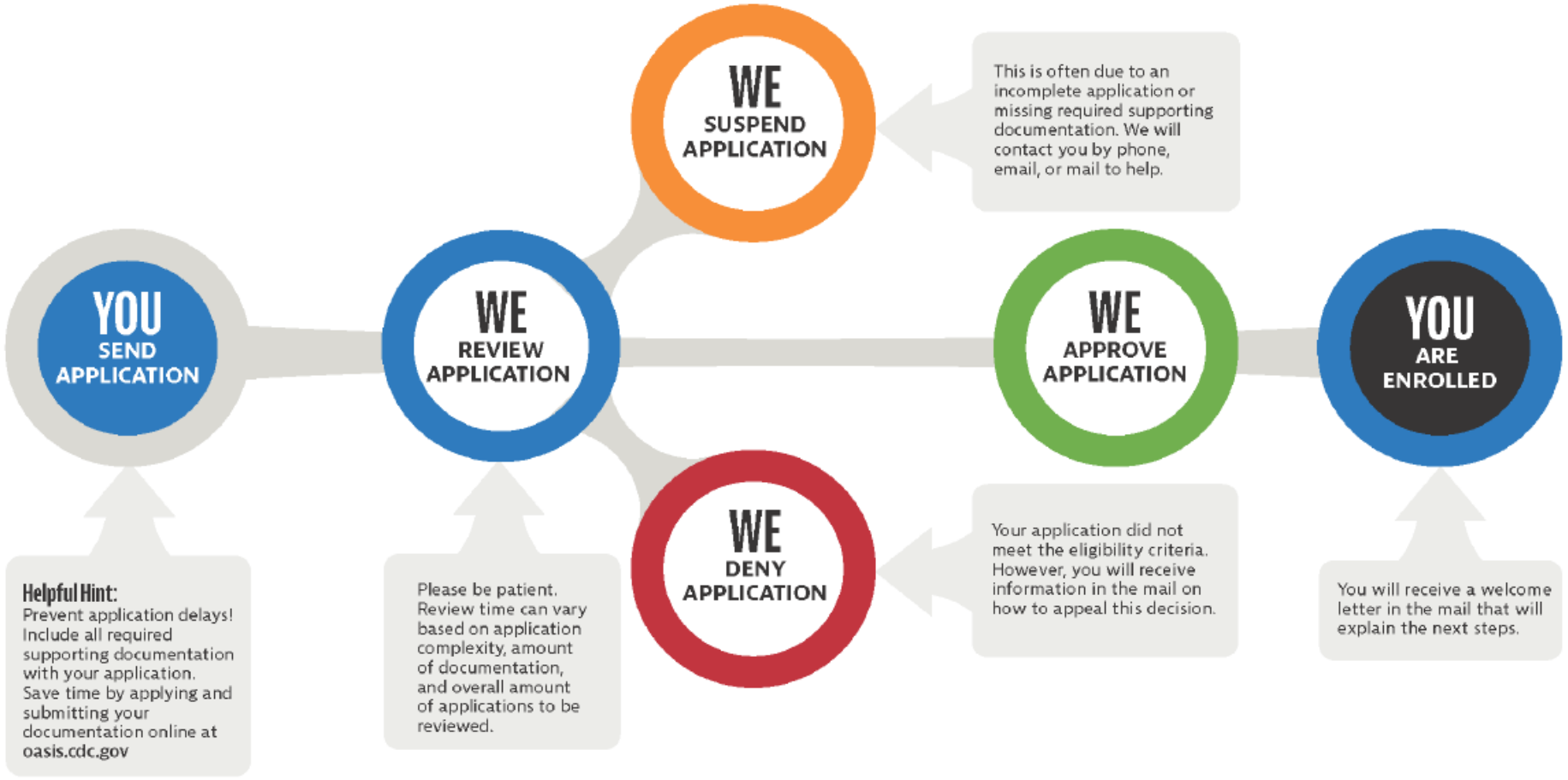
- **Cancer Screening:**
  - Annual monitoring bloods already screen for hematologic cancers
- Other tests align with USPSTF which requires proven mortality benefit

  WTC Covered:
  - Mammography
  - Colon – (Colonoscopy, Sigmoidoscopy, Cologuard)
  - Low Dose Chest CT Imaging
    - Age 50+, with 20+pk yr smoking history
    - Or Severe Lung Disease

  Not WTC Covered but if +, workup covered
  - Body imaging (Abdomen/Pelvis)
  - Dermatology Body Screen
  - Prostate Specific Antigen (PSA blood test)
  - Monoclonal Gammopathy of Undetermined Significance (MGUS blood test) – precursor for Multiple Myeloma

WTC HEALTH PROGRAM

You applied to the WTC Health Program.
What happens next?



Still have questions? Call us at 888-982-4748.

We are available Monday through Friday from 9am to 5pm Eastern Time.

Monitoring and Treatment
9.11
WTC Health Program

Certification Process: Simplified

Treatment fully covered at no cost to the enrollee, but need certification that the illness is on the WTC List of Covered Conditions

Types of Covered Conditions

- Aerodigestive
  - Obstructive Airway Disease (OAD)
  - Upper Respiratory Disease (URD)
  - Interstitial Lung Diseases (ILD)
  - Co-occurring GERD
  - Isolated GERD
  - Obstructive Sleep Apnea (OSA)
- Acute Traumatic Injuries (ATI)
- Musculoskeletal Disorders (MSD)
- Cancer
- Mental Health

The WTC Health Program's full "List of Covered Conditions" can be found on the Program's public website:

https://www.cdc.gov/wtc/conditions.html

Case Management is a Critical Part of The WTC Health Program

- A collaborative process that assesses, plans, implements, coordinates, and evaluates members' care and services
- A means to optimize member well-being by promoting quality and cost-effective interventions and outcomes
- Case managers help our members manage and better understand their care

Case Management Care Team

- Member, family member, caregiver
- CCE/NPN team (e.g., registered nurse, social worker, physician, nurse practitioner, pharmacist, other clinical/non-clinical support)

World Trade Center Health Program

Why is Research Important?

David Prezant, MD
Chief Medical Officer, Fire Dept. of the City of New York (FDNY)
Special Advisor to the Fire Commissioner on Health Policy
Director FDNY's WTC Health Programs: Clinical Center of Excellence & it's Data Center
and
Professor of Medicine, Epidemiology & Population Health
Albert Einstein College of Medicine, Pulmonary Division

WTC Health Program: Research

Research Mission

- To investigate health impacts (and disability) arising from the 9/11 attacks and to optimize WTC responder and survivor care

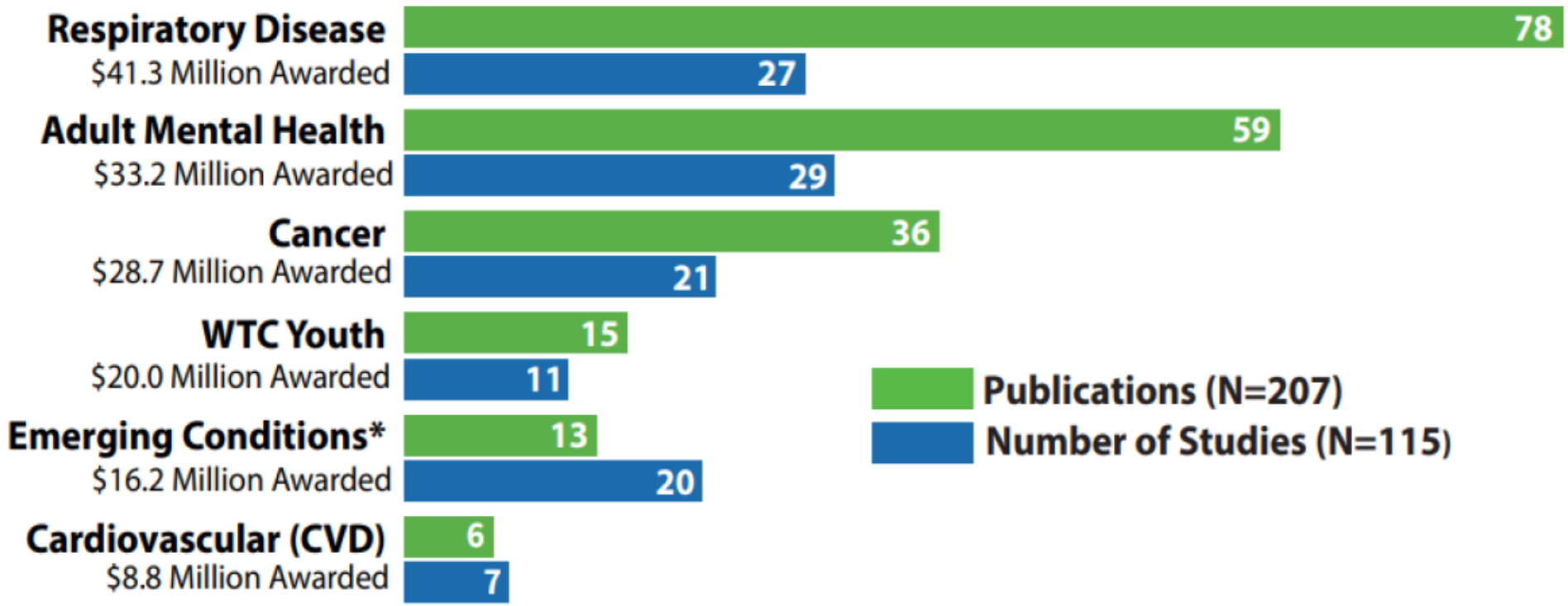
Research Funding:

- Provided through grants and cooperative agreements
- Managed by the WTC Health Program in collaboration with the NIOSH Office of Extramural Programs through a National Institutes of Health framework for competitive awards

WORLD TRADE CENTER HEALTH PROGRAM

Research Studies and Publications by Primary Focus Area

As of 8/2022



*Emerging conditions: autoimmune disease, assessment of bias in wtc studies, cognitive function, neuropathic symptoms, kidney disease, general responder mortality, wtc exposure assessment-global dna methylation, trace elements in autopsy tissues from wtc decedents, development of a comparison wtc occupational cohort, and hepatitis c.

As of August 2022
WTC Health Program

Regulations: Petitions to Add Conditions

- Petitions can be submitted to add a condition to the List of WTC-Related Health Conditions
- Who can submit a petition:
  - Member of the Program or general public
  - Clinical Centers of Excellence (CCEs)/Nationwide Provider Network (NPN)
  - Interested Party: congressional personnel, group of healthcare providers, etc.
- Petitions must include reasons for adding the condition(s), including the medical basis for the association between the 9/11 terrorist attacks and the condition(s) to be added:
  - Scientific, peer-reviewed articles
  - Case series - group or series of case reports involving 9/11-exposed patients

Regulations: WTC Health Program Petition History

As of April 2023:

- Over 250 submissions over the life of the WTC Health Program
- 24 valid petitions were reviewed and decisions were published to the Federal Register
- Examples of conditions added as a result of the petition process
  - Many Types of Cancer
  - Prostate Cancer
  - Uterine Cancer*
- Examples added via CCEs/DCs letter to Administrator – prior to "formal" petition process
  -- Acute Traumatic Injury
  -- Chronic Obstructive Pulmonary Diseases (COPD, Emphysema)

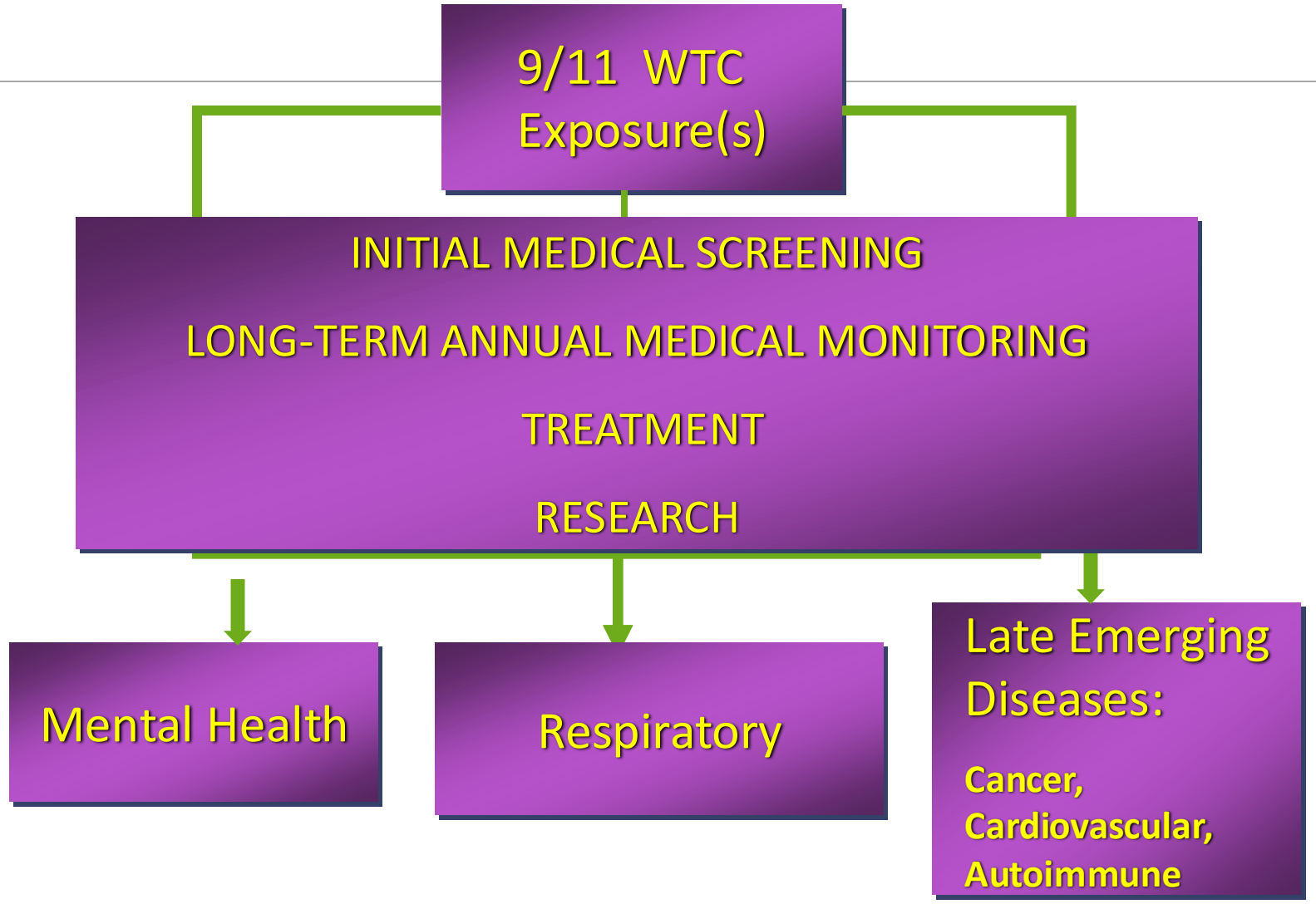
Regulations: WTC Health Program Petition History

Petitions submitted that NIOSH determined to be valid for review

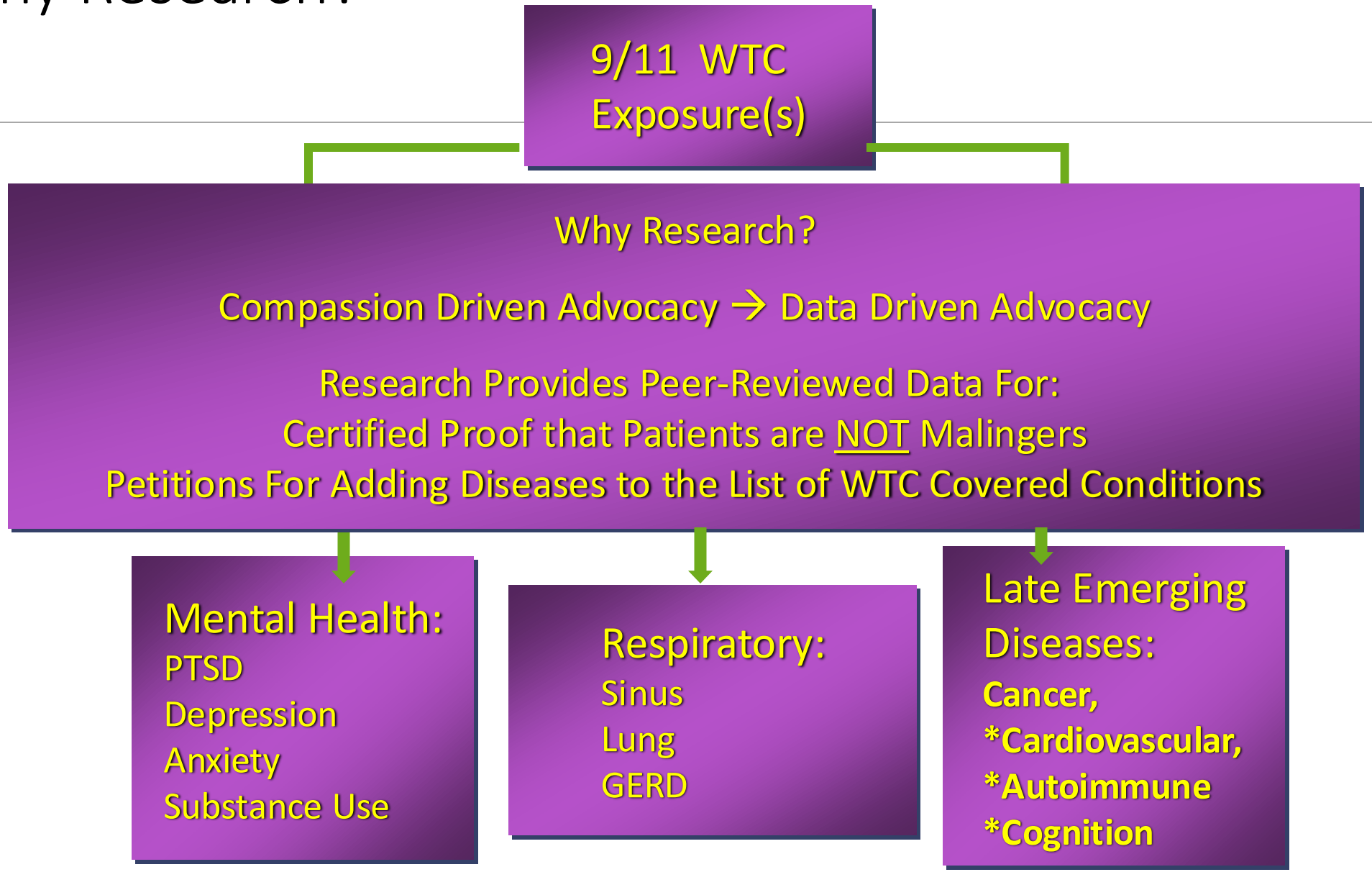
Decision still pending years later

- Autoimmune diseases with systemic rheumatologic involvement
- Cadiovascular diseases (atherosclerosis, HTN, ischemia, strokes, - not valve conditions)
- Neurologic Conditions – cognitive deficiencies, peripheral neuropathy

WTC Health Program's Health Surveillance Research



Why Research?



FDNY Leveraged its Strengths to Build the WTC Health Program for FDNY and for all the Exposed

FDNY had the:

- Extreme WTC exposure(s)
- Only group with pre-9/11 health data including:
  PFTs, Chest X-rays, Labs, Audiometry since 1996 thanks to the FDNY BHS / IAFF annual monitoring exam
- The first group to have a WTC medical monitoring exam beginning in October 2001
  - ~10,000 members screened within the first 6 months
  - Included blood banked for future biomarker research
- An organized, culturally integrated, population that would continue to participate in annual monitoring with minimal longitudinal dropout
- Labor, Management and Political Support

September 2022: One-year post-9/11

The New England Journal of Medicine Sept 2002

COUGH AND BRONCHIAL RESPONSIVENESS IN FIREFIGHTERS AT THE WORLD TRADE CENTER SITE

DAVID J. PREZANT, M.D., MICHAEL WEIDEN, M.D., GISELA I. BANAUCH, M.D., GEORGEANN MCGUINNESS, M.D., WILLIAM N. ROM, M.D., M.P.H., THOMAS K. ALDRICH, M.D., AND KERRY J. KELLY, M.D.

WTC Cough Syndrome:
- Cough,
- Shortness of Breath
- Air Hunger
- Intermittent Wheeze
- Sinusitis
- Acid Reflux
- Decreased Lung Function:
  - Decreased FEV1 & FVC
  - Preserved ratio & DLCO

THE September 11, 2001, terrorist attack that resulted in the collapse of New York City's World Trade Center led to an intense, short-term exposure to inorganic dust, products of pyrolysis, and other respirable materials. The Fire Department of New York City (FDNY) operated a continuous rescue and recovery effort at the site involving approximately 11,000 firefighters, who were exposed to such respiratory irritants,[1] which have been implicated in the development of airflow obstruction.[2,3] We identified conditions associated with airway obstruction — namely, severe, persistent cough ("World Trade Center cough") and airway reactivity — in exposed firefighters by assessing a case series of 332 firefighters with World Trade Center cough who required extensive medical leave as well as other firefighters who had been exposed but who did not re-

Long-term Lung Function

The NEW ENGLAND JOURNAL of MEDICINE

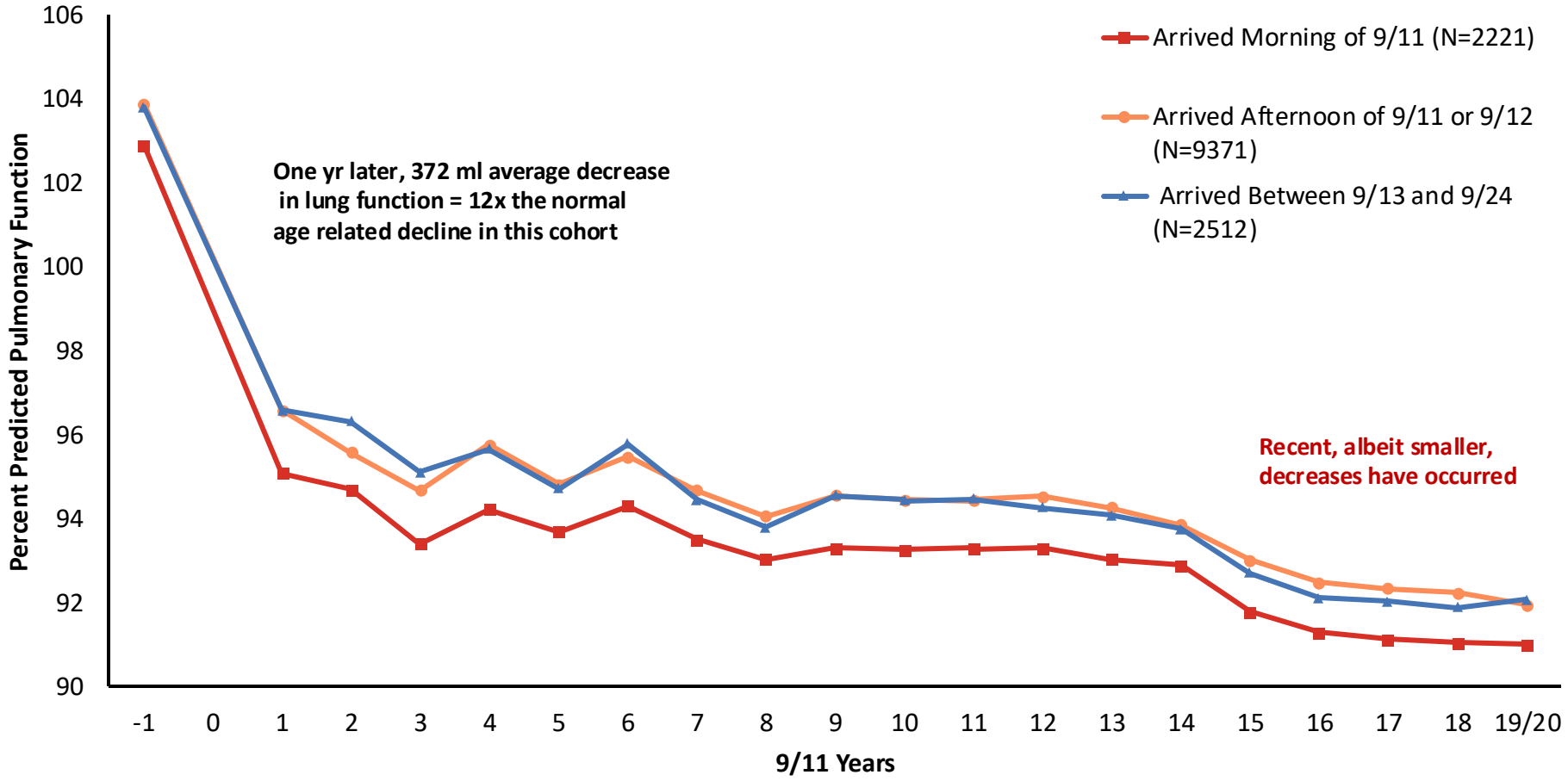
ESTABLISHED IN 1812 APRIL 8, 2010 VOL. 362 NO. 14

Lung Function in Rescue Workers at the World Trade Center after 7 Years

Thomas K. Aldrich, M.D., Jackson Gustave, M.P.H., Charles B. Hall, Ph.D., Hillel W. Cohen, Dr.P.H., Mayris P. Webber, Dr.P.H., Rachel Zeig-Owens, M.P.H., Kaitlyn Cosenza, B.A., Vasilios Christodoulou, B.A., Lara Glass, M.P.H., Fairouz Al-Othman, M.D., Michael D. Weiden, M.D., Kerry J. Kelly, M.D., and David J. Prezant, M.D.

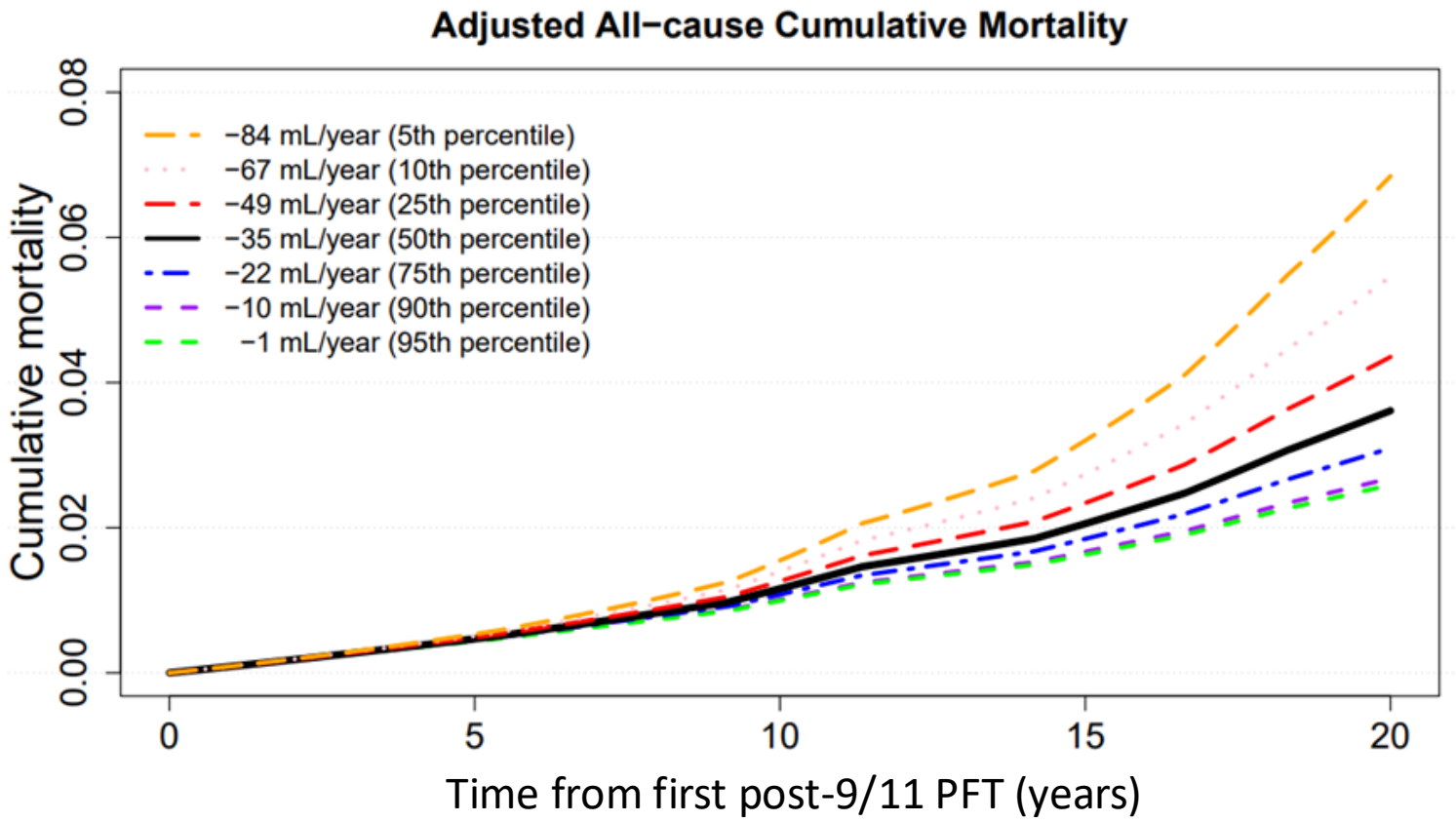
Aim: To assess longer-term lung function.
Question: Did the initial decline in lung function persist, recover, or worsen?
Answer: On average, persistence without improvement or worsening, but there are exceptions and possibly some recent declines

Pulmonary Function over Time in WTC-Exposed FDNY Responders (Fire & EMS)



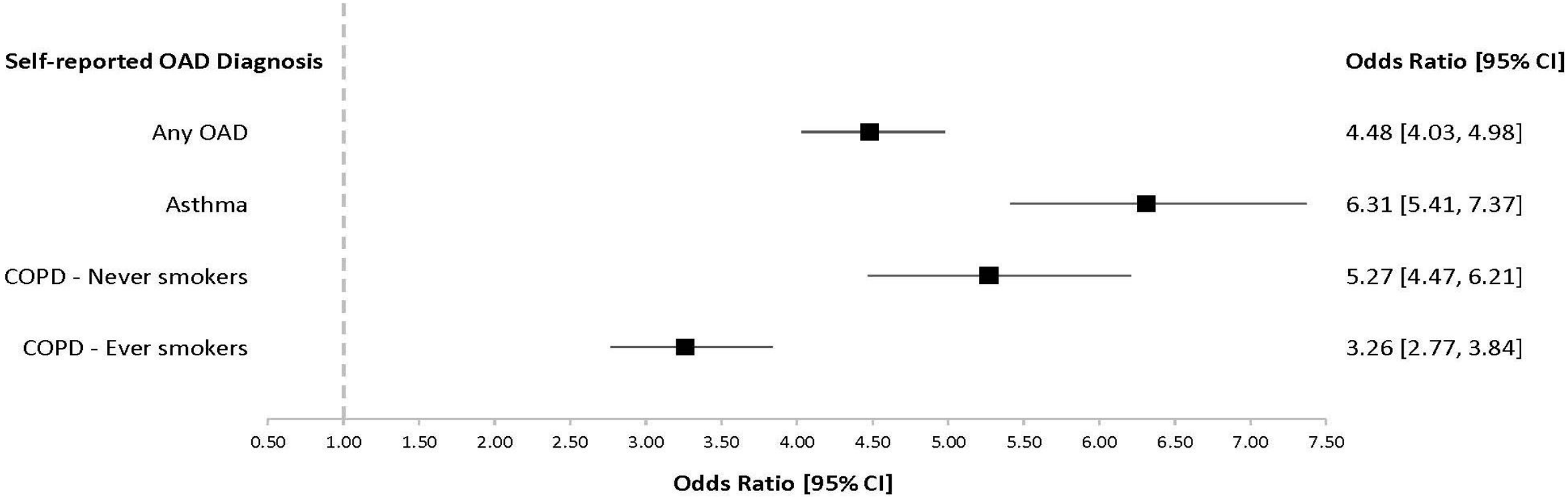
1st Post-9/11 Pulmonary Function & Mortality

- Having a lower FEV_1 right after 9/11 was associated with risk of death over next 20 years



Increased Risk for Death

Self-reported obstructive airways disease (OAD) rates in Firefighters: WTC vs. Non-WTC



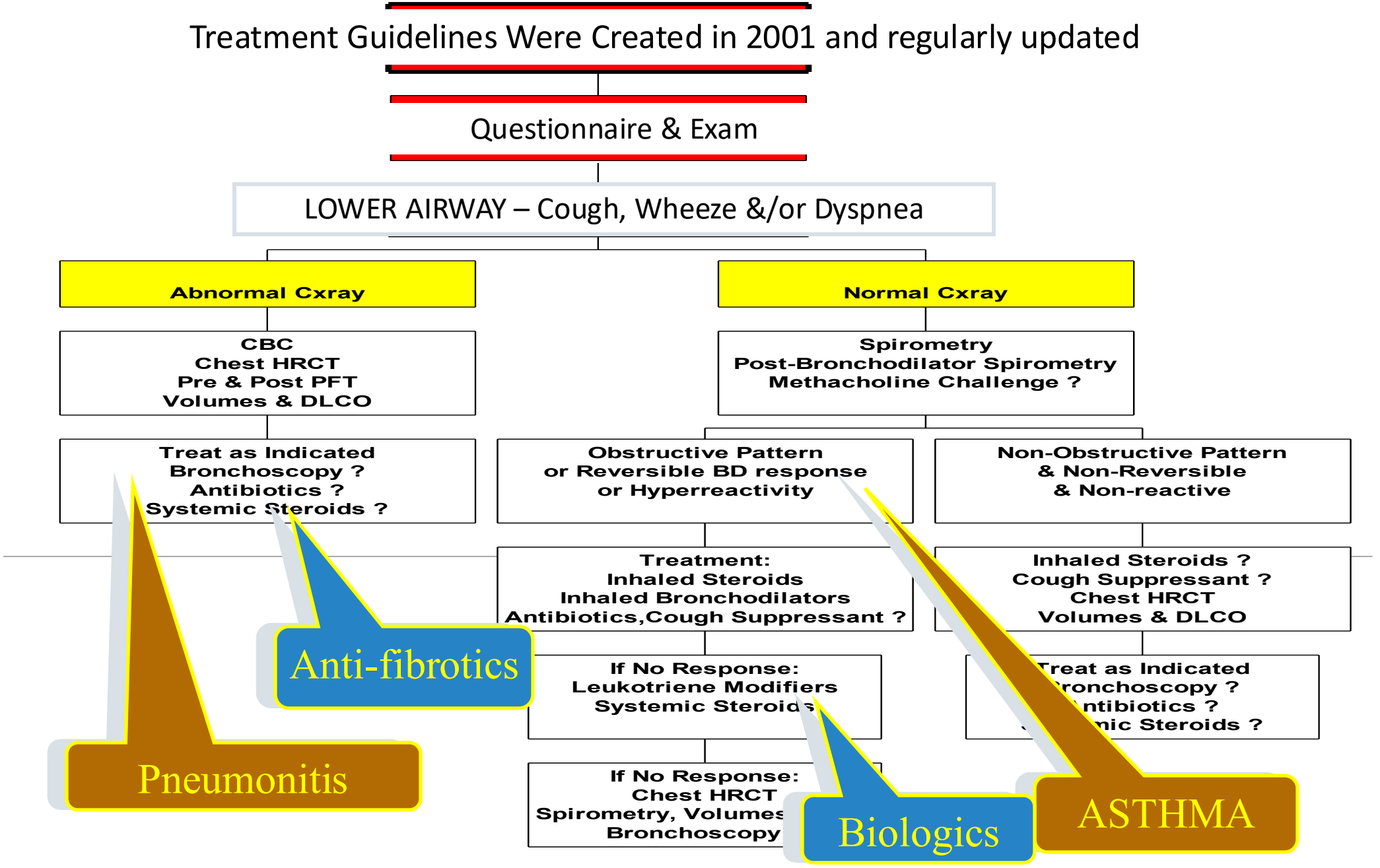
[1]Controlling for age, race, smoking status, and having a last medical visit within 2 years

[2]WTC-exposed firefighters from the New York City fire department

[3]Non-WTC-exposed firefighters from Chicago, Philadelphia, and San Francisco fire departments

Abbreviations: OAD: Obstructive airway disease; WTC: World Trade Center; COPD: Chronic obstructive pulmonary disease; 95% CI: 95% confidence interval

Treatment Guidelines Were Created in 2001 and regularly updated



Self-reported **Cardiovascular Disease** (CAD) rates in Firefighters (FF): WTC vs. Non-WTC

Estimated odds ratios (95% CI) for self-reported CVD diagnoses by exposure status

	Stroke/CAD[1]	Stroke[2]	CAD[3]
WTC-exposed FF	1.23 (1.06, 1.43)	1.03 (0.79, 1.35)	1.25 (1.06, 1.47)
Non-exposed FF	ref	ref	ref

Estimated odds ratios (95% CI) for self-reported CVD diagnoses by exposure level

	Stroke/CAD[1]	Stroke[2]	CAD[3]
High exposure	1.45 (1.18, 1.79)	1.18 (0.80, 1.75)	1.48 (1.18, 1.86)
Moderate exposure	1.31 (1.11, 1.54)	1.07 (0.79, 1.44)	1.32 (1.10, 1.57)
Low exposure	1.00 (0.83, 1.21)	0.90 (0.64, 1.27)	1.03 (0.84, 1.26)
Non-exposed	ref	ref	ref
P for trend	P<0.0001	P=0.33	P<0.0001

[1]Includes any report of stroke or CAD
[2]Includes diagnoses of stroke/CVA or TIA
[3]Inclused diagnoses of CAD, MI, or angina

Age, race, and BMI were included in the model (complete case analysis, n=12,516)

Autoimmune Disease: Sarcoidosis is a Covered Condition
Petition pending to add other autoimmune diseases

Age-specific incidence rates per 100,000 in FDNY WTC-exposed males	
Age Group	**Rate**
18 to 29 years	0.0
30 to 39 years	58.2
40 to 49 years	51.7
50 to 59 years	25.5
60 to 69 years	6.1
70 to 79 years	0.0
80 to 110 years	0.0
Age-adjusted rate[a]	25.4 (19.4 - 47.7)

[a] Rates adjusted to the 2010 US adult male population

25.4 is 2.5 times higher than this study's comparison population (Rochester Epidemiology Project), which had an age-adjusted incidence rate of 10.2

Respir Med. 2017 Nov;132:232-237

Lancet 9/3/2011

Early assessment of cancer outcomes in New York City firefighters after the 9/11 attacks: an observational cohort study

Rachel Zeig-Owens, Mayris P Webber, Charles B Hall, Theresa Schwartz, Nadia Jaber, Jessica Weakley, Thomas E Rohan, Hillel W Cohen, Olga Derman, Thomas K Aldrich, Kerry Kelly, David J Prezant

- In 2011 FDNY published the first cancer study among WTC exposed
  - Cohort of 8,927 WTC-exposed firefighters; Study period 1996 through 2008
- Similar findings from the General Responder Cohort & the WTC Health Registry
- Findings include:
  - Risk of all cancers among WTC-exposed male firefighters and General Responders (10-20%) Greater than US male population
    - Higher Risk for several cancers especially thyroid & prostate cancers
    - Lower Risk for lung cancer
      - Likely related to lower smoking rates than found in US male population
    - Nearly all cancers, including Lung Cancer, have been added as WTC-Covered Conditions

WTC & Career Firefighter Health Study Cancer Incidence

Standardized Incidence Ratios (SIRs) of cancers in male WTC-exposed and non-WTC-exposed firefighters vs. US males						
	WTC-exposed FDNY			**Non-WTC-exposed (SFFD + CFD + PFD)**		
Site	Observed case count	SIR	95% CI	Observed case count	SIR	95% CI
All cancer sites[ab]	915	1.15	(1.08-1.23)	1,002	1.05	(0.98-1.12)
Prostate	332	1.70	(1.53-1.88)	358	1.22	(1.11-1.35)
Lung	44	0.53 ⇩	(0.39-0.72)	83	0.71	(0.57-0.89)
Kidney	39	0.93 ⇩	(0.67-1.28)	55	1.19	(0.90-1.56)
Non-Hodgkin Lymphoma	55	1.39	(1.06-1.83)	43	1.04	(0.77-1.41)
Melanoma (skin)	96	1.59	(1.30-1.96)	70	1.39	(1.07-1.79)
Thyroid	46	2.37	(1.78-3.17)	15	1.01	(0.61-1.67)

[a]All malignant cancers (multiple primaries), and in situ bladder cancers;
[b]Excludes non-melanoma skin cancers

WTC & Career Firefighter Health Study Cancer Results

WTC vs. Non-WTC Fireifghter Incidence Rates

- We compared incidence rates in FDNY WTC-exposed male firefighters to incidence rates to the non-WTC-exposed male firefighters (CFD, PFD, SFFD)

		FDNY WTC-exposed vs CFD, PFD & SFFD non-exposed
		Webber et al, 2021 *Data through 2016*
RR (95% CI)	All cancer	1.13 (1.02-1.25)
	Thyroid	2.53 (1.37-4.70)
	Prostate	1.39 (1.19-1.63)
	Lung	0.87 (0.57-1.33) ⇩
	Skin Melanoma	1.12 (0.80-1.57)

- *WTC-exposed male firefighters had significantly <u>higher</u> rates of cancers especially thyroid and prostate compared to Non-WTC male Firefighters*

Ref: Webber et al OEM 2021

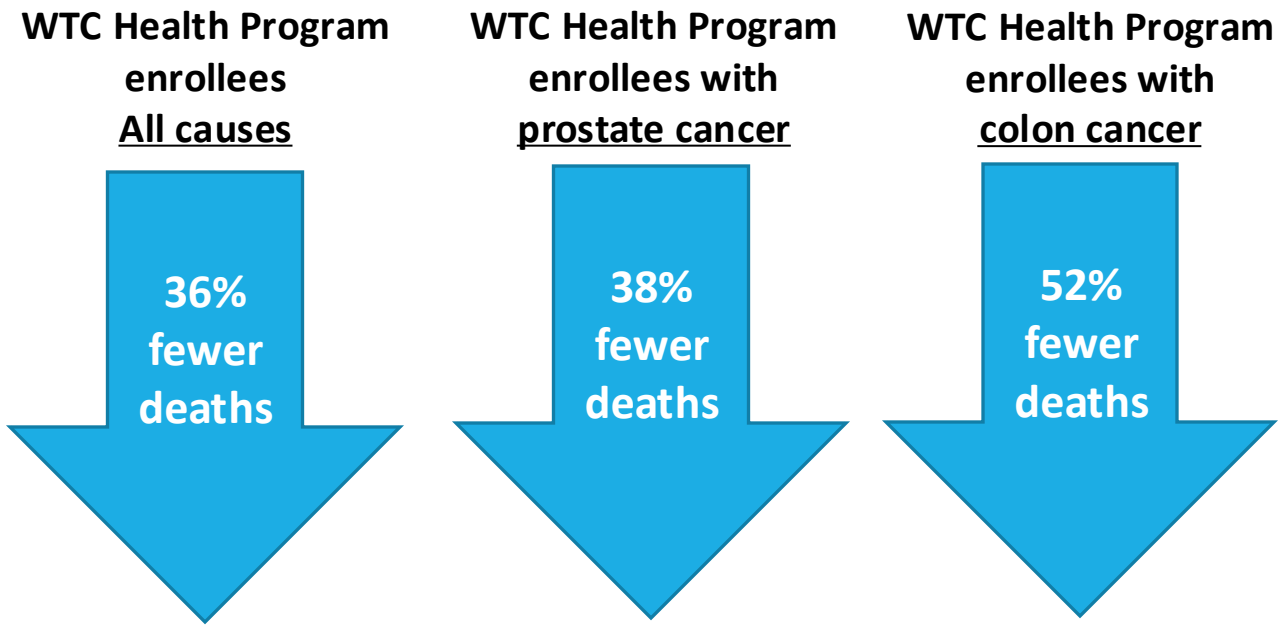
WTC Responder Combined Cohort

- Collaboration between FDNY, General Responder Cohort WTC Health Program & WTC Health Registry
- Joint Labor-Management-Government (NIOSH) Initiative
- NYS DOH Combined and de-duplicated the 3 responder cohorts
- Total of **69,134** WTC-exposed rescue/recovery responders
- Uses previously described combined WTC exposure definitions
- Uses the same reference population as comparison

<u>Primary research questions:</u>

- To compare overall cancer incidence, and incidence of specific cancer sites, in WTC rescue/recovery workers to that of the general US population
- To study mortality rates in WTC rescue/recovery workers with cancer

WTC Health Program Responder Cancer Survival vs. New York State Patients with same diagnosis



Lower All-cause Mortality Risk in WTC Health Program Responders (FDNY & GRC) compared to NYS population with same cancer

All-cause Mortality by cancer site	WTC MMTP vs. NYS non-responders
	HR (95%CI)
Prostate	0.62 (0.44, 0.88)
Lung and bronchus	0.74 (0.56, 0.97)
Esophagus	0.65 (0.36, 1.18)
Colon and rectum	0.48 (0.31, 0.74)
Myeloma	0.49 (0.22, 1.10)
Pancreas	1.66 (1.15, 2.39)
Brain and other nervous system	1.11 (0.70, 1.76)
Liver	0.74 (0.44, 1.22)
Melanoma of the skin	0.54 (0.27, 1.08)
Kidney and renal pelvis	0.36 (0.16, 0.79)

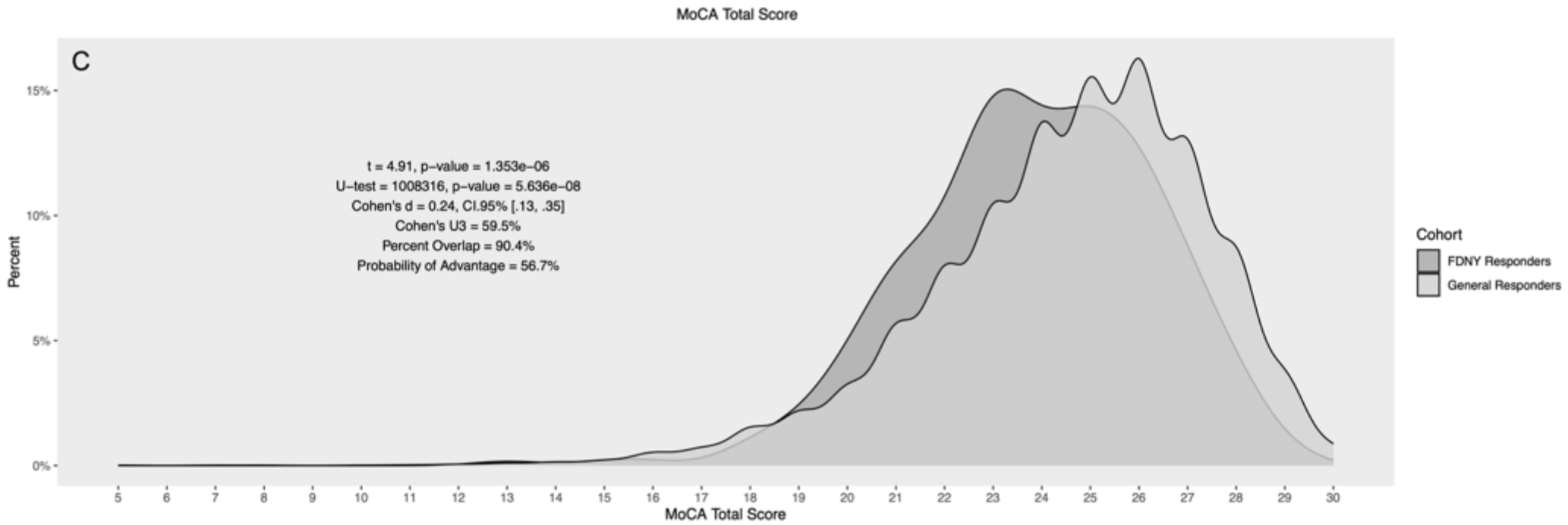
Survival Benefit	WTC MMTP n=2,037 (%)	NYS non-responders n=574,075 (%)
Deaths n (%)	303 (14.9)	224,040 (39.0)
Cancer deaths n (%)	248 (12.2)	158,645 (27.6)
Survival rate n (%)		
1-year survival	1,916 (94.1)	474,895 (82.7)
3-year survival	1,346 (88.3)	326,959 (69.6)
5-year survival	**919 (86%)**	**228,933 (63%)**

Follow-up time starts at diagnosis date, males only, adjusted for age and date of diagnosis

Lower Mortality Rates: Multiple Reasons Why

- Cancer Screening
  - Colon, Lung, Breast,
  - Prostate (?)
  - Other Organs ???
  - Healthy Worker Effects
  - Diet & Exercise
  - Tobacco Prevention & Cessation:
- Early Diagnosis
- Early Treatment
- No cost, No stress
- Case Management
- Family Assistance Units

MOCA Cognition Scores: FDNY & General Responders



Notes. Level of cognitive impairment was measured using MoCA total scores, and MCI was determined using standard and conservative criteria. "0%" indicates less than 0.50%. To help ease interpretation of the statistics reported in panel C, the standardized mean difference between cohorts is 0.24, approximately 59.5% of responders from the general responder cohort have MoCA total scores above the mean of FDNY responders, 90.4% of scores from the two cohorts overlap, and there is a 56.7% chance that a WTC responder picked at random from the GRC will have better cognitive performance on the MoCA than a WTC responder picked at random from the FDNY cohort.

Lower the score., the greater the cognitive impairment; 5% FDNY met criteria for severe impairment

Lessons Learned:

- Pre-Disaster Pre-Exposure Health Baselines including pulmonary functions, Chest Imaging and Labs are critical for responders:
- Workers with pre-existing cardiopulmonary or mental health conditions may not be suitable for certain types of disaster work
- Personal Protective Equipment is essential.
  Its Use must be mandatory. Which requires:
  - Better PPE designs are needed
  - Better training
  - Better Supervision
- Fully integrate Monitoring, Treatment and Research using a Multidisciplinary Approach
- Nothing is possible without broad support - > identified on next slide

NIOSH Health Programs for Responders:

World Trade Center Health Program

Emergency Preparedness & Response Program

Firefighter Fatality Investigation and Prevention Program

National Firefighter Registry for Cancer

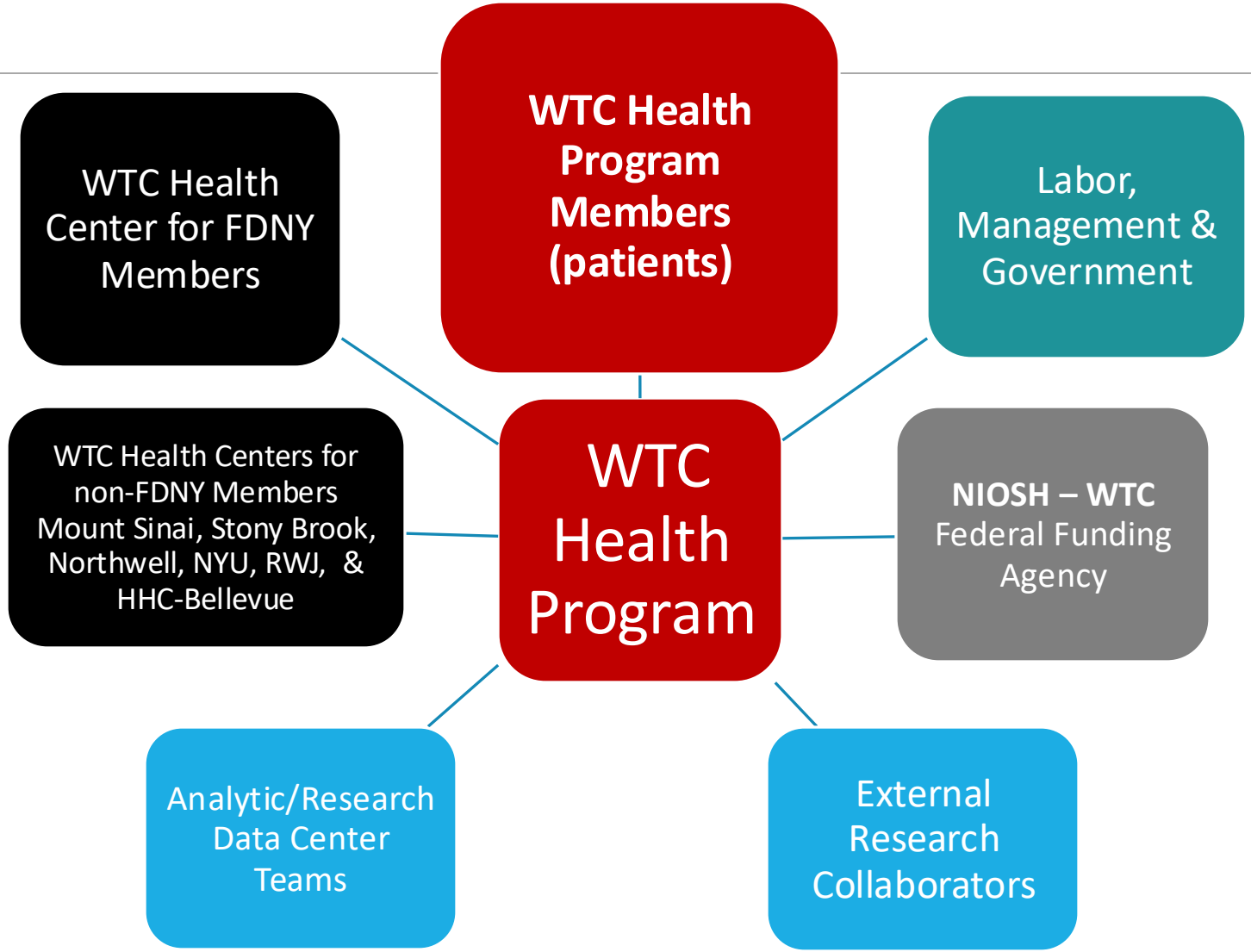
National Personal Protective Technology Laboratory (NPPTL)

Respirator Certification Program

Health Hazard Evaluation Program

Nothing is possible without broad support - > identified on next slide

Nothing is Possible Without Broad Support
Enlist & Maintain Support From Stakeholders




THANK YOU