

Association between WTC exposure and excess cancer risk

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Learning Objectives

After completion, attendees will be able to:

- Enumerate some WTC carcinogenic exposures
- Describe exposure-cancer associations obtained with internal & external references
- Interpret findings for 3 cancer types: prostate, thyroid, & multiple myeloma
- Compare and interpret Registry findings with other WTC cancer reports

Brief History of WTCHR

Largest U.S. effort to monitor health after a disaster

- **2002: Launched as an exposure registry**
 - Funding from FEMA, ATSDR cooperative agreement
 - Input from scientific, community & labor advisors
- **2003-04: Wave 1 Survey**
 - 30-minute telephone interview by RTI on health & exposures
 - 71,434 enrolled, including >3,000 children
- **2006-08: Wave 2 Survey**
 - Emerging conditions (e.g., sarcoidosis), unmet healthcare needs
 - 46,322 adults participated (68.1% response rate)
 - 1,022 parent proxies responded (50.1% response rate)
- **2011-12: Wave 3 Survey**
 - Emerging conditions (e.g., sleep apnea, and multiple sclerosis)
 - 43,134 adults participated (63% response rate)

Background

- WTC towers collapse produced known & suspected carcinogens: PAH, benzene, PCBs, asbestos, dioxins, silica
- Few published WTC cancer studies
 - Myeloma case-series report (Moline 2009)
 - FDNY cancer study (Zeig-Owens 2011)
 - Cancer mortality among survivors (Jordan 2011)
 - Cancer incidence among RR workers (Solan 2013)
- Challenges in linking WTC exposure to cancer outcomes
 - Actual dosages to individuals are not known
 - Latency period for most cancers is long

Research Questions

- Is there evidence of an excess incidence of cancer among enrollees?
- Are there cancers associated with WTC exposures?
- Is there a dose-dependent relationship between WTC exposures and cancer incidence?

Methods

■ Study Population

- NYS residents on 9/11 at risk for 1st primary cancer
- Rescue/recovery workers (RR Workers) and participants not involved in rescue/recovery (Non-RR participants) (analyzed separately)

■ Cancer cases

- 1st primary cancer (reportable) after enrollment
- Identified via linkage to NYSCR (majority) & 10 others through 12/31/2008
- All sites combined and 23 sites

Analysis 1

External Comparison - SIR

- Comparison to external population
 - Apply the cancer incidence rate of the reference (**NYS**) population to our study population by strata (i.e., age, sex, race/ethnicity, and study periods)
 - Standardized Incidence Ratio (SIR): observed/expected
- TWO periods of follow-up because diagnoses >5 years after 9/11 more likely related to 9/11 exposure
 - **Early**: Enrollment in Registry through 2006
 - **Later**: 2007 through 2008

Analysis 2

Internal comparisons

- Compares cancer incidence among those highly exposed to those less exposed, using Cox Proportional Hazards model
- WTC exposures were categorized into 3 levels
- Cancers with significant SIRs in the later period were examined
- Adjusted for personal characteristics, enrollment source, smoking, underlying medical conditions

Definition of WTC-related exposures

WTC-
related
exposure
level

Rescue and recovery exposure
among rescue/recovery workers

WTC-related residential, office, school,
or pass-through exposure among
participants not involved in rescue/
recovery

High

Workers who were in Manhattan, south of Chambers Street, between the time of the first plane impact and 1200 h on 9/11 (encompassing the collapse of WTC towers) and who worked on the WTC dust and debris pile on 9/11 or worked at the WTC site for more than 90 days, starting before Sept 18, 2001.

Participants who reported two or more injuries on 9/11; and on 9/11 (a) worked or was a passerby south of Chamber street in lower Manhattan, (b) resided in Lower Manhattan zip codes including Canal Street and south and did not evacuate their home, or (c) were present at school in Lower Manhattan zip codes including Canal Street and south.

Low

Workers who began work at the WTC site after Sept 17, 2001, did not work on the WTC debris pile, worked fewer than 30 days at the WTC site, and were not present south of Chambers Street between the first plane impact and 1200 h on 9/11.

Participants who reported no injuries on 9/11, and on 9/11 (a) worked or was a passerby below south of Chamber street, (b) resided in Lower Manhattan zip codes including Canal Street and south, and evacuated their home for any amount of time, or (c) were not present at school in Lower Manhattan zip codes including Canal Street and south.

Intermediate

All other rescue/recovery workers.

All other participants not involved in rescue/recovery.

Results

- Study population: N=55,778
 - 39% RR workers, 61% non-RR (residents, area workers, passersby, students/staff)
 - % male: 59%
 - Median age at enrollment: 42 years
- 1187 first lifetime primary cancer cases
 - Early period: 613 (34% RR workers)
 - Later period: 574 (40% RR workers)
 - None diagnosed under age 20 years

SIR Results

All cancer sites combined

	RR Worker (N=21,218)			Non-RR (N=32,740)		
	Obs.	SIR	(95% CI)	Obs.	SIR	(95% CI)
Early period (Enrollment-06)	198	0.94	(0.82-1.08)	381	0.92	(0.83-1.02)
Later period (2007-08)	223	1.14	(0.99-1.30)	324	0.92	(0.83-1.03)

Cancer sites with significant SIRs Later period (2007-08)

- Elevated SIRs among RR Workers
 - Prostate (SIR=1.4, 95%CI=1.1-1.8, n=67)
 - Multiple myeloma (SIR=2.9, 95%CI=1.2-5.9, n=7)
 - Thyroid (SIR=2.0, 95%CI=1.1-3.5, n=13);
also significantly elevated in early period
- Decreased SIR among Non-RR participants
 - Lung cancer (SIR=0.7, 95%CI=0.4-0.95, n=26)

Results

Internal comparisons

- No statistically significant association between intensity of WTC exposure and selected cancer sites:
Prostate, thyroid, non-Hodgkin's lymphoma, hematological cancers (lymphoma, myeloma, leukemia), & lung
- Non-statistically significant trend with exposure levels for hematological cancers among RR workers
 - $HR_{adj}=4.5$, 95% CI=0.5-37.4, n=9; **high exposure vs. low**
 - $HR_{adj}=3.7$, 95% CI=0.5-27.6, n=41; **intermediate vs. low**

Strengths

- Included both sexes, all ages, and survivors as well as responders
- Identified cancers through linkage with 11 state cancer registries
- Addressed latency by examining early and later periods
- Multi-level metric of WTC exposure enabled examination of dose-response relationship

Limitations

- Relatively short follow-up time and small number of cases
- Unknown family history of cancer, pre- and post-9/11 occupational/ environmental exposures other than WTC
- Unknown history of medical screenings
- Potential self-selection bias

Summary of Findings

- All cancer SIRs were not statistically significantly different from expected in either group or time period
- Later period SIRs were significantly elevated in RR workers for myeloma, prostate and thyroid cancers; none elevated in non-RR
- For RR workers, there was a non-statistically significant trend toward an increase in hematological cancers with increasing level of WTC exposure

Interpretation / Next Step

- This is an early assessment of cancer incidence among enrollees
- Biological plausibility
- Compare and interpret Registry findings with other WTC cancer reports
 - Similar findings in prostate and thyroid cancers
 - Different in study populations, reference rates, & lag time
- Longer follow-up is required to examine risk for typically long-latency cancers

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11 State Cancer Registries
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The cancer paper

<http://jama.jamanetwork.com/article.aspx?articleid=1486831>