



Association between Pulmonary Function and Recovery from Lower Respiratory Symptoms in WTC-Exposed Firefighters

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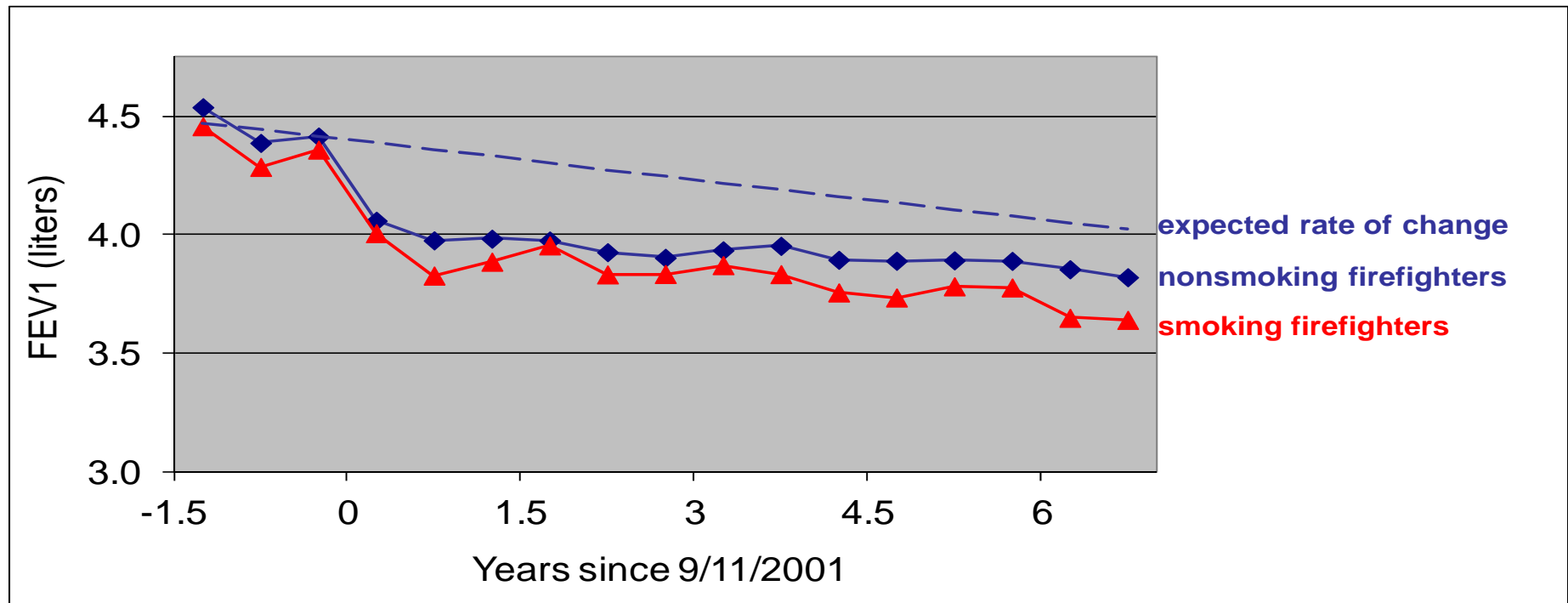
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Background

- After 9/11 FDNY firefighters experienced substantial and immediate reductions in pulmonary function (FEV1)





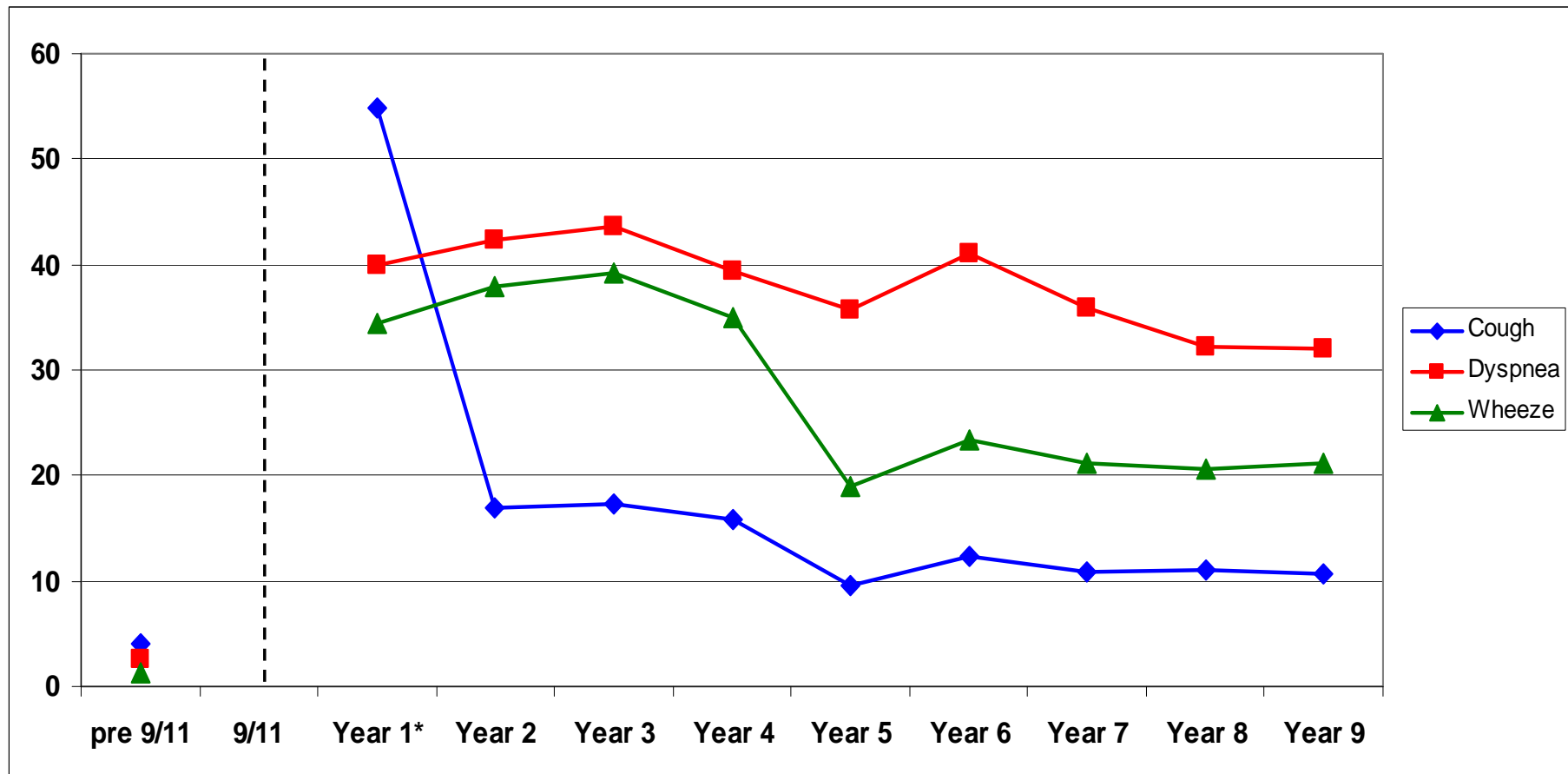
Background

- Reported increased upper and lower respiratory and gastroesophageal reflux symptoms in many WTC cohorts
 - Exposure gradient found based on earliest arrival time and work duration



Background

Prevalence of symptoms of WTC-Exposed firefighters across 9 years since 10/02/2001





Background

- Small but statistically significant associations between pulmonary function and respiratory symptoms measured at the same visit



Study Objective

To examine whether pulmonary function measured soon after WTC exposure predicts confirmed recovery from lower respiratory symptoms (LRS) over the nine year period post-9/11



Confirmed Symptom Recovery

Defined as:

The absence of all LRS on at least two consecutive surveys

AND

Symptom absence on all subsequent surveys



Confirmed Symptom Recovery

- Date of confirmed recovery defined as date of the first monitoring exam during follow-up which an individual reported no LRS
- Follow-up time for participants without confirmed recovery was stopped on the date of their last survey



Study Population

- N=4,368
- Male, Caucasian and African American WTC-exposed FDNY firefighters
- All reported at least one LRS (cough, dyspnea or wheeze) during the first year post-9/11 at monitoring exam
- All completed at least two subsequent exams, the last between post-9/11 years 7-9.



Pulmonary Function

- Measured with spirometry
 - Assess pulmonary function at every medical exam (18 mos)
- FEV1 %predicted is calculated based on age, height, gender and race/ethnicity.



Pulmonary Function

Defined in 3 ways:

- First post-9/11
 - FEV1 and %predicted FEV1
- Time-dependent “concurrent” variable
 - FEV1 and %predicted FEV1 values that were obtained same day that each symptom questionnaire was completed
- Time-dependent difference
 - Difference between individuals’ concurrent FEV1 and his first-post 9/11 FEV1



Potential Cofounders

- Smoking (ever/never)
- Arrival group (FDNY exposure measure*)
- Age on 9/11
- Concurrent weight
- Ever respiratory medication use



FDNY Exposure Measure

Time of first arrival to WTC site

- Group 1: Morning of 9/11/2001
- Group 2: Afternoon of 9/11/2001
- Group 3: Day of 9/12/2001
- Group 4: Any day between 9/13/2001 - 9/24/2001



Data Analysis

- Cox regression models
 - Analyzed pulmonary function in relation to time to confirmed recovery in both univariable and multivariable analysis



Results

- 1,592 (36%) of analytic cohort had confirmed recovery at some point during follow-up.
 - Confirmed recovery occurred a mean of 4.5 years after 9/11
- 2,776 (64%) did not recover
 - Mean follow-up time of 8.1 years after 9/11



Results

- Consistent positive associations between pulmonary function and confirmed recovery
 - Concurrent pulmonary function showed the strongest association with confirmed recovery
- WTC exposure had a significant inverse relationship with confirmed recovery
 - Those in arrival group 1 were 27% less likely to recover compared with those in arrival group 4



Pulmonary Function

- FEV1 measurements are estimated in units per 355 mL increase
 - 355 mL was found to be the average decline in FEV1 for firefighters during the 1st 6 months post-9/11
- % Predicted FEV1 are estimated for every 10% point increase



Results

- Results were consistent for all measures of pulmonary function in univariable models

Pulmonary Function Measure	Hazard Ratio	95% Confidence Limits	
First post %predicted FEV1	1.12	1.08	1.17
→ Concurrent %predicted FEV1	1.17	1.12	1.22
→ First post FEV1	1.09	1.06	1.12
→ Concurrent FEV1	1.15	1.12	1.18
Difference between first post and concurrent FEV1	1.06	1.01	1.10



Results

- Results were consistent across LRS
- Results were consistent across number of LRS (one, two or three)



Limitations

- Did not take into account a change in the number of respiratory symptoms experienced between year 1 and confirmed recovery
- Time to recovery may be inflated if individuals did not adhere to regular monitoring exams
- Could not clearly establish the role of treatment in confirmed recovery



Conclusions

- Defined confirmed LRS recovery in a WTC exposed cohort
- 64% were still symptomatic 9 years post-9/11
- Higher pulmonary function was consistently found to predict confirmed recovery
- Confirmed recovery was least likely to occur in the most exposed



Future Implications

- Spirometric measurement of pulmonary function should be considered for inclusion as a regular part of any post-exposure respiratory health assessment



Thank You!

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