

**PULMONARY FUNCTION AFTER EXPOSURE TO THE WORLD
TRADE CENTER IN THE NEW YORK CITY FIRE DEPARTMENT**

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ONLINE SUPPLEMENT

SPIROMETRY IN WTC-EXPOSED FDNY WORKERS:

When adjusted average FVC during the 5 years before 09/11/2001 was compared to adjusted average FVC during the first year after 09/11/2001 in WTC-exposed workers, a substantial loss of 405ml was observed following 09/11/2001 (95% confidence interval [95% CI] 395-415ml; $p < 0.001$). The decrement in adjusted average FVC after 09/11/2001 was equal in magnitude to 13 years of aging-related FVC decline in this cohort (longitudinally computed aging-related FVC decline rate before 09/11/2001 was 31ml/year).

FVC REDUCTION AND WTC ARRIVAL TIME:

Within arrival time-based exposure groups, means of the first FVC measurement after 09/11/2001 (in liters and percent predicted) were significantly lower than those of the last measurement before 09/11/2001 ($p < 0.001$; table A). The percentage of FDNY rescue workers with FVC measurements below the LLN increased nearly two-fold within each exposure group from before to after 09/11/2001 ($p < 0.001$; table A).

In order to explore whether WTC exposure intensity affected adjusted average FVC following 09/11/2001, we included an estimate of WTC exposure intensity based on initial arrival time at the WTC site in comparisons of adjusted average FVC during the 5 years before 09/11/2001 to adjusted average FVC during the first year after 09/11/2001. We observed substantial FVC reductions after 09/11/2001; however, the exposure intensity-response gradient between FDNY rescue workers with increasing arrival time-based WTC exposure intensities was not statistically significant ($p = 0.257$). Early arrival, high intensity exposure workers experienced an average reduction of 415ml (95% CI, 394-436ml). Intermediate intensity exposure workers experienced an average reduction

of 404ml (95% CI 394-414ml). Workers with late arrival, low intensity exposure experienced an average decrement of 394ml (95% CI 374-414ml).

FVC REDUCTION AND WORK ASSIGNMENT:

In order to further substantiate that WTC exposure resulted in adjusted average spirometric decrements following 09/11/2001, we included another estimate of WTC exposure intensity based on work assignment in other comparisons of adjusted average FVC during the 5 years before 09/11/2001 to adjusted average FVC during the first year after 09/11/2001. We again observed a substantial reduction (320ml; 95% CI 297-345ml) in all WTC-exposed FDNY rescue workers after 09/11/2001 ($p < 0.001$). In addition to this significant decrement, we found further FVC reductions for Fire (101ml for firefighters not assigned to SOC units, 99ml for SOC firefighters) compared to EMS workers (figure 3B; $p < 0.001$). We did not find significant differences between firefighters who were and who were not assigned to SOC units.

RESPIRATORY SYMPTOMS:

We compared adjusted average FVC reduction between FDNY rescue workers with increasing symptom severity in order to determine whether objective spirometric measurements correlated with clinical complaints. Each added symptom was associated with a significant additional adjusted average FVC decrease (8ml for each symptom, 95% CI 0.2-17ml; $p = 0.044$).

Table E1 – FVC Characteristics of WTC-Exposed FDNY Rescue Workers by Arrival
Time-Based WTC Exposure

Arrival Time-Based WTC Exposure	Last FVC Before 09/11/2001 (Median, Interquartile Range/Percent)			First FVC After 09/11/2001 (Median, Interquartile Range/Percent)		
	<i>Liters</i>	<i>Percent Predicted</i>	<i>Percent Below Lower Limit of Normal</i>	<i>Liters</i>	<i>Percent Predicted</i>	<i>Percent Below Lower Limit of Normal</i>
<i>Early Exposure</i> N=1,660	5.02 (4.43-5.58)	93 (85-103)	18.5	4.60* (4.07-5.15)	86* (78-95)	36.8*
<i>Intermediate Exposure</i> N=8,185	5.08 (4.52-5.68)	95 (86-104)	16.0	4.70* (4.17-5.25)	88* (80-97)	31.6*
<i>Late Exposure</i> N=1,921	4.95 [†] (4.29-5.57)	95 (86-104)	17.0 [‡]	4.56 ^{*,†} (3.95-5.18)	88 ^{*,‡} (79-97)	32.1 ^{*,†}
Total	5.03 (4.45-5.63)	95 (86-104)	16.8	4.65 (4.10-5.21)	88 (80-96)	32.7

*-p<0.001 between last measurement before and first measurement after 09/11/2001 within exposure group (paired t-test for FVC in liters or percent predicted; McNemar's test for percentage below lower limit of normal)

[†]-p<0.001 between early, intermediate and late exposure groups (ANOVA for FVC in liters or percent predicted; chi square for percentage below lower limit of normal)

[‡]-p<0.05 between early, intermediate, and late exposure groups (ANOVA for FVC in liters or percent predicted; chi square for percentage below lower limit of normal)