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The Impact of the World Trade Center Attack on FDNY Firefighter Retirement, Disabilities, and Pension Benefits

J.K. Niles,[1] M.P. Webber, PhD,[1] J. Gustave, MPH,[2] R. Zeig-Owens, MPH,[1] R. Lee,[2] L. Glass, MPH,[2] M.D. Weiden, MD,[2,3] K.J. Kelly, MD,[2] and D.J. Prezant, MD[2,4*]

Background *Our goal was to examine the effect of the World Trade Center (WTC) attack and subsequent New York City Fire Department (FDNY) rescue/recovery activities on firefighter retirements. We also analyzed the financial impact associated with the increased number and proportion of service-connected "accidental" disability retirements on the FDNY pension system.*

Methods *A total of 7,763 firefighters retired between 9/11/1994 and 9/10/2008. We compared the total number of retirements and the number and proportion of accidental disability retirements 7 years before and 7 years after the WTC attack. We categorized WTC-related accidental disability retirements by medical cause and worked with the New York City Office of the Actuary to approximate the financial impact by cause.*

Results *In the 7 years before 9/11 there were 3,261 retirements, 48% (1,571) of which were accidental disability retirements. In the 7 years after 9/11, there were 4,502 retirements, 66% (2,970) were accidental disability retirements, of which 47% (1,402) were associated with WTC-related injuries or illnesses. After 9/11, the increase in accidental disability retirements was, for the most part, due to respiratory-related illnesses. Additional increases were attributed to psychological-related illnesses and musculoskeletal injuries incurred at the WTC site. Pension benefits associated with WTC-related accidental disability retirements have produced an increased financial burden of over $826 million on the FDNY pension system.*

Conclusions *The WTC attacks affected the health of the FDNY workforce resulting in more post-9/11 retirements than expected, and a larger proportion of these retirees with accidental disability pensions.* Am. J. Ind. Med. *© 2011 Wiley-Liss, Inc.*

KEY WORDS: firefighters; retirement; disability; World Trade Center

[1]Department of Medicine, Montefiore Medical Center, Albert Einstein College of Medicine, Bronx, New York
[2]Fire Department of the City of New York, Brooklyn, New York
[3]New York University Langone Medical Center, New York, New York
[4]Division of Pulmonary Medicine, Montefiore Medical Center, Albert Einstein College of Medicine, Bronx, New York
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*Correspondence to: D.J. Prezant, MD, Fire Department of the City of New York, Office of Medical Affairs, 9 Metrotech Center, Rm 4W-1, Brooklyn, NY 11201.
E-mail: prezand@fdny.nyc.gov

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INTRODUCTION

The World Trade Center (WTC) terrorist attacks of September 11, 2001 (9/11) resulted in catastrophic loss of life and property. Three hundred forty three rescue workers (341 firefighters and 2 paramedics) from the New York City Fire Department (FDNY) were killed during the collapse of the towers and 158 others sustained injuries requiring hospitalization (MMWR, 2002). Virtually every firefighter in FDNY's 11,500 member workforce faced numerous health and safety challenges during the 10-month WTC rescue and recovery effort (Lioy et al., 2002; Landrigan et al., 2004). We have previously documented associations between WTC exposures and persistent respiratory symptoms (Prezant et al., 2002; Webber et al., 2009), decline in pulmonary function (Prezant et al., 2002; Banauch et al., 2006; Aldrich et al., 2010), increased incidence of airway hyperreactivity (Banauch et al., 2006), asthma (Prezant et al., 2002, 2008), chronic rhinosinusitis (Prezant et al., 2008), "sarcoid-like" granulomatous pneumonitis (Izbicki et al., 2007), and Post-Traumatic Stress Disorder (PTSD; Corrigan et al., 2009).

When job-related injuries/illnesses result in significant functional impairment that interferes with the safe performance of essential job tasks, FDNY firefighters invariably turn to the disability pension system for recourse. Prior to 9/11, the FDNY disability pension system recognized that due to work exposures not only injuries but some illnesses (respiratory, coronary artery disease, psychological, and cancer) may qualify persons for accidental disability retirement. Documentation of work-related cause is required for injuries, including psychological trauma. The FDNY workforce undergoes physical and mental health evaluation prior to hiring with candidates screened for many illnesses. Exposures to potential toxins can occur during the performance of routine firefighting duties. In recognition of these cumulative exposures, New York State legislative actions presume that some post-hire illnesses (respiratory, coronary artery disease, and cancer) are service-connected, and that those who develop these conditions prior to retirement are entitled to receive accidental disability retirement benefits under the "Lung Bill," "Heart Bill," and "Cancer Bill," respectively. New York State legislation, enacted in 2005 and implemented in 2006, broadened presumptive eligibility by allowing for WTC-related disability pensions under a comprehensive "WTC Bill." This recent WTC bill included the same respiratory and cancer illnesses contained in prior legislation and added new ones including chronic rhinosinusitis, certain auto-immune diseases, and psychological conditions. Disability still required strict objective medical evidence that the illness or injury resulted in a functional impairment severe enough to interfere with the safe performance of essential job tasks, but work-related "cause" was presumptive as long as the member's WTC exposure was documented. In addition to adding new covered conditions, for the first time, this bill recognized that disability may occur after retirement with a provision added for reclassification to WTC-related accidental disability retirement even years after "ordinary" non-disability, or non-WTC accidental disability retirement had started.

The primary goal of this study was to examine the impact of the WTC attack on FDNY retirements by comparing retirements (number, type, and medical condition for disability) during the 7 years after the WTC attack (9/11/01–9/10/08) to retirements during the 7 years before the WTC attack (9/11/1994–9/10/2001). A secondary goal was to estimate the long-term financial impact on the FDNY pension system that resulted from WTC-related accidental disability retirements using actual pension data.

METHODS

Data Sources

Demographic data (age, gender, rank, years of service, and date of retirement) came from the FDNY personnel database. The FDNY Fire Service includes firefighters and officers with different ranks, salaries, and annual retirement allowances. Throughout this paper, the term "firefighter" is used to refer to all ranks unless specifically stated otherwise. FDNY Emergency Medical Service workers are part of a different pension system and, therefore, are not included in this study. Pension data ("ordinary" non-disability retirement or accidental disability retirement, and the type of injuries/illnesses that resulted in the disability claim) came from the FDNY Pension Database and the FDNY Bureau of Health Services. Data were obtained 1 month after the end of our study period on 10/11/2008. All data was de-identified. WTC exposure (see below) was obtained from the FDNY WTC Medical Monitoring database. We did not have access to personal financial data. All financial calculations were made by the New York City Office of the Actuary at our request. Participation in the study required written informed consent and was approved by the Institutional Review Board of Montefiore Medical Center.

WTC Exposure

The FDNY-WTC Exposure Intensity Index (Prezant et al., 2002) categorized exposure based on first arrival at the WTC site as follows: "Group 1," the most severely exposed, arriving on the morning of 9/11 and present during the tower collapses; "Group 2," arriving during the afternoon of 9/11; "Group 3," arriving the next day on 9/12/2001; and "Group 4," the least exposed, arriving any day between days 3 and 14.

Medical Conditions for Accidental Disability Retirement

"WTC-related musculoskeletal accidental disability retirements" refers to members awarded accidental disability retirement for musculoskeletal injuries incurred during the WTC rescue/recovery effort. "Respiratory" accidental disability retirements include retirements under the "Lung Bills" that could eventually be reclassified under the "WTC Bills" as well as retirements initially awarded under the "WTC Bills" for respiratory conditions. The term also includes a small number of "potential respiratory" accidental disability retirements—members awarded a non-WTC-related musculoskeletal accidental disability retirement who we believe could, in the near-future, re-classify under the "WTC Bills" due to objective evidence of WTC-related respiratory disease. "Psychological accidental disability retirements" include all disability pensions granted for psychological conditions (including those under the "WTC Bills"). "Cancer-related accidental disability retirements" include members retiring under the "Cancer Bills" and members retiring under the "WTC Bills" due to cancer. It is important to note that the category "WTC Bills" includes some proportion of members who previously retired with an "ordinary" non-disability pension and "reclassified" years later. The component numbers making up the final count in figures 6C–F are shown in the figure notes.

Financial Impact Analysis

Using data from the FDNY Pension database, the number of members who retired with accidental disability retirements for injuries or illnesses that were either directly connected to the WTC or may have been exacerbated by exposure to the WTC was calculated. Based on this analysis a dataset including these retirees, the medical reason for their disability, and their monthly retirement allowances was sent to the New York City Office of the Actuary. All of the Office of the Actuary's estimates were made at our request, using the dataset we provided.

Calculating annual retirement allowances requires an understanding of the differences between "ordinary" (non-disability) pensions and service-connected accidental disability pensions. In general, an "ordinary" non-disability pension for a firefighter with at least 20 years of service is equal to half of their "final pay," chosen from whichever is higher—their last year's salary, or an average of their three highest-paid consecutive salary years. This calculation includes overtime which, for most firefighters, was substantial in the first several years after 9/11. Fire chiefs are an exception as they do not receive overtime. Lesser pensions are payable to firefighters who withdraw with <20 years of service but this is unusual. Firefighters granted an accidental disability retirement immediately retire, even if they have <20 years service, and receive a pension worth $^3/_4$ of their "final pay" calculated using the same rules as those for ordinary pensions. Accidental disability retirements, however, are granted only after objective medical evaluations by FDNY's independent Pension Board. The Pension Board members decide if the applicant has permanent functional impairment that prevents the safe performance of essential job tasks and if the cause is "work or service-connected" or covered under a presumptive bill. If these conditions are met, accidental disability retirement benefits are awarded.

The actuarial methods used to estimate the financial impact on the FDNY pension system associated with WTC-related accidental disability retirements in excess of what was projected prior to the WTC attack are complex and beyond the scope of this health study, but several key issues require explanation. Based on assumptions adopted by the FDNY Pension System Trustees' during the 2000 fiscal year (Actuary report, 1999) and on the 11,333 active members in FDNY as of June 30, 2001, many of those who retired with WTC-related disabilities, and received annual retirement allowances worth $^3/_4$ of their final salary, had been projected to retire with "ordinary" non-disability pensions, worth half of their final salary. Others had been projected to retire with accidental disability retirements worth $^3/_4$ of their final salary from non-WTC causes. Life-expectancy was also projected based on pre-9/11/2001 data, which, for example, would estimate that a 45-year-old white male would survive until age 81. Firefighters with accidental disability retirements were assumed to have 2 years less life-expectancy than those with normal retirement but this also was based on actuarial experience prior to 9/11/01 and may underestimate or overestimate life-expectancy based on WTC-related illnesses. Finally, there was an additional financial obligation associated with increases in overtime above historic expectations (often accumulated during the WTC rescue and recovery effort). After accounting for all of the above, the resulting changes in annual retirement allowances in excess of pre-9/11/01 projections served as the foundation for the estimates of the financial impact on the FDNY pension system from WTC-related accidental disability retirements. The financial estimates describe the amount of money necessary now to cover future debts incurred for payment of these annual retirement allowances, assuming these funds grow at 8% per year. These estimates were made based on retirements as of June 30, 2008 because pension data were available through this date and it is impossible to accurately estimate the number of WTC-related retirements that may be granted after June 30, 2008. Estimates do not include future death benefits. Actuarial estimates are based on the City of New York's fiscal year (July 1–June 30th) and, therefore, totals of accidental disability

retirements are slightly different from calculations based on years starting each September 11th. Estimates of increased financial impact were performed by the Office of the Actuary using methodology similar to that used in their initial assessment of the WTC's financial impact on the FDNY pension system submitted to Federal Emergency Management Agency (FEMA) in June, 2003 (Actuary Memo, 2003) but now include actual retirement numbers and costs through June 30, 2008 rather than numbers and costs through March, 2003 (Actuary Memo, 2010). When financial estimates are broken down by injury or illness type, all WTC Bills are grouped together, regardless of their associated medical conditions.

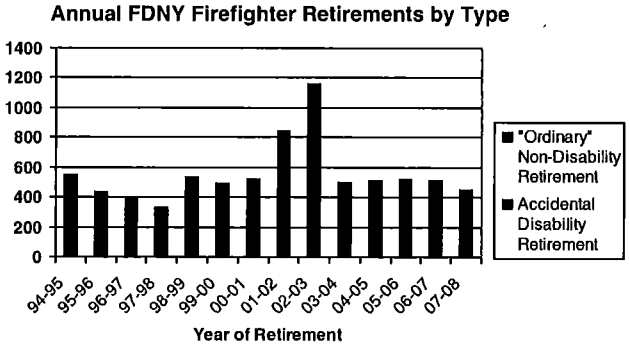

FIGURE 1. Years of retirement start on September 11th.

RESULTS

A total of 7,763 FDNY firefighters that retired between 9/11/1994 and 9/10/2008 are the subject of this study. A total of 4,502 of these firefighters retired within 7 years after 9/11/2001, comprising 40% of the 11,336 active firefighter workforce on 9/11/2001. Comparing retirees in the 7 years before the WTC attacks to the 7 years after there were significant differences in mean length of service at the time of retirement (25.3 ± 8.0 and 21.6 ± 6.9 years, respectively, $P < 0.01$). There were also significant differences in years of service between those with accidental disability retirements and those with "ordinary" non-disability retirements both before 9/11/2001 (23.1 ± 8.7 and 27.3 ± 6.7 years, respectively, $P < 0.01$) and after 9/11/2001 (20.8 ± 7.0 and 23.3 ± 6.4 years, respectively, $P < 0.01$). Of those reporting first arrival at the WTC site in the first 2 weeks after 9/11/01, 18% were present during the morning of 9/11, 57% reported arriving during the afternoon of 9/11/01, 14% on day 2 (9/12/01), and 11% between days 3 and 14. The group did not include the 341 firefighters who died in the line-of-duty on 9/11 and the 31 firefighters who died prior to retirement between 9/12/2001 and 9/10/2008 because this is a study of retirements only.

In the 7 years before the WTC attack (9/11/94–9/10/01), there was an average of 464 firefighter retirements per year, 48% of which were accidental disability retirements. During each of the first 2 years after the WTC attack, the number of retirements increased to 843 and 1,159 for post-9/11 years 1 and 2, respectively, for a total of 2,002 firefighters (18% of the 11,336 firefighter workforce active on 9/11/2001), of which 1,132 (56%) were accidental disability retirements. In the next 5 years (9/11/03–9/10/08), the average number of annual retirements (501), returned to near pre-WTC values (Fig. 1). During this period, however, the proportion of accidental disability retirements increased substantially, averaging 74% per year, a 54% increase when compared to the years before 9/11 (Fig. 2). Including only those associated with WTC-related injuries or illnesses, 1,402 accidental disability retirements were granted in the 7 years after the WTC attack (9/11/01–9/10/08).

After 9/11, the increase in accidental disability retirements was primarily due to respiratory illnesses (Fig. 3), nearly all attributable to obstructive airways diseases (asthma, asthmatic bronchitis, or COPD), with a few attributable to interstitial lung disease (sarcoidosis or pulmonary fibrosis). In the 7 years before 9/11, 280 firefighters retired with accidental disability retirements for respiratory illnesses, an average of 40/year. In the 7 years after 9/11, 1,088 firefighters received a respiratory accidental disability retirement, an average of 155/year or a nearly fourfold annual increase (Fig. 3). Seven hundred ninety eight (73.3%) of these respiratory accidental disability retirements were awarded to members who first arrived at the WTC on the first day—9/11/01 (Exposure Groups 1–2). The number of members retiring with

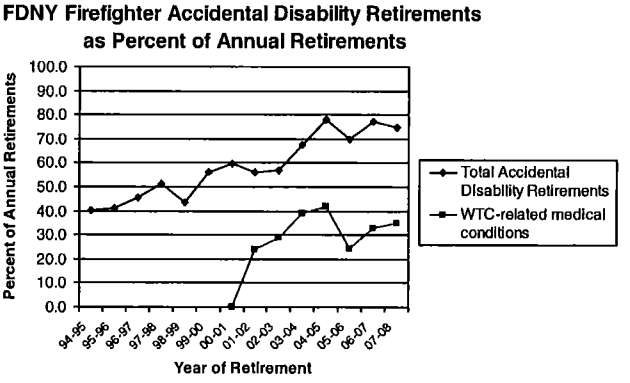

FIGURE 2. Total accidental disability retirements include those for WTC-related medical conditions. Years of retirement start on September 11th. WTC-related medical conditions include respiratory, psychological, WTC-related musculoskeletal, and "WTC Bills." The total accidental disability retirements includes those granted for respiratory and psychological conditions, but pre-9/11/01 these were clearly not attributable to the WTC attacks.

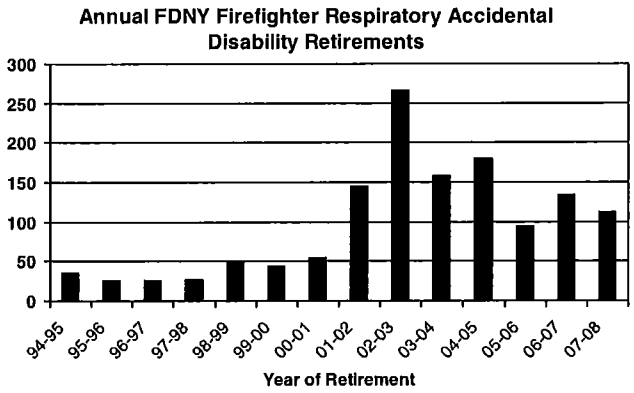

FIGURE 3. Respiratory accidental disability retirements post-9/11 include 790 "Lung Bills," 216 "WTC Bills" (of which 111 were reclassifications post-retirement), and 83 "potential" respiratory accidental disability retirements (potential reclassifications in near-future based on review of medical record). Years of retirement start on September 11th.

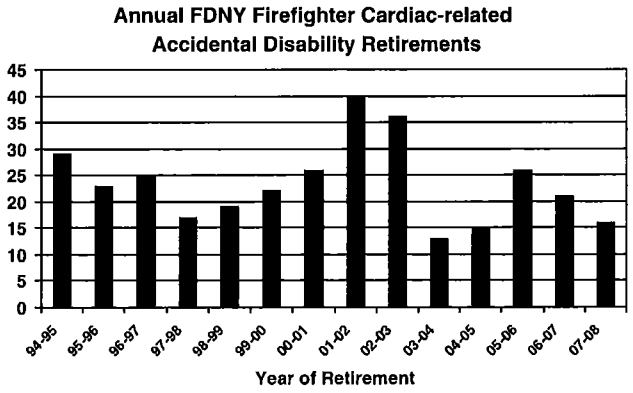

FIGURE 5. Years of retirement start on September 11th.

respiratory-related disabilities peaked in the second year (n = 266) and, thereafter, remained at least twice the pre-WTC annual average.

In comparison to respiratory disability pensions, the number of psychological disability pensions was small but the percent increase from pre-9/11 was greater. Most psychological accidental disability retirements were due to PTSD. Before 9/11, disability pensions for psychological impairment were rarely granted, averaging <1/year, and required unique circumstances such as psychological trauma resulting from burn injuries (Fig. 4). In the 7 years after 9/11, 128 firefighters received psychological accidental disability retirements, an average of 18/year, peaking the second year of the analysis at 27. One hundred five (82.0%) of these psychological accidental disability retirements were awarded to firefighters who first arrived at the WTC on the first day—9/11/01.

Musculoskeletal injuries, usually the largest single cause of firefighter accidental disability retirement, were relatively rare on 9/11 as the collapse resulted in death rather than injury to 341 firefighters. One hundred forty one firefighters were awarded accidental disability retirements for WTC-related musculoskeletal injuries, most (112/141 or 79.4%) to those arriving on 9/11.

Comparing the number of cardiac-related accidental disability retirements and cancer-related accidental disability retirements in the 7 years before 9/11 to the 7 years after 9/11, there does not appear to be any significant associations with WTC-exposure at this time. There was a transient increase in cardiac pensions limited to the first 2 years after 9/11 (Fig. 5). Cardiac accidental disability retirements, therefore, were not included in our calculations of WTC-related financial impact. There was also a transient increase in the number of cancer-related accidental disability retirements granted to firefighters retiring between 9/11/02 and 9/10/03 (Fig. 6). However, 9 members that year reclassified under the expanded eligibility of

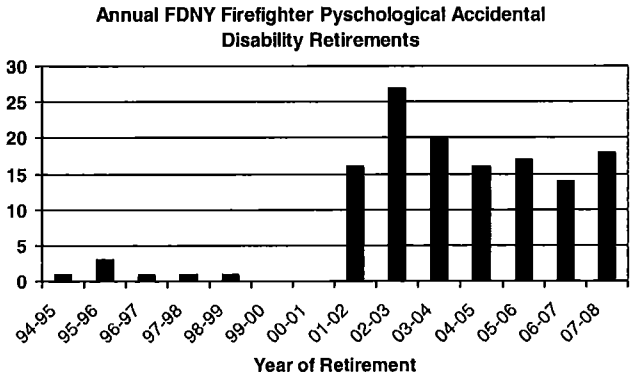

FIGURE 4. Psychological accidental disability retirements post-9/11 include 75 accidental disability retirements for psychological reasons and 53 "WTC Bills" (of which 31 were reclassifications post-retirement). Years of retirement start on September 11th.

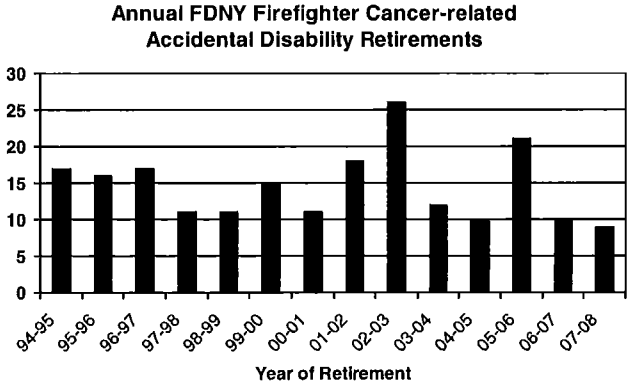

FIGURE 6. Cancer-related accidental disability retirements post-9/11 include 74 accidental disability retirements for cancer-related illnesses and 32 "WTC Bills" (of which 19 were reclassifications post-retirement). Years of retirement start on September 11th.

TABLE I. Retirements by Type and Exposure Group

	Exposure 1		Exposure 2		Exposure 3		Exposure 4		Trend[a]
All retirements ("ordinary" + accidental disability retirements	n = 724		n = 2,266		n = 567		n = 441		
Total accidental disability retirements	530	73.3%	1,534	67.7%	369	65.1%	243	55.1%	<0.01
Respiratory accidental disability retirements	214	29.6%	584	25.8%	134	23.6%	71	16.1%	<0.01
Psychological accidental disability retirements	59	8.1%	46	2.0%	5	0.9%	9	2.0%	<0.01
WTC musculoskeletal accidental disability retirements	55	7.6%	57	2.5%	10	1.8%	5	1.1%	<0.01
Cancer-related accidental disability retirements	20	2.8%	49	2.2%	11	1.9%	11	2.5%	0.33
Cardiac-related accidental disability retirements	18	2.5%	72	3.2%	23	4.1%	22	5.0%	<0.01

504 members retiring post-9/11 were excluded due to arriving at the WTC site more than 2 weeks after 9/11, not present at WTC site or unknown status.
[a]Cochran-Armitage test for trend; n = 3,998.

the WTC Bills, which permits accidental disability retirement coverage to firefighters who develop the condition post-retirement. As we did not find a significant increase in the number of Cancer Bill pensions, they were not included in the financial analyses. WTC Bills granted for cancer, however, are specifically linked to the WTC by the FDNY pension system and are, therefore, included in the financial estimates.

Table I shows the significant association between earlier arrival at the WTC site and the increase in accidental disability retirements, as well as accidental disability retirements granted for respiratory and psychological conditions, and WTC-related musculoskeletal injuries (all $P < 0.01$). The WTC exposure gradient for cancer-related accidental disability retirements was not statistically significant ($P = 0.33$). There was an inverse relationship between exposure and cardiac-related accidental disability retirements granted post-9/11 (Table I).

Financial Impact Analysis

Pension data were only available through 6/30/08. A total of 1,355 accidental disability retirements were granted from 9/11/01 to 6/30/08 for medical conditions associated with WTC-related injuries or illnesses (Table II). This included 789 "Lung Bills," 75 psychological-related disabilities, 138 WTC-related musculoskeletal disabilities, and 271 "WTC-Bills" for all covered medical conditions. It also includes 82 non-WTC musculoskeletal disabilities because these "potential respiratory" cases have medical records documenting respiratory illness that would make reclassification under the "WTC Bills" likely. In fact, all of the above disability pensions awarded prior to the passage of the "WTC Bills" (n = 1,084) would, upon request, be considered for reclassification under the "WTC Bills." Of the 271 already retired under the "WTC Bills" as of 6/30/08, 179 were for respiratory conditions, 50 were for psychological conditions, 30 were for cancer-related illnesses, and 12 were for other conditions. Based on assumptions adopted by the FDNY Pension System in 2000 (Actuarial Report, 1999), the estimated funds necessary to cover the future retirement benefits of these 1,355 members (based on projected numbers, types of retirement, projected overtime, and projected life-expectancy) if the WTC had not occurred would have been $926.0 million. Estimates based on

TABLE II. Financial Impact on the FDNY Pension System of Additional Firefighter Accidental Disability Retirements Due to the WTC Attack as of June 30, 2008—By Category ($ Millions)

Category	Lung Bills	Potential respiratory	WTC Bills	WTC musculoskeletal	Psychological disabilities	Total
Count[a]	789	82	271	138	75	1,355
Projected financial impact[b]	$523.4	$65.6	$194.7	$97.7	$44.6	$926.0
Actual financial impact[c]	$1,030.8	$101.2	$352.0	$180.5	$88.3	$1,752.8
Increased financial impact[d]	$507.4	$35.6	$157.3	$82.8	$43.7	$826.8
June, 2003 FEMA Support[e]						$103.6
Total Increased actuarial accrued liability						$723.2

[a]Based on data for 1,355 retirees with WTC-related injuries or illness as of June 30, 2008.
[b]Based on members' census data used in June 30 actuarial valuation of FDNY immediately preceding retirement.
[c]Based on estimated WTC ADR benefits payable as of June 30 following date of retirement and on 2000 A&M.
[d]Reflects actuarial loss attributable to change from active member status to WTC ADR status and to differences from expected amounts for salary, service, etc. in the final calculations of ADR benefits.
[e]Amount Granted by FEMA as a result of the WTC's Financial Impact on the FDNY Pension System from the first 187 WTC ADRs.

actual numbers and types of retirement and *actual* overtime for these members after the WTC amounted to $1,752.8 million. Thus the estimated increased financial impact to the FDNY Pension System as a result of WTC-related accidental disability retirements is $826.8 million. $157.3 million of this was directly associated with the WTC attack through the "WTC Bills," enacted in 2006. $543.1 million of the increase was associated with "Lung Bills" and "potential respiratory-related accidental disability retirements," $43.7 million with psychological disabilities, and $82.8 million with musculoskeletal injuries incurred while working at the WTC site. In June, 2003 a similar analysis of the first 187 WTC-related accidental disability retirements was submitted to FEMA, which supported the FDNY Pension System with $103.6 million in relief to the City of New York. Since that time, WTC-related accidental disability retirements have increased the financial impact to the FDNY Pension System by an additional $723.2 million (Tables II and III).

DISCUSSION

In occupational settings, job-related injuries, often musculoskeletal in nature, have been found to be important in subsequent retirement rates and service-connected disability costs (Hannerz et al., 2007). Our study is unique in that it is the first to document the impact of a terrorist attack on the retirement outcomes of a heavily exposed workforce. Medical records allowed us to examine numbers and retirement benefits by specific condition, providing insight into the ongoing physical burdens of the WTC attack. Overwhelmingly the conditions resulting in disability were due to illness, primarily respiratory, rather than musculoskeletal injuries. Availability of actual, rather than estimated, pension data both 7 years before and 7 years after 9/11 made calculation of increased accidental disability retirements and financial estimates possible. Finally, examination of the entire post-WTC retired population allowed our analyses to be based on the complete population rather than small samples that may or may not be representative.

By comparing pre- and post-WTC FDNY retirement data, we identified significant increases in the total number of retirements, the number of accidental disability retirements and their estimated financial impact. While some of the increase in these disability retirements could be attributed to changes in the Board's review of claims, the requirement of strict objective medical evidence and the large number of firefighters meeting these requirements indicate that these increases are much more than an artifact. The majority of these increases were due to accidental disability retirements associated with respiratory illness and are consistent with the wide-spread and persistent pulmonary function declines, airway hyperreactivity, asthma, and other respiratory illnesses associated with WTC exposure in previous studies of FDNY firefighters and other workers (Prezant et al., 2002; Skloot et al., 2004; Banauch et al., 2006; Herbert et al., 2006; Buyantseva et al., 2007; Izbicki et al., 2007; Prezant et al., 2008; Webber et al., 2009; Aldrich et al., 2010). For firefighters, these pulmonary deficits make the performance of critical job tasks unsafe for the individual, the firefighting unit and civilians in need of rescue. The relatively low number of WTC-related musculoskeletal accidental disability retirements reflects the unfortunate fact that during the WTC attack and subsequent collapses, most acute trauma to FDNY firefighters resulted in fatalities rather than disabling injuries. The few disabling musculoskeletal injuries after day 1 also demonstrate that this workforce, if not for respiratory and psychological exposures, was able to operate safely in this hazardous environment.

We found a transient, almost twofold, increase in the number of disability pensions awarded for coronary artery disease in the first year after 9/11 which returned to and remained at pre-9/11 levels thereafter (Fig. 4). There were no reports of firefighters suffering myocardial infarcts or unstable angina during the rescue/recovery effort. We suspect that the transient increase, therefore, was most likely related to the large number of firefighters

TABLE III. Financial Impact on the FDNY Pension System of Additional Firefighter Accidental Disability Retirements Due to the WTC Attack as of June 30, 2008—By Category ($ Millions)

	2002	2003	2004	2005	2006	2007	2008	Total
Lung Bills	$43.5	$154.5	$90.6	$106.8	$64.2	$45.4	$2.4	$507.5
Potential respiratory	$0.3	$6.9	$9.5	$7.2	$5.0	$3.7	$3.0	$35.6
WTC Bills	$9.6	$27.0	$6.7	$9.6	$4.8	$33.2	$66.5	$157.3
WTC musculoskeletal	$12.6	$26.3	$9.2	$10.0	$11.2	$7.5	$5.9	$82.8
Psychological disabilities	$2.5	$9.1	$8.9	$6.4	$9.0	$5.5	$2.2	$43.7
Total	$68.4	$223.9	$124.9	$139.9	$94.3	$95.4	$80.1	$826.8

Based on data for 1,355 retirees with WTC-related injuries or illness as of June 30, 2008. Reflects actuarial loss attributable to change from active member status to WTC ADR status and to differences from expected amounts for salary, service, etc. in the final calculations of ADR benefits.

who, interested in retiring shortly after 9/11, obtained pre-retirement medical evaluations revealing coronary artery disease.

There was a dramatic increase in accidental disability retirements for psychological illnesses after 9/11. This is understandable in the wake of the horrific circumstances experienced by the rescue and recovery workforce. On 9/11, firefighters at the scene of attack personally dealt with near death exposures as well as the death of thousands, including their own co-workers and friends. Considering the 13–22% prevalence rates of probable PTSD in recent studies of FDNY firefighters (Chiu et al., 2010; Berninger et al., 2010a; Berninger et al., 2010b), and the fact that FDNY has treated thousands of firefighters for mental health problems related to 9/11—many with PTSD, we consider the overall number of psychological-related accidental disability retirements (n = 128) to be relatively low.

Before 2006, cancer-related accidental disability retirements were awarded to active firefighters who developed a disabling cancer under the "Cancer Bills." There has been no significant increase in the number of "Cancer Bills" awarded post-9/11, and, as a result, we excluded "Cancer Bills" from the financial impact analysis. However, in 2006, the "WTC Bills" broadened eligibility to include members developing cancer after retirement. "WTC Bills" granted for cancer-related illnesses have been deemed WTC-related by the FDNY Pension Board, and are, therefore, included in all analyses.

There was a statistically significant exposure gradient in post-WTC accidental disability retirements demonstrating that those with earlier exposure to the WTC were more likely to experience negative health effects and were also more likely to retire with a disability. Analysis by injury/illness type revealed significant exposure gradients in respiratory, psychological, and WTC-related musculoskeletal accidental disability retirements.

In the first 2 years after 9/11/01, more senior workers retired. The potential impact of the remaining younger workforce on disability retirement rates over years 3–7 is complex and beyond the scope of this paper, but may lead to an increased proportion of disability retirement because the number of those with more than 20 years of FDNY service (a requirement for "ordinary" retirement) has declined. However, it also has the potential to lead to a decreased rate due to a more robust healthy worker effect. The financial analysis by the OA accounts for expected pre-9/11 retirement rates based on actual data going back decades and, therefore, any slight increase in retirements in the 2 years before 9/11 is misleading and not the beginning of an underlying upward trend.

There were some limitations to our analysis of the financial impact to the FDNY pension system. First, lacking specific information we assumed that overtime was WTC-related for those receiving WTC-associated accidental disability retirement. Second, estimates do not account for future multi-million dollar impacts due to new or reclassified WTC accidental disability retirements that could be granted after 9/11/2008 to currently active or retired WTC-exposed firefighters. Nor do they include 30 persons with WTC-related accidental disability retirements granted after 6/30/08 but before 9/11/2008, as the Office of the Actuary's estimates were based on fiscal years. And, due to this study's focus on accidental disability retirements, we do not include death benefit costs either to the 341 firefighters who died on 9/11/01 or in the future resulting from the WTC Bills' unique survivor benefit. These multi-million dollar financial impacts are difficult to project in the absence of historic data and because part of the survivor benefit will be covered by New York State. Finally, these estimates do not consider non-pension costs related to the increased workforce attrition rates post-WTC. For example, they do not include the costs associated with training new recruits to take the place of retirees in the active workforce. Nor do they consider the medical costs related to the diagnosis and treatment of these WTC-related conditions, currently funded by the National Institute of Occupational Safety and Health (NIOSH) WTC Medical Program. All of these factors have the potential to substantially increase the financial impacts associated with the WTC attack, and, therefore, we consider these estimates to be conservative and limited to the financial impact of WTC-related accidental disability retirements upon the FDNY pension system.

CONCLUSION

It is clear that the WTC attack has had an enormous impact on the health of the FDNY workforce and, as a consequence, its pension system. In addition to the 341 FDNY firefighters who died that day and the attrition that introduced an incredible challenge, there have been increased numbers of respiratory and psychological-related accidental disability retirements since 9/11—far in excess of pre-WTC levels. There were also musculoskeletal injuries incurred at the WTC site that resulted in accidental disability retirements, and other accidental disability retirements attributed directly to the WTC via the "WTC Bills," beginning in 2006. These WTC-related accidental disability retirements have had a dramatic financial impact on the FDNY pension system, creating a conservative estimate of increased actuarial liability of $723.2 million in addition to the $103.6 million in previous FEMA support. Human suffering cannot be measured in dollars alone but does serve as a reminder that recovery efforts, when rescue is no longer possible, should be carried out with special attention to the preservation of respiratory and mental health.

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