Worker Productivity and Outpatient Service use after Terrorist Attacks: Implications for Preparedness and Research

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Running Head

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Abstract

Objective: Previous research has documented the impact of psychological status on worker productivity. In the current study we assessed the impact of exposure to terrorist attacks on productivity and service utilization among workers in New York City (NYC).

Methods: We used a prospective cohort study to examine the impact of exposure the World Trade Center disaster (WTCD) among 1,167 workers who were living in NYC. Our study included measures of WTCD event exposures, exposure to stressful events, history of traumatic events, posttraumatic stress disorder (PTSD), and depression, assessed at 1-year post-disaster (baseline) and 2-years post-disaster (follow-up).

Results: Bivariate analyses suggested that exposure to WTCD events was associated with high productivity loss at baseline, but not consistently at follow-up. Both PTSD and depression were associated with lower quality workdays at baseline and follow-up, but depression was more consistently associated with high work loss and medical service use at baseline and follow-up. In multivariate analyses, WTCD exposure was associated with productivity loss at baseline, but less consistently at follow-up. At baseline, depression and history of traumatic events were associated with lower quality workdays and negative life events were associated with greater workdays lost. Multivariate analyses at follow-up also indicated that experiencing negative life events was associated with higher workdays lost and lower quality workdays and that PTSD was associated with lower quality workdays. Similar regression models suggested that increased outpatient service use was associated with depression and lifetime traumatic events at baseline and with negative life events at follow-up.

Conclusion: Our study suggested that while the WTCD had an adverse impact on worker productivity within the first year after the attack, this did not generally persist into the second year, especially after controlling for baseline status. Having PTSD or experiencing stressful life events, however, was associated with lower quality workdays, even after controlling for baseline status.

Introduction

It has been noted that a goal of terrorism is to create sufficient socioeconomic disruption to achieve political objectives otherwise unattainable (1). The terrorist attacks in New York City (NYC) on September 11, 2001, killed nearly 3,000 persons, caused extensive public infrastructure damage, and had an adverse impact on the regional economy (2,3). These attacks not only increased pubic fears of terrorism threats (4), but also had an adverse psychological impact on area residents (5-7). Research in the post-disaster period indicated that 11% of NYC adults, approximately 700,000 persons, suffered panic attacks during this event (5). Other studies conducted nationally, and within the New York metropolitan area following the attacks, also found psychological distress widespread (8-10). Adding to this level of public distress during this period was the anthrax attacks that occurred in New Jersey and New York – the first publicized bioterrorism attack in US history (11) – and the onset of war in the Middle East (12).

Given this environment, it was reasonable to expect a negative impact on worker productivity (4,12). One study conducted by the Centers for Disease Control and Prevention (CDC) shortly after the attacks, among employees who worked near the World Trade Center disaster (WTCD) site, found that both the physical and psychological heath status of workers had been adversely affected (13). Another study of area employees in companies that had behavioral health coverage found significant increases in anti-anxiety medication use after the attacks (14). In addition to the terrorist attacks and ongoing threats that occurred over the past several years in NYC, it has been noted that the workplace is also a risk environment for worksite shooting, employee violence, and unintended injuries (15). Despite these hazards, preparedness activities in the US generally have ignored the workplace and have focused on the technological and biomedical aspects of these events (16-18), rather than on the psychosocial impacts (4,12,19). Below we present findings from, to our knowledge, the only study that provides data related to the impact of the NYC terrorist attacks and on going threats on worker productivity and outpatient service use. For this study, we assessed both the short-term (1 year after) and long-term impacts (2 years after) of these exposures. If terrorist attacks in urban civilian areas become more commonplace (4,12), then understanding the impact of these events and developing interventions for working populations will be of strategic importance (20).

Data and Methods

Survey Methods

The data for the present study come from a prospective cohort study of English- or Spanish-speaking adult residents who were living in NYC on the day of the WTCD and exposed to ongoing terrorist threats over a 2-year period. Using random-digit dialing, we conducted a baseline telephone survey one year after the attacks. One year later, we attempted follow-up interviews with all baseline participants (i.e., 2 years after the WTCD). Questionnaires were translated into Spanish and then back-translated by bilingual Americans to ensure the linguistic and cultural appropriateness. For most of the scales discussed below, we used the test developer's Spanish version of the measure. The baseline interviews occurred between October and December 2002. The follow-up interviews occurred between October 2003, and February 2004.

The procedures were the same for both surveys. Trained interviewers using a computer-assisted telephone interviewing system conducted the interviews and were supervised by the survey contractor in collaboration with the investigative staff. A protocol was in place to provide mental health assistance to participants who required psychiatric counseling (5). The mean duration of the interviews was about 45 minutes for baseline and 35 minutes for follow-up. The Institutional Review Board of the New York Academy of Medicine reviewed and approved the study's protocols.

Overall, 2,368 individuals completed the baseline survey and 1,681 completed the follow-up survey. Approximately, 7% of the interviews were conducted in Spanish for the baseline and 5% for follow-up surveys, respectively. Using industry standards (21), as reported elsewhere, the baseline cooperation rate was approximately 63% and the re-interview rate for follow-up was 71% (7). As part of the study design, we over-sampled residents who reported receiving mental health treatment in the year prior to the baseline survey, identified by means of screener questions at the beginning of the survey. The population was also stratified by the 5 NYC boroughs and sampled proportionately.

Sampling weights were developed for each wave to correct for potential selection bias related to the number of telephone numbers and persons per household and for the over-sampling of treatment-seeking respondents (22). As discussed below, demographic weights also were used in the follow-up wave, in order adjust for slight differences in response rates by different demographic groups, a common practice in panel surveys (23). With these survey adjustments, our study is considered representative of adults who were living in NYC on the day of the WTCD (22).

Since our study focused on workplace, we eliminated respondents who were not working, including those who were retired, students, homemakers, on sick leave, on

maternity leave, or those who were disabled. Also, those who were working at year 1, but not year 2, were eliminated from our study. In addition, we eliminated respondents who were 65 or older, since we wanted to concentrate on individuals in their primary working years. These selection criteria resulted in eliminating 514 respondents (475 not working and 39 who were 65+ years old) from the 1,681 adults in our panel data, resulting in 1,167 persons for analyses.

Study Outcome Variables

The outcomes of interest in our present study were adopted from standard measures of worker productivity used in previous research. Based on previous productivity studies related to workdays lost and lower quality workdays reported (24-26), at baseline and follow-up we asked respondents following survey questions: “Now think about the last four weeks you worked for pay or profit; during these four weeks, on how many days did you: (i) miss an entire day of work because of health problems; (ii) miss part of a work day because of health problems; or (iii) perform lower quality work than you normally would have?” These survey questions had been used and validated in previous occupational health studies (24-26). In addition to these measures, we also asked respondents to report the number of visits they had to a medical doctor’s office in the past 12 months for medical care or for medical tests. This healthcare utilization measure has been used in population health studies designed to assess services utilization, including the ongoing *National Health Interview Survey*, conducted by the National Center of Health Statistics (27). For descriptive bivariate analyses, we classified 3+ workdays lost, cutback, or 3+ lower quality workdays reported as high productivity loss; for outpatient service use, we dichotomized 5+ doctor visits as high service utilization. These designated cut points represented about the 90th percentile (or greater) for these survey measures, respectively.

Study Predictor and Control Variables

Demographic Characteristics: Our analyses included 6 demographic measures used as study control variables, including: age, education, gender, marital status, race/ethnicity, and income. Age was coded in years (baseline mean = 38.6; SD = 11.8). Education was coded as an ordinal scale ranging from 1 to 5, representing less than high school through to graduate school (baseline mean = 3.3: SD = 1.2). Female gender and marital status (dichotomized as married/cohabitating vs. not) were coded as binary variables. Consistent with past research (4,8,28), race/ethnicity was classified based on self-report and coded as a categorical variable as follows: White, Black or African American, Latino/Hispanic, and Other.

Income was coded as a 7-category ordinal scale, representing under $20,000 to greater than $100,000 (baseline mean = 4.1; SD = 2.1). Approximately, 3% of respondents had missing data for income after substituting follow-up responses, if baseline responses were missing. For these 3% of cases, we substituted the mean baseline income category for these respondents.

PTSD: Our PTSD scale was based on the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (29) and specifically designed for telephone administration (30,31). To meet the PTSD criteria, a respondent had to be exposed to a traumatic event and experience intense feelings of fear, helplessness, or horror (Criteria A1 and A2). Second, the person had to re-experience the event in one of five ways (Criteria B), avoid stimuli associated with the event in three of seven ways (Criteria C), and had to have increased arousal in two of five ways (Criteria D). Third, the symptoms for Criteria B, C, and D had to last one month or longer (Criteria E). Finally, the symptoms had to have a significant impact on the individual's functional status (Criteria F). Our assessment involved 3 sets of experiences, including the WTCD, the most stressful traumatic event experienced "other than the WTCD," and any other traumatic event experienced. To have PTSD, the person had to meet criteria A through F for one or more of these traumatic events. Data supporting the validity of this instrument have been presented elsewhere and suggested that this scale can successfully diagnose PTSD in the general population (5,8,30,31,32,33). For the current analyses we had 2 measures of PTSD: PTSD in the past year (baseline) and PTSD in year 1 or year 2 (follow-up).

Depression: For a diagnosis of major depression, we used a version of the SCID's major depressive disorder scale from the non-patients version (34), which also has been extensively used in telephone-based, population surveys (5,8,32,35,36). Following DSM-IV criteria (29), respondents met the criteria for depression if they had five or more depression symptoms for at least two-weeks. In the current study, Cronbach's alpha for the 10 symptoms used in this scale was 0.87. Data related to the validity of this scale were also previously reported and suggested that this scale can successfully diagnose depression in the general population (5,8,32,35,36). For the current analyses we had 2 measures of depression: depression in the past year (baseline) and depression in year 1 or year 2 (follow-up).

Stressor Measures: In addition to PTSD and depression, our statistical models included 3 stressor variables that could affect our outcome measures. The first stressor measure was a WTCD event exposure measure, which was only assessed during the baseline survey. This consisted of 14 possible events that the responded could have

experienced during the attacks (e.g., was at the WTCD site during attack, had to be evacuated, lost job, etc.) (baseline mean = 3.1; SD = 1.8). For bivariate analyses, we classified high exposure as experiencing 6 or more of these events; those with a score of 6+ events were in the 90th percentile for this exposure measure. The second stressor measure was a negative life event scale (37), which was the sum of eight experiences that the respondent could have had in the year before the WTCD (e.g., divorce, death of spouse, problems at work, etc) (baseline mean = 0.8; SD =1.1). The follow-up survey contained the same negative life events scale, but covered the past 36 months. The Third stressor measure was a traumatic events scale that included 10 traumatic events (e.g., forced sexual contact, being attacked with a weapon, having a serious accident) (37) (baseline mean = 1.9; SD = 1.9). For both the baseline and follow-up the trauma scale measured lifetime trauma from the time of survey. All 3 stressor measures were used and validated in previous WTCD studies and discussed in detail elsewhere (5-8,19,32,33,38).

History of Chronic Diseases: To control for physical health status in our study, we ascertained whether the respondent *ever* had been told by a doctor that he/she had any chronic diseases, such as high blood pressure, asthma, heart disease, cancer, etc. This survey measure is commonly used in population health studies designed to assess disease prevalence, including the *National Health Interview Survey* conducted by the National Center of Health Statistics (27). Consistent with other studies (26), we developed a count of these chronic conditions (baseline mean = 1.3; SD = 1.4) and used this measure to control for level of physical health impairment.

Other Study Variables

For descriptive and analytical purposes, our analyses also included measures of mental health visits, social support, and self-esteem, which were each measured in the baseline and follow-up surveys, respectively.

Mental Health Service Utilization: In our study, we also inquired about the use of mental health services, which we adopted the National Comorbidity Survey (NCS) (39,40). Specifically, we asked participants about receiving counseling from a helping professional (e.g., psychiatrist, counselor, physician, self-help group, etc.) for “problems with emotions or nerves or use of alcohol or drugs” after the attacks. We asked how many visits they had to each of these professionals during the past 12 months in both the baseline and in the follow-up surveys, respectively. This measure has been used and validated in previous national surveys (39,40). For the current study, we developed a measure of the total count of mental health visits across all providers for each survey period (baseline mean = 4.9; SD = 18.9). A

more detailed description of this mental health use measure has been presented elsewhere (5).

Social Support: Social support was the sum of four questions about emotional, informational, and instrumental support currently available to the respondent measured on a 4-point scale (e.g., someone available to help you if you were confined to bed; not al all to all the time)(baseline mean = 10.9; SD = 3.5) (41). This measure was used and validated in previous studies and discussed in detail elsewhere (5,7,8,38).

Self-esteem: Self-esteem was measured by a modified version of the Rosenberg self-esteem scale (42). This measure was the sum of five items measured on a 4-point scale (e.g., on the whole, I am satisfied with myself; never to always) (baseline mean = 17.7; SD = 2.8). This measure was also used and validated in previous studies and also discussed in detail elsewhere (5,7,38).

Statistical Analysis

Our analytic strategy proceeded in several steps. First, we present univariate, descriptive statistics for our population demographics, health status, and productivity measures discussed. Next, we assess the associations between our productivity and health status measures at baseline and follow-up, using paired statistical tests (McNemar test for binary and paired t-test for continuous outcomes). Descriptive bivariate results also are presented to explore associations between our outcome measures and our mental health and WTCD exposure measures. As noted, for these bivariate analyses, we dichotomized our productivity, outpatient service use, and WTCD event measures at about the 90th percentile for descriptive purposes. Next, we estimated a series of multivariate ordinary least-squares (OLS) regression equations. For baseline productivity, we predicted lost productivity at baseline from baseline PTSD, depression, WTCD exposure, negative life events, and lifetime trauma measures, separately and then combined, controlling for age, education, gender, marital status, race/ethnicity, income, and the number of chronic medical conditions reported. For follow-up, we conducted the same regressions, except that for PTSD, depression, negative life events, and lifetime trauma variables we combined these predictors across the baseline and follow-up surveys (as noted, WTCD exposure was only assessed at baseline). We used these combined mental health and exposure measures at follow-up, because we wanted to assess the overall impact of these factors on worker outcomes. These regression analyses, thus, assessed the association between stressor exposures, PTSD, depression and productivity outcomes, controlling other factors that could have affected the results.

Since healthcare service utilization was also of interest, we estimated OLS regressions for these outcomes as well, using the same models discussed for productivity. Finally, due to the skewed distributions for our productivity and healthcare utilization measures, we log-transformed these variables and used these transformed variables in our multivariate analyses. For all of our analyses, we used the survey estimation (svy) command set in Stata, version 9.1 (43) to generate point estimates, cross-tabulations, and estimate OLS regression models. This estimation procedure adjusted the data for our sampling design, which included stratification by city borough and gender and, as noted earlier, case weights, to correct the data for selection bias and for study over-sampling.

Results

The demographic characteristics of our sample are shown in Table 1. As can be seen, the study population represents a cross-section of the NYC workers, with 51% female, 46% college graduates, 26% African Americans, and 26% Hispanics. The mean population age was 39 years old. The point estimates related to health status and productivity are also shown in Table 1. As can be seen, 4% and 11% of workers met the criteria for PTSD and depression 1-year post-disaster, respectively. Among workers, the average number of outpatient visits to medical doctors in the past year was 3 and the average number of visits to mental health professionals or self-help groups was 5 visits. Our health status results appeared to be similar at follow-up as well. In terms of productivity measures, both in the baseline and follow-up surveys the average for days missed and part-days missed in the past month was about half a day. In terms of poor quality workdays reported in the past month, during both periods the average poor quality days reported was approximately 1 day (Table 1). In terms of changes from baseline to follow-up, the only significant difference found was for doctor visits, whereby there was a slight increase in the follow-up period ($p < 0.05$).

Bivariate associations between our productivity measures and outpatient medical visits are shown in Table 2. As can be seen, at baseline, missing 3 or more days, missing 3 or more part days, or experiencing 3 or more lower quality days were all associated with high exposure to the World Trade Center disaster ($p < 0.01$). However, having PTSD in the past year was only associated with experiencing 3 or more lower quality workdays ($p < 0.001$). Depression in the past year was also associated with part workdays missed ($p < 0.01$) and lower quality workdays reported at baseline ($p < 0.001$). Experiencing 5 or more doctor visits in the past year was associated with PTSD ($p < 0.01$) and depression at baseline ($p < 0.001$). During the study follow-up (2 years post-disaster), high WTCD exposure was only associated

with lower quality workdays ($p < 0.01$). PTSD at follow-up was associated with both part workdays missed ($p < 0.01$) and lower quality workdays reported ($p < 0.001$). Depression at follow-up was associated with all 3 lower productivity indicators ($p < 0.01$). At follow-up, higher outpatient medical visits were also associated with depression ($p < 0.05$) (Table 2).

The multivariable regression results for our baseline productivity measures (Table 3, top panel) confirmed that stressor exposures generally had an impact on missing workdays and reports of lower quality workdays, even after controlling for demographic factors, mental health status, and existing medical conditions (M1-M4). For baseline, only in the final model for lower quality workdays (M4), was current depression a significant predictive factor ($p < 0.001$), concurrent with WTCD exposure ($p < 0.05$), and lifetime exposure to psychological trauma ($p < 0.001$). Having PTSD or depression was not related to missing an entire day of work or missing part a workday at baseline in the multivariable model. However PTSD was significant for the lower quality workday model ($p < 0.05$), before depression was added (M2).

During the follow-up period, the findings were somewhat different (Table 3, middle panel). In terms of full or part workdays missed, unlike baseline, WTCD exposure appeared to have little impact in the models assessed. In addition, only exposure to negative life events was significant and only for full workdays missed ($p < 0.05$). However, for lower quality workdays, PTSD was significant in the model without depression ($p < 0.01$) (M2) and remained significant in the full model that included depression (M4) ($p < 0.01$). Interestingly, in the final quality workday model (M4), WTCD was significant during follow-up, but lifetime trauma exposure was not compared to baseline. However, exposure to negative life events was now significant for lower quality days in all the models (M1-M4) ($p < 0.01$). As a final assessment, we conducted additional analyses, whereby we included the respective baseline measure for each of our 3 follow-up productivity measures (Table 3, bottom panel). This is generally considered a conservative approach, since this adjusts for the baseline status of the follow-up measure (7). These “lagged” models generally produced similar results, especially for lower quality workdays. For example, in the final workday quality model (M4), we found that PTSD ($p < 0.01$) and negative life events ($p < 0.01$) remained significant for lower quality workdays, while WTCD was now marginally significant in the final multivariable model ($p < 0.10$).

Because employers are concerned about employee health care costs (44), we used the same multivariable models to examine outpatient service utilization (Table 4). After controlling for demographic factors, mental health status, and chronic medical conditions (M1-M4) (Table 4, top panel), we found that in the baseline period exposure to lifetime

traumatic events was associated with greater physician office visits ($p < 0.01$)(M1). In the final baseline model (M4), this was still significant ($p < 0.05$) together with having had depression in the past year ($p < 0.01$). During the follow-up period (Table 4, middle panel), exposure to negative life events was now significant (M1) and remained significant even in the final model ($p < 0.01$) (M4). In the final model for the follow-up period (M4), interestingly, WTCD exposure was also marginally significant ($p < 0.10$). As a final assessment, again, we also included the baseline measure for our follow-up outcome of interest (Table 4, bottom panel). As can be seen, these results were similar to follow-up results without baseline adjustments. Controlling for baseline services utilization, the most significant variable in the model was exposure to negative life events ($p < 0.01$), followed by WTCD event exposures ($p < 0.10$).

Discussion

As noted, the WTCD attacks not only increased pubic fears and concerns about future attacks (4,12), but also affected the psychological status of area residents (5,8,45,46). In addition, as mentioned, adding to the level of distress among area residents was the anthrax attacks that occurred in New Jersey and New York City after the September attacks (11) and the onset of war in the Middle East (12). Thus, it was reasonable to expect that these experiences would have an impact adverse impact on workforce productivity (4,6,13,14). As also noted, in addition to terrorist threats, the workplace in general is a higher risk environment for such things as interpersonal violence and industrial accidents (15). Despite these risks, little has been done related to workforce preparedness (15). In addition, other studies have documented the impact of mental health disorders on work loss, lower worker productivity, and worker disability (24,25,44).

Within this context, we examined the impact of the terrorist attacks on NYC workforce productivity and outpatient services utilization up to 2 years after these events. As was seen, in bivariate analyses, our study suggested a strong association between exposure to the WTCD and lower worker productivity, especially in the first year after the attack. The occurrence of PTSD and depression were also associated with these outcomes. In the second year after the attack, bivariate analyses suggested that these associations were also present, but not as consistent. Increased office visits were associated with PTSD and depression at baseline and with depression at follow-up. Furthermore, multivariable analyses suggested that at baseline, productivity losses were associated with exposure to major stressors (including WTCD exposure, stressful life events, a history of traumatic stress

exposures) and depression. During follow-up, these associations mostly held for lower quality work only, even when controlling for baseline status. Interestingly, for the year-2 follow-up, it was PTSD that was associated with lower work quality, not depression. In terms of outpatient medical visits, depression and history of lifetime trauma were associated with office visits during baseline, but during the follow-up, this was associated with negative life events and, to a lesser degree, WTCD exposure.

In summary, while exposure to the WTCD events had an impact on worker productivity (as measured by work-loss and lower work quality) this was mostly confined to the first year post-disaster. However, there were other key factors that had a negative impact, such as mental health status, and history of exposure to other stressful events. These findings were similar for post-disaster medical visits as well. Given the high-stress environment in the post-disaster period, the lack of a consistent environmental impact among workers is noteworthy and may suggest that psychological resiliency was higher that expected (47-49). To explore this further, within the context of psychosocial resource in the current study, we also entered measures of self-esteem and social support into our regression models, measures that we have described elsewhere (7). While these “protective” measures had a limited impact on the outcomes discussed, they generally tended to offset lower productivity. Clearly additional research is needed in this area to more fully assess this phenomenon. Given previous reports of increased post-disaster vulnerability (7), we also assessed whether there was an interaction effect between WTCD exposure and stressful life events, but no association was found. Nevertheless, in terms of quality workdays, both PTSD and depression appeared to have both a short- and long-term impact, consistent with other non-disaster mental health research results reported elsewhere (24,25).

It should be noted that there are both limitations and strengths associate with this study. First, by omitting individuals without telephones and those who did not speak either English or Spanish, we may have missed vulnerable individuals. In addition, ideally our baseline response rate could have been higher. Since our final sample matched the 2000 Census for NYC, however (7), these exclusions did not appear to have introduced systematic bias. Nevertheless, we are limited in our generalizations about the associations found beyond English- and Spanish-speaking workers and our study results may include selection bias. In addition, even though we used standardized and validated instruments, all measures discussed were based on self-report. Furthermore, although there has been progress in assessing mental health status using standardized instruments (50-52), there continue to be discrepancies. Finally, our conclusions are limited by the retrospective nature of the pre-

disaster data, in that we did not have data collected before the disaster. The disaster experience itself may have altered recall related to pre-disaster mental health or productivity. In addition, our data do not allow us to model the changes in worker productivity over a longer period of time. This limitation, though, is common in much disaster-related research (8,50).

Despite these limitations, our study suggests that while there was a post-disaster impact on worker productivity and medical service use, this impact was limited and mostly confined to the first year post-disaster. Generally, experiencing negatively life event had a more consistent and longer-term impact than WTCD event exposures. Interestingly, PTSD appeared to have a long-term impact on reported work quality 2 years after the WTCD. Also of interest, at least within the context of the current study, depression was only associated with adverse worker outcomes within the first year but not the second year post-disaster, again, a finding worthy of additional investigation. It is important to note that our study controlled for existing medical conditions, as well as social economic status, race, gender, age, and other variables, so we think our findings are noteworthy.

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Table 1: Health Status & Worker Productivity Following Terrorist Attacks in New York City

Study Outcome Measures	Unweighted N	Weighted % or mean*	95% CI
Demographics			
Mean age	1,167	38.60	37.70-39.48
% Female Gender	651	50.97	47.30-54.62
% College Graduate	607	46.16	42.62-49.73
% White	519	40.61	37.21-44.10
% African American	298	25.72	22.72-28.97
% Hispanic	259	25.63	22.46-29.09
% Other Race/Ethnicity	91	8.04	6.31-10.18
Baseline: Health Status			
% PTSD past year	79	4.24	3.01-5.48
% Depression past year	192	11.02	8.94-13.11
Mean Number of Doctor Visits past Year	1,167	3.17†	2.88-3.47
Mean Number of Mental Health Visits past Year	1,167	4.86	3.81-5.92
Follow-up: Health Status			
% PTSD past year	58	3.33	2.17-4.51
% Depression past year	166	10.01	8.04-11.98
Mean Number of Doctor Visits past Year	1167	3.73†	3.41-4.04
Mean Number of Mental Health Visits past Year	1167	4.15	3.21-5.09
Baseline: Productivity			
Mean Missed Days of Work past month	1,167	0.58	0.40-0.75
Mean Missed Part of Workday past month	1,167	0.33	0.22-0.43
Mean Poor Quality Work Days past month	1,167	0.88	0.66-1.10
Follow-up: Productivity			
Mean Missed Days of Work past month	1,167	0.61	0.45-0.76
Mean Missed Part of Workday past month	1,167	0.36	0.24-0.48
Mean Poor Quality Work Days past month	1,167	0.84	0.69-1.01

*All percentages, means & confidence levels are based on weighted data; N's reflect unweighted data.

†Baseline measure is different from follow-up measure, $p<.05$, paired t- test, 2-tailed.

Table 2: Productivity and Health Visits by WTCD Exposure, PTSD and Depression (N=1167) ‡

Study Outcome Measures	Total Sample % (N)	% High WTCD Exposure†	Baseline % PTSD	Baseline % Depressed
Baseline Worker Productivity Loss and Outpatient Service Use†				
Missed Entire Day 3+ Times past month				
No	94.6 (1084)	86.3 (122)**	90.8 (68)	91.6 (166)
Yes	5.5 (83)	13.7 (19)	9.2 (11)	8.4 (26)
Missed Part Day 3+ Times past month				
No	97.2 (1122)	92.2 (131)**	94.8 (73)	93.9 (174)**
Yes	2.8 (45)	7.8 (10)	5.2 (6)	6.1 (18)
Lower Quality Workday 3+ Times past mo.				
No	91.9 (1039)	83.2 (116)**	79.4 (56)***	79.5 (144)***
Yes	8.1 (128)	16.7 (25)	20.6 (23)	20.6 (48)
5+ Visits to Medical Doctor past year				
No	81.7 (908)	76.0 (101)	64.1 (55)**	68.7 (122)***
Yes	18.3 (259)	24.0 (40)	35.9 (24)	31.3 (70)
Follow-up Worker Productivity Loss and Outpatient Service Use†	Total Sample % (N)	% High WTCD Exposure†	Follow-up % PTSD	Follow-up % Depressed
Missed Entire Day 3+ Times past month				
No	94.0 (1090)	93.9 (128)	90.8 (50)	88.3 (139)**
Yes	6.0 (77)	6.1 (13)	9.2 (8)	11.7 (27)
Missed Part Day 3+ Times past month				
No	96.8 (1118)	94.5 (129)	90.6 (51)**	92.8 (147)**
Yes	3.2 (49)	5.5 (12)	9.4 (7)	7.2 (19)
Lower Quality Workday 3+ Times past mo.				
No	90.3 (1018)	82.4 (113)**	63.2 (37)***	73.8 (110)***
Yes	9.7 (149)	17.6 (28)	36.8 (21)	26.2 (56)
5+ Visits to Medical Doctor past year				
No	75.8 (834)	72.7 (95)	69.9 (33)	66.6 (97)*
Yes	24.2 (333)	27.4 (46)	30.1 (25)	33.4 (69)

†High WTCD exposure defined at the 90th percentile (or higher) for WTCD exposure; High productivity loss defined at 3+ days per month and high outpatient utilization defined at 5+ visits per year, both categories also defined at the 90th percentile (or higher), respectively.

‡ All percentages are based on weighted data. All N's are based on unweighted data.

* p<0.05 ** p<.01 *** p<0.001, $\chi 2$ test

WTCD = World Trade Center Disaster.

Table 3: Multivariate Linear Regression Coefficients and (Standard Errors) Predicting Worker Productivity, Baseline & Follow-up (N=1167) ‡

Predictor Variables§	Number of Days Missed Entire Day of Work Past 30 Days (log)				Number of Days Missed Part of Workday Past 30 Days (log)				Number of Days Performed Lower Quality Work Past 30 Days (log)			
Baseline Outcomes	**M1**	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**
Baseline PTSD	--- ---	0.05 (.08)	--- ---	0.01 (.08)	--- ---	0.03 (.06)	--- ---	0.01(.06)	--- ---	0.25 (.12)*	--- ---	0.10 (.13)
Baseline Depression	--- ---	--- ---	0.08 (.05)	0.07 (.05)	--- ---	--- ---	0.03 (.04)	0.03(.04)	--- ---	--- ---	0.33 (.09)***	0.30 (.09)***
Exposure to WTCD	0.03 (.01)*	0.03 (.01)†	0.02 (.01)†	0.02 (.01)†	0.03 (.01)***	0.03 (.01)***	0.03 (.01)***	0.03(.01)***	0.04 (.01)**	0.03 (.01)**	0.03 (.01)*	0.03 (.01)*
Negative Life Events	0.06 (.02)*	0.06 (.03)*	0.05 (.03)*	0.05 (.03)*	0.05 (.02)*	0.05 (.02)*	0.04 (.02)*	0.04(.02)*	0.05 (.02)*	0.04 (.02)†	0.03 (.02)	0.03 (.02)
Traumatic Events	0.01 (.01)	0.01 (.01)	0.01 (.01)	0.01 (.01)	0.00 (.01)	-0.00 (.01)	-0.00 (.01)	-0.00 (.01)	0.05 (.01)***	0.05 (.01)***	0.05 (.01)***	0.05 (.01)***
R^2	0.05***	0.05***	0.05***	0.05***	0.06***	0.06***	0.06***	0.06***	0.06***	0.07***	0.09***	0.09***
Follow-up Outcomes	**M1**	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**
PTSD Past 2 Years	--- ---	0.04 (.08)	--- ---	0.02 (.08)	--- ---	-0.00 (.06)	--- ---	-0.02 (.05)	--- ---	0.40 (.12)**	--- ---	0.37 (.12)**
Depression Past 2 Yrs.	--- ---	--- ---	0.05 (.06)	0.05 (.07)	--- ---	--- ---	0.04 (.05)	0.04 (.05)	--- ---	--- ---	0.16 (.07)*	0.08 (.07)
Exposure to WTCD	0.01 (.01)	0.01 (.01)	0.01 (.01)	0.01 (.01)	0.01 (.01)	0.01 (.01)	0.01 (.01)	0.01 (.01)	0.04 (.01)*	0.03 (.01)*	0.03 (.02)*	0.03 (.01)*
Neg. Events past 3 Yrs.	0.04 (.01)**	0.04 (.01)**	0.04 (.02)*	0.04 (.02)*	0.01 (.01)	0.01 (.01)	0.01 (.01)	0.01 (.01)	0.08 (.02)***	0.06 (.02)***	0.06 (.02)**	0.05 (.02)**
Traumatic Events	0.02 (.01) †	0.02 (.01)†	0.02 (.01)†	0.02 (.01)†	0.01 (.01)	0.01 (.01)	0.01 (.01)	0.01 (.01)	0.00 (.01)	-0.00 (.01)	0.00 (.01)	-0.00 (.01)
R^2	0.07***	0. 07***	0.07***	0.11***	0.05***	0.05***	0.05***	0.05***	0.07***	0.09***	0.08***	0.10***
Follow-up Outcomes w/ Baseline Controlled	**M1**	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**	**M1**	**M2**	**M3**	**M4**
PTSD Past 2 Years	--- ---	0.04 (.08)	--- ---	0.02 (.08)	--- ---	-0.00 (.05)	--- ---	-0.02 (.05)	--- ---	0.33 (.11)**	--- ---	0.31 (.10)**
Depression Past 2 Yrs.	--- ---	--- ---	0.05 (.06)	0.05 (.07)	--- ---	--- ---	0.03 (.05)	0.04 (.05)	--- ---	--- ---	0.11 (.07)	0.04 (.07)
Exposure to WTCD	0.00 (.01)	0.00 (.01)	0.00 (.01)	0.00 (.01)	0.01 (.01)	0.01 (.01)	0.00 (.01)	0.00 (.01)	0.03 (.01)*	0.02 (.01)†	0.03 (.01)†	0.02 (.01)†
Neg. Events past 3 Yrs.	0.03 (.01)*	0.03 (.01)*	0.03 (.02)†	0.02 (.02)	0.00 (.01)	0.00 (.01)	-0.00 (.01)	-0.00 (.01)	0.06 (.01)***	0.05 (.01)**	0.05 (.02)**	0.05 (.02)**
Traumatic Events	0.02 (.01)†	0.02 (.01)	0.02 (.01)†	0.02 (.01)	0.01 (.01)	0.01 (.01)	0.01 (.01)	0.01 (.01)	-0.01 (.01)	-0.02 (.01)	-0.01 (.01)	-0.02 (.01)
Baseline Measure#	0.19 (.06)**	0.19 (.06)**	0.19 (.06)**	0.19 (.06)**	0.28 (.08)***	0.28 (.08)***	0.28 (.08)***	0.28 (.08)***	0.28 (.05)***	0.27 (04)***	0.28 (05)***	0.27 (.04)***
R^2	0.10***	0.10***	0.11***	0.11***	0.11***	0.11***	0.11***	0.11***	0.14***	0.16***	0.15***	0.16***

‡ All calculations are based on weighted data and take into account the data collection's sampling design.

§ Other variable in the models: age, education, gender, marital status, race/ethnicity, income, and number of physical diseases.

† p<.10 * p<.05 ** p<.01 *** p<.001, two-tailed t-test

Baseline measures controlled final models included: entire days of work missed at baseline; part days of work missed at baseline; and days performed lower quality work at baseline, respectively.

Table 4: Multivariate Linear Regression Coefficients and (Standard Errors) Predicting Outpatient Doctor Visits, Baseline & Follow-up (N=1167) ‡

Predictor Variables§	Number of Medical Doctor Visits past Year (log)			
Baseline Outcomes	**M1**	**M2**	**M3**	**M4**
Baseline PTSD	--- ---	0.11 (.12)	--- ---	-0.01 (.12)
Baseline Depression	--- ---	--- ---	0.23 (.08)**	0.24 (.09)**
Exposure to WTCD	0.01 (.02)	0.00 (.02)	-0.00 (.02)	-0.00 (.02)
Negative Life Events	0.03 (.03)	0.03 (.03)	0.02 (.03)	0.02 (.03)
Traumatic Events	0.04 (.02)**	0.04 (.02)*	0.04 (.02)*	0.04 (.02)*
R^2	0.16***	0.16***	0.17***	0.17***
Follow-up Outcomes	**M1**	**M2**	**M3**	**M4**
PTSD Past 2 Years	--- ---	-0.10 (.11)	--- ---	-0.13 (.11)
Depression Past 2 Yrs.	--- ---	--- ---	0.05 (.07)	0.08 (.08)
Exposure to WTCD	0.02 (.01)	0.03 (.01)†	0.02 (.01)	0.02 (.01)†
Neg. Events past 3 Yrs.	0.06 (.02)***	0.07 (.02)***	0.06 (.02)**	0.06 (.02)**
Traumatic Events	0.01 (.01)	0.01 (.01)	0.01 (.01)	0.01 (.01)
R^2	0.16***	0.16***	0.16***	0.16***
Follow-up Outcomes	**M1**	**M2**	**M3**	**M4**
PTSD Past 2 Years	--- ---	-0.12 (.10)	--- ---	-0.14 (.11)
Depression Past 2 Yrs.	--- ---	--- ---	0.01 (.07)	0.04 (.07)
Exposure to WTCD	0.02 (.01)†	0.03 (.01)†	0.02 (.01)†	0.03 (.01)†
Neg. Events past 3 Yrs.	0.05 (.02)**	0.05 (.02)**	0.05 (.02)**	0.05 (.02)**
Traumatic Events	-0.00 (.01)	-0.00 (.01)	-0.00 (.01)	-0.00 (.01)
Baseline Controlled#	0.31 (.04)***	0.31 (.04)***	0.31 (.04)***	0.31 (.04)***
R^2	0.24***	0.24***	0.24***	0.24***

‡ All calculations based on weighted data & take into account the sampling design.

§ Other variables in the models: age, education, gender, marital status, race/ethnicity, income, and number of physical diseases.

Baseline doctor visit measure controlled final models.

† p<.10 * p<.05 ** p<.01 *** p<.001, two-tailed t-test