The WTC Medical Monitoring and Treatment Program

Long Island Clinical Center Of Excellence

Final Progress Report

12/31/2011

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HIGHLIGHTS OF THE LONG ISLAND PROGRAM

1. Established a vibrant health monitoring program for WTC disaster responders that provides annual comprehensive health assessments and serves approximately 6,200 patients who are based on Long Island.
2. Maintained a very high retention rate over several years and continued to increase retention rates with the implementation of a targeted retention program.
3. Established an innovative, comprehensive and integrative physical and mental health treatment program for nearly 3,000 WTC disaster responders who are diagnosed with illnesses that are related to their WTC disaster exposures.
4. Developed a novel study of comorbid physical and mental health conditions in WTC responders that identified PTSD symptoms as a potential mediator between WTC exposure and respiratory illness.
5. Developed a ground-breaking oral history project to record the human stories of the WTC responders for an archive to be housed by the Library of Congress and that will serve to educate the public on 9/11 from the first-hand accounts of the responders.

INTRODUCTION AND OVERVIEW OF ACCOMPLISHMENTS

The Long Island Clinical Center of Excellence at SUNY- Stony Brook began serving the healthcare needs of WTC responders in the months following the disaster. Over 8 years later, this program grew to serve over 6,000 WTC Long Island-based responders. Due to the broad geographic distribution of the Long Island responder cohort, our Long Island Clinical Center of Excellence established multiple clinical sites in Nassau and Suffolk counties that are centralized by a clinical and administrative center in Islandia, NY. The Islandia space is the hub for retention, outreach, data, communication, medical record storage, and professional staff office space for those who travel between Suffolk and Nassau county sites. This center allows for the seamless

coordination of services, outreach, data collection and quality assurance to ensure consistent, high-quality care is afforded to all Long Island responders.

The intellectual environment at Stony Brook University Medical Center is robust and Benjamin J. Luft, MD, the Director of the Long Island WTC Clinical Center of Excellence (LI-CCE), along with Melodie Guerrera, Director of Administration for the Center, has assembled a remarkable team of experts in both the clinical and scientific areas to lead this clinical center of excellence.
Dr. Luft led the development of a comprehensive and collaborative treatment program dedicated to meet the healthcare needs of the WTC responders it serves by providing high-quality, accessible, and individualized treatment. The mission of the program is to assist WTC responders in the management of their WTC-related illnesses, to detect and treat these conditions as early as possible, to encourage high-adherence to prescribed treatment, to identify health risk behaviors that may contribute to symptom burden, to educate the responder on preventive health behaviors, and to provide support services that will help the responders improve their well-being, cope with persistent health conditions and reduce their disability.
The treatment model utilized by the Long Island Clinic integrates internists andnurse practitioners, clinical social workers, and specialists (e.g. psychiatrists, clinical psychologists, gastroentronologists, pulmonogists) to assist patients to achieve improved health. In addition to this cooperation across provider disipline, the program also integrates care across illness and health domains, for example, management of pulmonary disease that is comorbid with PTSD. Physicians, psychiatrists, clinical psychologists, social workers, and nurses within our network of providers are all trained to focus broadly on health and well-being to supplement a more narrow and traditional focus on specific illnesses or symptoms.

These clinical achievements are strengthed by the Long Island WTC Health Program's vigorous research and education program. Dr. Luft has co-authored several articles on various health issues facing the WTC responders (see attached list). Furthering our mission to provide comprehensive and integrated services, our research studies seek to better understand the

relationship between physical and mental health following exposure to WTC toxins and trauma, and to identify treatment interventions to improve the health of our patients.

The Long Island WTC Health Program has partnered with community organizations to educate the public on WTC responder issues, including WTC- related health problems. The primary objective of our education program is to make known the profound human impact of this disaster on the WTC responders and tell the story of Americans that sacrificed for their country in the wake of 9/11. The foundation of our educational program is an oral history project that documents the first-hand accounts of over 150 responders, "Remembering 9/11: An Oral History of Responders to the WTC Attack". This historic archive will be preserved by the Library of Congress and be a resource for generations of Americans to learn from the people who responded to the 9/11 terrorist attacks about the deep and long-lasting impacts.

The "Remembering 9/11" project led to the book, "We're Not Leaving: 9/11 Responders Tell Their Stories of Courage, Sacrifice, and Renewal", and a documentary film, "9/11: An American Requiem". A public library program was created to promote public discourse on 9/11 during the 10th anniversary. This program featured video testimony from WTC responders and the discussion is led by a responder. Similarly, Dr. Luft teaches a medical school course, "9/11: An Anatomy of a Healthcare Disaster", which incorporated WTC responder video testimony with research articles and presentations from experts to explore the physical, mental, social, personal and spiritual effects of 9/11 on the responder.

BACKGROUND/HISTORY OF THE PROGRAM

An estimated 50,000 men and women worked at Ground Zero, the former site of the World Trade Center (WTC) in New York City, and at the Staten Island landfill, the principal wreckage depository (Levin et al., 2004). Firefighters, law enforcement officers, paramedics, construction workers, utility workers, volunteers, and others carried out rescue-and-recovery operations, restored essential services, cleaned up massive amounts of debris and, in a time period far

shorter than anticipated, deconstructed and removed remains of buildings. The diverse worker and volunteer group included operating engineers, laborers, ironworkers, railway tunnel cleaners, telecommunications workers, and workers at the landfill and the Office of the Chief Medical Examiner. Many had no training in response to civil disaster. The highly diverse nature of this workforce posed unprecedented challenges for worker protection and medical follow-up.

Workers were exposed to a complex mix of toxic chemicals and extreme psychological trauma that varied over time and by location (Landrigan et al., 2004; Lioy et al., 2002). Combustion of 90,000 L of jet fuel created a dense plume of black smoke containing volatile organic compounds (VOCs, including benzene), metals, and polycyclic aromatic hydrocarbons (PAHs). The collapse of the "twin towers" (WTC 1 and WTC 2) and then of a third building (WTC 7) produced an enormous dust cloud containing thousands of tons of coarse and fine particulate matter (PM), cement dust, glass fibers, asbestos, lead, hydrochloric acid, polychlorinated biphenyls (PCBs), organochlorine pesticides, and polychlorinated dioxins and furans (Clark et al. 2003; Landrigan et al. 2004; Lioy et al. 2002; McGee et al. 2003). EPA estimates of airborne dust ranged from 1,000 $\mu g/m^3$ to over 100,000 $\mu g/m^3$ (U.S. EPA 2002). The high content of pulverized cement made the dust highly caustic (pH 10-11) (Lioy et al., 2002; Landrigan et al., 2004).

Dust and debris gradually settled, and rains on 9/14 diminished the intensity of outdoor ambient dust exposure somewhat. However, rubble removal processes repeatedly re-aerosolized the dust, leading to continuing intermittent exposure for many months. Fires burned both above and underground until December 2001 (Banauch et al. 2003; Chen and Thurston 2002; US EPA 2003). Levels of certain contaminants remained high well into 2002, with spikes in both benzene and asbestos levels, for example, as late as March and May 2002, respectively (US EPA 2003).

Workers began noting symptoms soon after September 11th, most commonly involving the aero-digestive tract (upper and lower respiratory tract and GERD) (Szeinuk et al., 2003; Banauch et al., 2006). FDNY firefighters experienced persistent cough, termed the "World Trade Center cough," accompanied by respiratory distress and bronchial hyperreactivity (Prezant et al.,

2002). A sample of FDNY firefighters who had sustained extreme exposures on September 11th was nearly 8 times more likely to manifest bronchial hyperreactivity than firefighters with lower exposures when examined after six months (Banauch et al., 2003). Laborers and ironworkers manifested new-onset cough, wheeze, and sputum production (Geyh et al., 2005; Skloot et al., 2004), likely attributable to respiratory inflammation caused by the highly alkaline dust (Chen and Thurston 2002).

Other reported pulmonary effects included cough, asthma, and RADS (Banauch et al., 2006; Balmes et al., 2006). Chronic rhinosinusitis, vocal cord inflammation, and laryngitis (de la Hoz et al., 2004) and case reports of eosinophilic pneumonia (Rom et al. 2002), granulomatous pneumonia, and bronchiolitis obliterans (Safirstein et al. 2003; Mann et al. 2005) were also reported.

The WTC Worker and Volunteer Medical Screening Program (MSP) was established shortly after 9/11 in order to identify and characterize possible WTC-related health effects in responders. The SUNY- Stony Brook's Long Island Occupational and Environmental Health Center was part of a multi-center clinical screening program that provided free standardized examinations to responders between July 2002 and April 2004. Examinations included medical, mental health, and exposure assessment questionnaires, physical examination, spirometry both pre- and post-bronchodilator, and chest X-ray. In April 2004, SUNY- Stony Brook obtained funding from NIOSH to establish the WTC Medical Monitoring Program (MMP) and later the Long Island Clinic the WTC Medical Monitoring and Treatment Program, both which are the subject of this final report.

RELEVANCE AND IMPACT OF THE LONG ISLAND CLINICAL CENTER OF EXCELLENCE

The Long Island Clinic of the WTC Medical Monitoring and Treatment Program had very small beginnings with expectations of seeing 500 patients in each of the two years of the monitoring program. However, it was soon recognized that the community needs were much greater. Over the 7 years, the monitoring program grew significantly and at the end of Year 7, the cohort size was 6,204 patients, 3,578 of whom were seen for their Monitoring visit in Year 7

and 4,782 of whom are considered active patients (seen in the past 24 months). 50 patients had died and 832 were enrolled for the study but were not yet seen for their first visit. Although we were very pleased to see our clinic growing, it did create several administrative challenges for us. In July 2009, additional funds permitted the securing of a state-of-the-art Clinical Center of Excellence in Islandia, NY and satellite locations in the neighboring Nassau county, as well as clinical and administrative staff focused on building this program of excellence. The result was a refined and robust medical monitoring and treatment program that effectively identified WTC health conditions in the responders and provided them with accessible, comprehensive and high-quality specialized health services on Long Island for their WTC-related health needs.

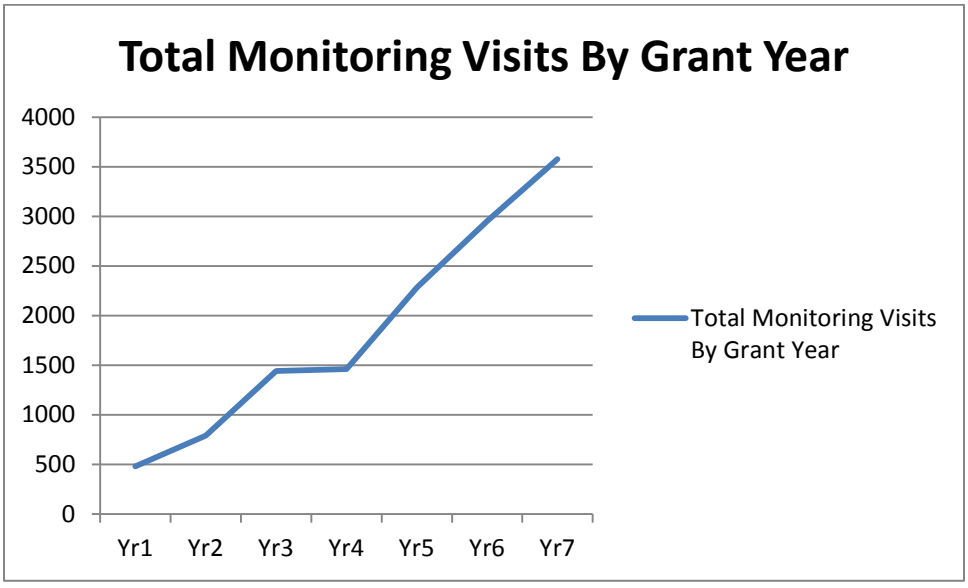
The Medical Monitoring Program

The purpose of the Medical Monitoring Program was to assess the clinical characteristics of WTC responders annually in order to identify the onset of illnesses that could be related to WTC exposures, to collect disease surveillance data and track the illness trends and disease burden in this population. Enrollment was open and rolling throughout the seven years; therefore, each year new patients joined the program and had their first visit (V1).

TABLE 1: Monitoring Exam Volume Data (2010-2011)

	V1	**V2**	**V3**	**V4**	**V5**	**V6**	**Year 7 Volume Total**	**Year 6 Volume Total**
July 2010	53	52	65	64	17	0	251	214
August 2010	45	47	117	55	41	0	305	194
Sept. 2010	54	49	76	69	28	0	276	263
Oct 2010	53	53	66	77	48	13	310	297
Nov. 2010	54	49	85	94	36	8	326	259
Dec. 2010	30	42	55	67	38	20	252	207

Jan. 2011	48	49	57	67	32	19	272	205
Feb. 2011	66	46	56	78	39	26	311	240
March 2011	60	47	66	111	58	34	376	277
April 2011	41	36	56	95	56	23	307	280
May 2011	41	36	59	86	57	23	302	232
June 2011	47	46	72	56	52	17	290	288
Total	**592**	**552**	**830**	**919**	**502**	**183**	**3,578**	**2,956**



Retention rates for the Long Island clinic improved overtime and in the last few years the retention rates range from 65 – 85 %, with a steady increase each year for all visits. The establishment of a retention program in 2008 and the expansion of the clinical center of excellence helped to overcome initial obstacles to retention.

Table 3. Average Retention Rate for Years 6 and 7 (# Completed Visits/# Eligible for Visit)

6 month interval	V2	V3	V4	V5 (from 10/2009)	V6 (from 10/2010)
7/2009-12/2009	71.53	69.47	73.60	73.17	N/A
1/2010-6/2010	74.60	73.85	73.33	72.57	N/A
7/2010-12/2010	77.30	78.55	76.93	77.33	64.86
1/2011-6/2011	78.30	82.65	83.32	83.73	81.50

The retention program of the Long Island Clinical Center of Excellence (CCE) began in earnest in January 2008. At that time, the Long Island CCE consisted of 4,400 eligible WTC responders who chose this CCE as their preferred clinic. The retention rate, although acceptable at the time, was in a range of 60-65%. The following retention program was designed to increase participation in annual monitoring exams at the Long Island CCE and to build community between our clinic and its members. The aim was to create a retention program that cultivated the relationship between the members and the clinic and increased the patient's adherence to his health management program and clinic loyalty.

Since its inception, the retention program steadily improved participation in medical monitoring visits at our Long Island CCE. The retention rates increased even as our cohort size grew from 4,400 in January 2008 to 6,204 in June 2011. By the end of Year 7, our retention rate was in the range of 78-83%, depending on visit type.

Several retention strategies were established to achieve these results. First, a retention database was created so that the retention outreach efforts could be coordinated among the staff and so that the retention coordinator could monitor and analyze the effectiveness of the various strategies. Second, quarterly letters sent to our entire cohort announced developments in the program, introduced new staff members, reported the program's growth, and reminded patients to make their annual appointments. These mailings served two main purposes: 1. the letters helped us communicate regularly with the entire cohort, and 2. the members' address information was updated on a quarterly basis. Since we have started quarterly mailings, the accuracy of our contact information for cohort members improved. The most recent mailing

was sent to 5,229 members and only 1.4% letters were returned due to inaccurate addresses. Third, other direct-to-member mailings targeted patients with no phone information, patients who cancelled or no-showed more than 3 times in a calendar year, and overdue patients who have not responded to phone calls. Fourth, we developed a team approach to retention. The retention team meets regularly to discuss retention goals, discuss problems, generate ideas, and maintain team cohesion. Finally, additional sites increased monitoring slots and making it easier for members to choose an appointment time and place that is convenient to them.

The Treatment Program

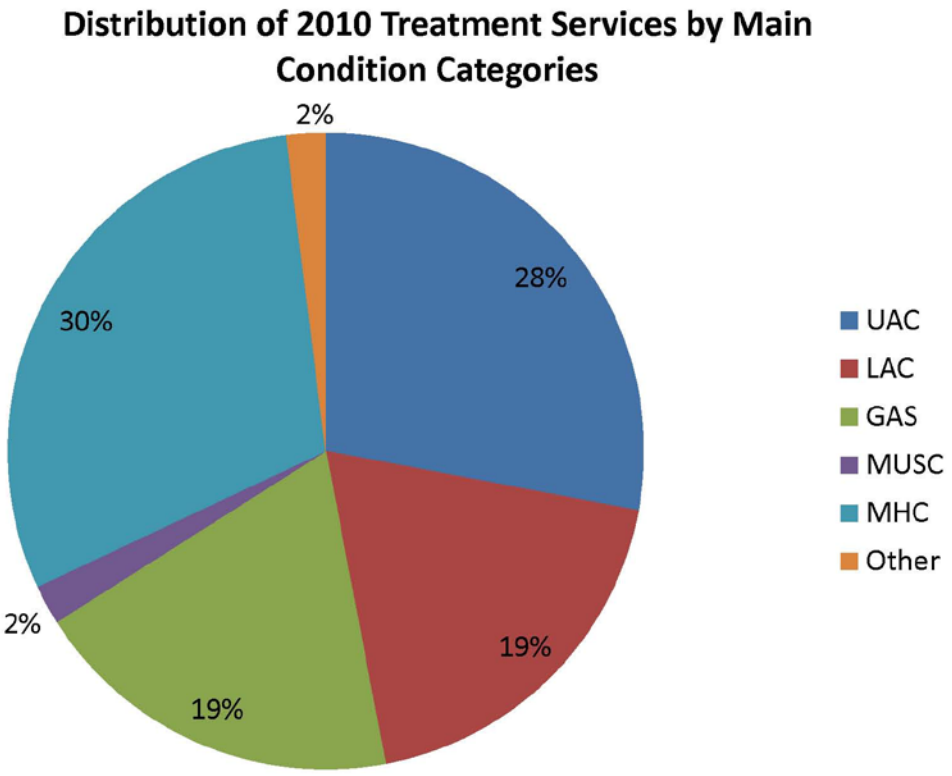
The treatment program that began in 2005 grew in tandem with the monitoring program. As patients were identified with WTC-related illnesses, many were referred to the treatment program at our clinic where they received the bulk of their care. In Year 7, there were 2,859 unique patients utilizing physical and/or mental health services in our treatment program. Of those, 2,485 were only receiving treatment services for physical health conditions and not utilizing our specialized mental health clinical services. Fifty-eight patients were received care exclusively for their mental health conditions. The remainder (n= 316) received combined services for physical and mental health conditions. Below is a chart indicating the month-to-month volume of clinical treatment services rendered at the Long Island Clinic.

Table 4: Treatment Volume Analysis (2010-2011)

	Physical Health Tx Encounters	Mental Health Tx Encounters	Unique Patients	Tx for Physical Health (unique patients)	Unique Patients Receiving Tx for Mental Health problems
July 2010	317	246	389	287	145
August 2010	374	259	440	341	142
Sept. 2010	419	277	482	359	157
Oct 2010	459	256	505	389	150

Nov. 2010	442	244	501	385	150
Dec. 2010	400	266	466	351	152
Jan. 2011	441	231	489	387	143
Feb. 2011	500	248	531	422	142
March 2011	530	344	596	456	181
April 2011	448	315	535	392	185
May 2011	562	364	566	410	193
June 2011	440	334	517	379	180
Total	5232	3385	2859	2802	374

As seen in the above table, patients who received mental health services were seen more often than patients with primarily physical health problems. There were 374 patients seen for mental health visits in Year 7 with a total number of encounters of 3,385; whereas there were 2,802 patients seen for physical health visits with a total of 5,232 encounters. In the pie chart below, the distribution of WTC-related conditions identified at treatment suggests that mental health conditions (MHC) require proportionately more frequent follow-ups and higher utilization of the clinic than most other conditions.



Treatment Model for WTC Health Conditions

Benjamin J. Luft, MD, led the development of a comprehensive and collaborative treatment program dedicated to meet the healthcare needs of the WTC responders it serves by providing high-quality, accessible, and individualized treatment. Our treatment program aimed to assist WTC responders in the management of their WTC-related illnesses, to detect and treat these conditions as early as possible, to encourage high-adherence to prescribed treatment, to identify health risk behaviors that may contribute to symptom burden, to educate the responder on preventive health behaviors, and to provide support services that will help the responders improve their well-being, cope with persistent health conditions and reduce their disability.

The design of the treatment program at Stony Brook is modeled on a modified stepped-care, collaborative model, referred to hereafter as the"Three Component Model." By definition,

the“Three Component Model” is integrative in design, with internists and nurse practitioners, clinical social workers, and specialists (e.g. psychiatrists, clinical psychologists, gastroentronologists, pulmonogists) working together to assist patients to achieve improved health. In addition to this cooperation across provider disipline, the program also integrates care across illness and health domains, for example, management of pulmonary disease that is comorbid with PTSD. Physicians, psychiatrists, clinical psychologists, social workers, and nurses within our network of providers are all trained to focus broadly on health and well-being to supplement a more narrow and traditional focus on specific illnesses or symptoms. Using a broad “Health Risk Appraisal” approach, clinicians assess patients’ major lifestyle risk factors (e.g. medication nonadherence, smoking, risky drinking, sedentary lifestyle) and use motivational strategies to help patients modify specific domains of interest or need. Importantly, our stepped care approach allows for the patient to receive the appropriate level of treatment intervention and best utilizes the resources of the program.

1. Internists, Nurse Practioners and/or occupational medicine specialists who prescribe appropriate psychotropic medications, following general site and project-specific treatment algorithms for PTSD and depression;
2. care (or ‘case’ manager), generally social workers with behavioral health training, who provides ongoing case management services, which involves regular symptom assessment and support, motivational interventions, and coordination of care; and
3. specialists (GI, pulmonogists, psychiatrists/psychologists0, who evaluate and treat those patients refractory to the first level of stepped care, who provide early intervention for more urgent cases, and who provide brief consultative support or treatment for complex cases, with uncertain diagnostic presentations or complex general medical-psychiatric comorbidity.

The Three Component Model is one variant of the more general concept of evidence-based collaborative population-based care for the treatment of mental disorders in general medical settings. Beginning with Katon’s landmark research in 1995, there have been 37 randomized, controlled trials of collaborative care for depression specifically (Katon 2010, McGregor 2011, Katon 2011), and more than 60 peer-reviewed publications, including systematic reviews and

meta-analyses documenting efficacy of collaborative care for other mental disorders, in addition to depression, including PTSD, panic disorder, and generalized anxiety disorder (Berninger 2010, Gilbody 2006, VanLeeuwen 2009, Bower 2006, Engel 2008, Upshur 2008, Chang-Quen 2009, Fortney 2009, Luck 2007, Morgan 2009, Muntingh 2009, Richards 2009). Furthermore, there is even more recent evidence to support the cost-effectiveness of this approach. That is, collaborative care not only provides better outcomes than "care as usual," but the intervention program saves total healthcare dollars compared to usual care (Unutzer2008, O'Malley 2008). While recent reports discuss specific programs focusing on depression in two chronic medical conditions (Katon 2010), to our knowledge, all previous collaborative care reports focus on only one psychiatric disorder (e.g. depression, PTSD, panic, or GAD). Our program is unique, to date, in that we apply the collaborative care approach to patients with multiple general medical conditions (e.g. respiratory, GI, pain, or any other) as well as multiple psychiatric disorders (e.g. PTSD, depression, panic disorder, and generalized anxiety disorder).

Our early experience with this cohort confirmed that a referral program was not going to be an effective method of linking clients with mental health services. We therefore re-evaluated this strategy and determined that providing services on-site would be more successful. Our Collaborative Care program has enabled clients to overcome the following barriers to mental health treatment:

- Personal Barriers: Experience has shown that stigma attached to help-seeking is particularly strong among this population of working males who normally help others.
- Provider Lack of Availability: In Suffolk County, there is a limited supply of mental health providers. This proposal increases patient access to mental health care, provides patient advocacy, and builds collaborations with community psychiatrists who prioritize the mental health interests of this group.
- Financial Barriers: Approximately 50% of our target population has significant financial barriers to accessing treatment, with a large number either uninsured or having severely limited mental health benefits, making care virtually

prohibited. Patients with Worker's Compensation face extreme delays in receiving reimbursement. Furthermore, many of our responders are unwilling to make mental health insurance claims out of concern for privacy and fear of job repercussions. And, among responders, the more debilitated a person is, the less likely they are to have health insurance, but most are not eligible for Medicaid. This proposal will significantly remove financial barriers to care.

- Geographic Barriers – Prior to the initiation of this program, there were no coordinated mental health treatment programs on Long Island directed specifically toward this population.

Because of its extensive evidence base, its efficient utilzation of scarce resources and its demonstrated cost-effectiveness, the collaborative care approach provides a compelling service paradigm as a public health model for disaster relief and the one adopted for implementation at the LI-CCE.

RELEVANCE/ IMPACT OF THE LONG ISLAND CENTER OF EXCELLENCE

Invaluable health surveillance data was recorded and combined with data from other consortium clinics and used for research, reporting, and improving practice standards for the program. Disease surveillance data from this cohort includes individual exposure history, WTC exposure and risk assessment, and use of personal protective equipment, in addition to the health data that is collected at the visits. With this data, conclusions can be drawn regarding the degree that workers were protected against exposure risks, the degree of exposure and its relationship with specific physical health and mental health outcomes overtime, the impact of this disaster on general well-being, functioning, and mortality rates for responders. Due to multiple follow-ups with this population, the long-term effects can be studied. With a diverse worker population and the range of WTC exposure among workers, conclusions can also be drawn regarding the exposure impacts on different groups of workers.

A preliminary study designed and implemented by Dr. Luft and his colleagues at Stony Brook Medical Center examined comorbidity between physical and mental health outcomes in WTC

responders and found the link between WTC exposure and respiratory illness was potentially mediated by PTSD (Psychological Med, 2011). This complex issue has opened to the door to further investigations of the link between mental health symptoms and physical health outcomes following the WTC disaster. Implications from this research include a better understanding of the etiology of WTC-related illness, especially for illnesses that do not respond well to traditional treatment. With this knowledge, treatment strategies can be modified to directly deal with the unique constellation of WTC-related illnesses. We think that if our hypotheses are correct that the development of integrative mental and physical health treatment therapies will enhance the health and well-being of our patients.

Since the WTC disaster, a major focus of WTC responder surveys has been on PTSD (e.g., Gross et al. 2006; Stellman et al. 2008) and respiratory symptoms or abnormal lung function (e.g., Aldrich et al. 2010; Banauch et al. 2005; Tapp et al. 2005). The WTC Registry reported that 12-20% of rescue/recovery workers and volunteers had probable PTSD, and 12% had newly diagnosed asthma since 9/11 (Perrin et al. 2007; Brackbill et al. 2006). Similarly, about 12% of responders participating in the WTC-MMTP had probable PTSD approximately 4 years post 9/11 (Stellman et al. 2008). One year after 9/11, nearly half of this sample reported incident WTC-related upper (49.6%) and lower (39.5%) respiratory symptoms. Among non-smokers, 31% had abnormal spirometry findings (CDC 2004). Two years after 9/11, 3.6% of WTC-MMTP responders had incident asthma (Wheeler et al. 2007).

To date, only one published study examined mental-physical comorbidity (Niles et al., 2011). This study found that baseline WTC-cough syndrome was significantly associated with baseline probable PTSD (OR=3.59; 95% CI=2.9-4.4) and follow-up PTSD (OR=1.7; 95% CI=1.3-2.1). In our own study of comorbidity of respiratory illness and PTSD, we confirmed and extended these findings (Luft et al, 2011 Psychological Medicine).

Our preliminary analyses of the WTC Medical Monitoring and Treatment Program examined responders who were police (N=8,508) and non-traditional responders in other occupations (e.g., building trades, maintenance, communications, transportation, health care, and other volunteers; N=12,333) separately because prior studies have shown that professional responders report fewer mental health symptoms (Perrin et al. 2007; Thormar et al. 2010). A

number of WTC exposures were assessed as part of the protocol. We focused on two indices previously found to be significantly associated with both mental and physical health in the study population (Brackbill et al. 2009; Perrin et al. 2007): working in the dust cloud, which occurred among responders who arrived on 9/11/2001 and worked on or near the pile; and long duration of work at Ground Zero, the Fresh Kills landfill (where debris from the disaster was brought), or the Office of the Chief Medical Examiner. The median duration of work was 633 hours (interquartile range 191-1353 hours). Long duration was defined as being in the top quartile (>1,353 hours).

Probable PTSD was derived from the PCL and was operationalized by scores of 50 or higher. Lower respiratory symptoms were ascertained by physicians based on questions from standard instruments (presence since 9/11 and past month persistence of shortness of breath, wheezing, chest tightness, exercise intolerance, dry cough, hemoptysis, or productive cough was scored as positive). Abnormal pulmonary function was evaluated using the EasyOne^{TM} spirometer following standard techniques. We focused on restrictive breathing pattern, measured by forced vital capacity tests (FVC) and defined FVC abnormality score below the age-sex-race-height-specific lower limit of normal estimated by Hankinson et al. (1999).

As shown in Table 1, the rates of PTSD and respiratory conditions differed significantly for the two groups. The adjusted odds ratio (adjusted for age, sex, BMI, smoking, and time to examination) for respiratory symptoms and probable PTSD was approximate 2.5 in each broad occupational group. Both exposures were associated with an approximately 1.5-fold increase in each of these outcomes.

Table 1. Comparison of police and other responders on study variables[a]

Variable	**Police** (N = 8,508)	**Other** (N = 12,333)	**p-value**
Years from 9/11 to assessment, mean (S.D.)	4.1 (1.8)	3.4 (1.9)	0.000
Current age, mean years (S.D.)	40.8 (6.6)	44.4 (9.9)	0.000
Sex: female, %	15.0	13.9	0.024
Worked in dust cloud, %	28.9	12.7	0.000
Long work on site, %	22.8	26.8	0.000

BMI, mean (S.D.)	30.0 (4.9)	29.3 (5.3)	0.000
Current cigarette smoker, %	10.2	20.3	0.000
Probable PTSD, %	5.9	23.0	0.000
FVC , Abnormal, %	23.7	22.1	0.014
Lower respiratory symptoms, %	22.5	28.4	0.000

[a] Dichotomous variables were compared using chi-squared test and continuous variables using t-test.

We used Structural Equation Modeling, a system of multiple regressions that are estimated simultaneously (Klein, 2011), to compare potential explanations of these cross-sectional associations. Three models were considered, namely: (1) comorbidity between PTSD and respiratory symptoms is due to shared risk factors, (2) respiratory symptoms mediate the link between exposure and PTSD, and (3) PTSD mediates the link between exposure and respiratory symptoms. The latter model received the strongest support and is presented in Figure 1.

Figure 1. Best-fitting Structural Equation Model

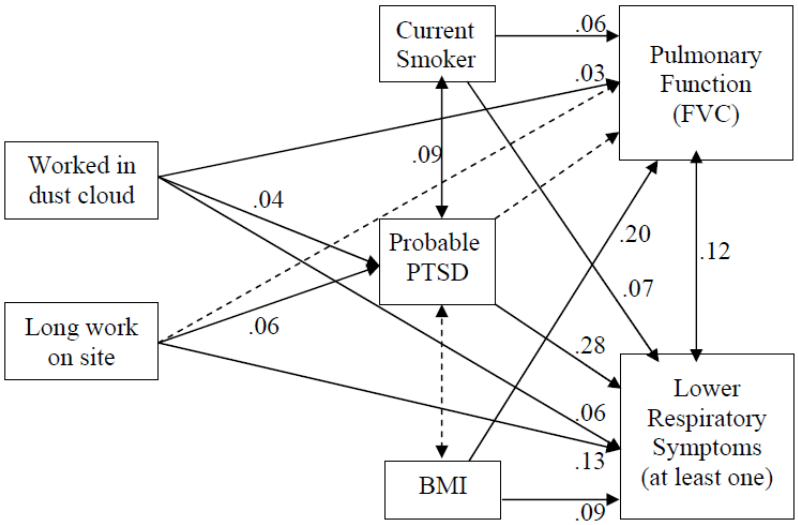


Figure legend. Values are standardized path coefficients. Non-significant ($p > .05$) coefficients are not shown, and the corresponding paths are dashed. Directional arrows indicate regression paths; double-headed arrows indicate correlations. Correlations are adjusted for time to assessment, age, and gender. Correlations among predictors are not shown.

We also examined other common medical problems in this sample, including abnormal lung function (present in 22.8%) as well as asthma attacks (7.6% of the cohort) and symptoms GERD (10.5%) that emerged since 9/11. Probable PTSD was associated with asthma (odds ratio of about 1.7) and GERD symptoms (about 2.3), but it was not related to abnormal FVC. These

results confirm other findings that PTSD is a risk factor for a range of medical problems, but also produced some evidence of specificity.

Several explanations for this comorbidity have been advanced. One possibility is that PTSD increases the risk of medical problems. Indeed, PTSD is associated with immunologic dysregulation (e.g., Schnurr & Jankowski 1999; McEwen & Stellar 1993; Boscarino & Chang 1999), which may increase pulmonary inflammation and autonomic dysregulation resulting in respiratory abnormalities, such as worsening asthma (Blechert et al. 2007). There is evidence from a primary care population that PTSD mediates the effects of trauma on chronic bronchitis and bronchial asthma (Spitzer et al. 2009). Also, the cognitive and attentional processes associated with PTSD may increase perception and reporting of respiratory symptoms (Schnurr & Green 2004; North et al. 2009). Another possibility is that chronic respiratory symptoms could serve as recurrent reminders of the horrors of a traumatic event and elevate PTSD rates (Engel 2004). Thus, respiratory problems may mediate effects of trauma on PTSD. Third, the association between respiratory symptoms and PTSD symptoms may be coincidental, being the result of common risk factors for both conditions although it does not appear that genetics is necessarily the explanation (Goodwin, Fischer & Goldberg 2007). Studies of Vietnam and other veterans suggest that PTSD might in fact mediate the effect of exposure on respiratory symptoms (Schnurr & Spiro 1999). As shown below, our preliminary results are consistent with this hypothesis.

Comorbidity also complicates care. Bills et al. (2008) reviewed studies of PTSD in first responders and concluded that disaster workers needed “accessible mental health treatment service supported by comprehensive postdisaster surveillance…” (p. 115). A promising approach to this question is the collaborative care model that integrates the treatment of mental disorders into general medical settings. Beginning with Katon’s landmark research in 1995, there have been 37 randomized, controlled trials of collaborative care for depression specifically (Katon et al. 2010, McGregor et al. 2011, Katon 2011) and more than 60 peer-reviewed publications, including systematic reviews and meta-analyses documenting efficacy of collaborative care for mental disorders including PTSD, panic disorder, and generalized anxiety

disorder (e.g., Bower et al. 2006; Engel et al. 2008; Muntingh 2009; Upshur & Weinreb 2008). Furthermore, recent evidence supports the cost-effectiveness of this approach. That is, collaborative care not only provides better outcomes than "care as usual," but the intervention program saves total healthcare dollars compared to usual care (O'Malley 2007; Unutzer et al. 2008).

LESSONS LEARNED

The ramifications of long-term health effects affect the worker's well-being, social functioning, job functioning, medical care costs and we suspect, mortality rates. Although this program cannot answer whether or not these risks to health and safety of the WTC worker could have been prevented, it does underline the importance of taking all necessary steps to protect the worker. It is hopeful the findings from this program would inform decision-makers in the event of a future disaster, so that the imprudent practices seen at the WTC Center disaster are not repeated.

PUBLICATIONS

Herbert R, Moline J, Skloot G, Metzger K, Baron S, Luft BJ, Markowitz S, Udasin I, Harrison D, Stein D, Todd A, Enright P, Stellman JM, Landrigan PJ, Levin SM. The World Trade Center disaster and the health of workers: five-year assessment of a unique medical screening program. Environ Health Perspect. 114:1853- 8, 2006.

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Moline JM, Herbert R, Levin S, Stein D. Luft BJ, Udasin IG, Landrigan PJ. Medical monitoring and treatment program: comprehensive health care response in aftermath of disaster. Mt Sinai J Med. 75:67-75, 2008.

Moline JM, Herbert R, Crowley L, Troy K, Hodgman E, Shukla G, Udasin I, Luft B, Wallenstein S, Landrigan P, Savitz DA. Multiple myeloma in World Trade Center responders: a case series. J Occup Environ Med. 51:896-902, 2009.

Skloot GS, Schecter CB, Herbert R, Moline JM, Levin SM, Crowley LE, Luft BJ, Udasin IG, Harrison D, Enright PL. Dynamic Upper Airway Obstruction in World Trade Center Disaster Responders. Submitted to Elsevier, August 2010.

Crowley LE, Herbert R, Moline JM, Wallenstein S, Shukla G, Schechter C, Skloot GS, Udasin I, Luft BJ, Harrison D, Shapiro M, Wong K, Sacks HS, Landrigan PJ, Teirstein AS. "Sarcoid like" granulomatous pulmonary disease in World Trade Center disease responders. Am J Ind Med. 54:175-84, 2011.

Udasin I, Schechter C, Crowley L, Sotolongo A, Gochfeld M, Luft B, Moline J, Harrison D, Enright P. Respiratory symptoms were associated with lower spirometry results during the first examination of WTC responders. Occup Environ Med, 53:49-54, 2011.

Wisnivesky JP, Teitelbaum SL, Todd AC, Boffetta P, Crane M, Crowley L, de la Hoz RE, Dellenbaugh C, Harrison D, Herbert R, Kim H, Jeon Y, Kaplan J, Katz C, Levin S, Luft B, Markowitz S, Moline JM, Ozbay F, Pietrzak RH, Shapiro M, Sharma V, Skloot G, Southwick S, Stevenson LA, Udasin I, Wallenstein S, Landrigan PJ. Persistence of multiple illnesses in World Trade Center rescue and recovery workers: a cohort study. Lancet. 3;378(9794):888-97, 2011.

Luft BJ, Schechter C, Kotov R, Broihier J, Reissman D, Guerrera K, Udasin I, Moline J, Harrison D, Friedman-Jimenez G, Pietrzak RH, Southwick SM, Bromet EJ. Exposure, Probable PTSD, and Lower Respiratory Illness among World Trade Center Rescue, Recovery, and Clean-up Workers. 2011 Psychological Medicine.

FINAL FINANCIAL STATUS REPORT:

The final financial status report follows this brief narrative. A total of $702,080.02 was unspent. The major reasons why this amount was unspent is as follows: $86,679.22 was originally encumbered to meet expenses associated with pharmaceutical costs and the vendor Express Scripts. However, during the transition from this program to the new WTC Health Program, the third party administrator CSC inadvertently processed this payment from their funds. We, therefore, did not process payment resulting in this excess. Furthermore, the establishment of our Brooklyn satellite clinic was postponed by NIOSH. This, combined with the insecurity attached with securing future funding resulted in our not spending restricted funds attached to filling new staff positions. Funds originally identified to meet

indirect rates associated with these hires as also unspent.

FEDERAL FINANCIAL REPORT

(Follow form instructions)

1. Federal Agency and Organizational Element to Which Report is Submitted	2. Federal Grant or Other Identifying Number Assigned by Federal Agency (To report multiple grants, use FFR Attachment)	Page 1 of pages
National Institute Occupational Safety & Health	3U10OH00821605W1S3	

3. Recipient Organization (Name and complete address including Zip code)

The Research Foundation of SUNY, Stony Brook University
Stony Brook University, Office of Grants Management
Stony Brook, NY 11794-3366

4a. DUNS Number	4b. EIN	5. Recipient Account Number or Identifying Number (To report multiple grants, use FFR Attachment)	6. Report Type: Quarterly / ☐ Semi-Annual / ☐ Annual / x Final	7. Basis of Accounting: x Cash ☐ Accrual
804878247	1146013200F7	47076 Dr. Luft		

8. Project/Grant Period From: (Month, Day, Year)	To: (Month, Day, Year)	9. Reporting Period End Date
7/15/2008	6/30/2011	6/30/2011

10. Transactions	Cumulative
(Use lines a-c for single or multiple grant reporting)	
Federal Cash (To report multiple grants, also use FFR Attachment):	
a. Cash Receipts	$ 27,353,379.98
b. Cash Disbursements	$ 27,353,379.98
c. Cash on Hand (line a minus b)	$ -
(Use lines d-o for single grant reporting)	
Federal Expenditures and Unobligated Balance:	
d. Total Federal funds authorized	$ 28,055,460.00
e. Federal share of expenditures	$ 27,353,379.98
f. Federal share of unliquidated obligations	$ -
g. Total Federal share (sum of lines e and f)	$ 27,353,379.98
h. Unobligated balance of Federal funds (line d minus g)	$ 702,080.02
Recipient Share:	
i. Total recipient share required	$ -
j. Recipient share of expenditures	$ -
k. Remaining recipient share to be provided (line i minus j)	$ -
Program Income:	
l. Total Federal program income earned	$ -
m. Program income expended in accordance with the deduction alternative	$ -
n. Program income expended in accordance with the addition alternative	$ -
o. Unexpended program income (line l minus line m or line n)	$ -

	a. Type	b. Rate	c. Period From	Period To	d. Base	e. Amount Charged	f. Federal Share
11. Indirect Expense	Predetermined	26%	7/15/2008	6/30/2011	$ 3,190,738.00	$ 829,591.90	$ 829,591.90
				g. Totals:			

12. *Remarks: Attach any explanations deemed necessary or information required by Federal sponsoring agency in compliance with governing legislation:*

13. **Certification: By signing this report, I certify that it is true, complete, and accurate to the best of my knowledge. I am aware that any false, fictitious, or fraudulent information may subject me to criminal, civil, or administrative penalties. (U.S. Code, Title 18, Section 1001)**

a. Typed or Printed Name and Title of Authorized Certifying Official	c. Telephone (Area code, number and extension)
Ana Maria Goncalves-Lopes **Manager of Accounts Receivable**	631-632-9038 d. Email address OGM_billing@notes.cc.sunysb.edu
b. Signature of Authorized Certifying Official	e. Date Report Submitted (Month, Day, Year) 12/6/11
	14. Agency use only:

Standard Form 425
OMB Approval Number: 0348-0061
Expiration Date: 10/31/2011

Paperwork Burden Statement

According to the Paperwork Reduction Act, as amended, no persons are required to respond to a collection of information unless it displays a valid OMB Control Number. The valid OMB control number for this information collection is 0348-0061. Public reporting burden for this collection of information is estimated to average 1.5 hours per response, including time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding the burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to the Office of Management and