What Is Known?

- World Trade Center (WTC) exposure has been associated with behavior problems in adolescents 6-7 years after the event.
- WTC-related post-traumatic stress disorder (PTSD) among parents has been associated with behavior problems in their adolescents.

What This Paper Adds?

- Even 10-11 years later, adolescents with moderate/severe WTC-exposure were more likely to have behavior problems.
- Adolescents whose parent had comorbid PTSD and at least one other chronic health condition were more likely to have behavior problems than adolescents whose parents had PTSD only or chronic health condition only.
- Parents who reported 14 or more poor mental health days were more likely to have an adolescent with behavior problems.

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Abbreviations: *WTC – World Trade Center, PTSD – Post-traumatic stress disorder, SDQ – Strengths and Difficulties Questionnaire, QoL – Quality of life*

Chronic illness in a family member can create an environment that leads to emotional distress throughout the family, particularly the children. Children may react by isolating themselves, feeling guilty and worrying about changes in parental health. Other reactions can be symptoms of depression, anxiety, as well as withdrawn behavior and physical complaints, all of which describe internalizing problem behavior (Pakenham et al., 2006). Moreover, under these circumstances children may also act out exhibiting externalizing problems through aggressive and delinquent behavior (Diareme et al., 2006). There may also be a combination of externalizing, internalizing, social, identity and thought problems (Rodrigue & Houck, 2001). Effects of parental mental health problems due to 9/11 on child behavior have been reported in a number of studies, most of which focused on younger children (Chemtob et al., 2010; DeVoe et al., 2006; Mann et al., 2015; J. M. Stellman et al., 2008; Stuber et al., 2005). In addition, most of the pediatric studies utilized data gathered in the months after 9/11 and do not represent more recent health or behavioral status. One exception was a study conducted six to seven years after 9/11, which found that behavior problems were signiýcantly associated with 9/11-exposure, fear for oneôs own safety on 9/11, and 9/11-related PTSD in the parent (Mann et al., 2015). All of the previous 9/11 research has focused on the mental health of the parent; in this study we expanded parent health to include physical health conditions and comorbidities.

Exposure to disasters is associated with reduced quality of life (QoL), (Adams & Boscarino, 2005; Slottje et al., 2007; Wen et al., 2012) a concept that broadly refers to an individualôs everyday functioning and well-being (Bayliss et al., 2012). Studies of rescue and recovery workers found that New York City Fireýghters with respiratory conditions had impaired QoL (Berninger et al., 2010). Adams and Boscarino (2005) reported that WTC-exposure was associated with poorer QoL in New York City adult residents one year after the attacks (Adams & Boscarino, 2005). Similarly, another study conducted one year after 9/11 found that QoL was inversely related to mental health symptoms (Simeon et al., 2005). A study conducted 5-6 years after 9/11 found that adults with self-reported diagnosed PTSD and/or PTSD symptoms were more likely to report 14 or more poor mental health days (Brackbill et al., 2013). To date, there have been no studies examining the relationship between parent QoL and adolescent behavior among a 9/11-exposed population.

The ýrst objective of this study was to assess the relationship between

their parents and active outreach to community organizations and schools. Schools south of Canal Street in Manhattan, which included child care centers, nursery schools, and public and private schools with grades kindergarten through 12th (K–12), were contacted by mail and telephone. Registry staff gave presentations about the project to teacher and parent groups. In addition, the New York City Department of Education and several private schools endorsed the Registry project to families with potentially exposed children.

For enrollees less than 18 years of age parents or guardians completed the Wave 1 (enrollment) questionnaire which gathered data on demographics, medical history, 9/11 experiences and exposures, and current health, and, except for sections on mental health, was identical for adults and children. Follow-up surveys (Wave 3) were conducted in 2011-2012. At Wave 3, parents of adolescents completed an “adult” questionnaire that provided data on their relationship to the adolescent, household composition and income, the parentôs own emotional health, and the adolescentôs 9/11-exposures and physical health. Adolescents completed a separate questionnaire about their behavior and mental and physical health, for which a separate return envelope was provided for conýdentiality (S. D. Stellman et al., 2013). Parents who were also Registry enrollees completed a separate survey that i04Fbken by adult enrollees.

Study Sample

Figure 1 shows the development of the two study samples. Wave 3 collected 472 paired parent-adolescent questionnaires. Of these, 449 pairs had complete data on adolescent behavior, and were used in the ýrst part of the analysis. For second part of the analysis we used 176 (of 449) pairs for which the parent was also a Registry enrollee and parent had complete PTSD data. These “enrollee dyads” were used to relate parental comorbidity and adolescent behavior. The Institutional Review Boards of the NYC Department of Health and Mental Hygiene and the Centers for Disease Control and Prevention approved thi04study.

Behavioral Assessment

Behavioral difýculties among adolescents were assessed at Wave 3 (2011-12) using the adolescent-reported Strengths and Difýculties Questionnaire (SDQ). The SDQ i04a reliable screening instrument for child and adolescent behavioral problems that asks about 25 positive and negative behaviors, scored as 0, 1, and 2 for responses of “not true,” “somewhat true,” and “certainly true,” respectively (Bourdon et al., 2005; R. Goodman, 2001; R. Goodman et al., 2000; Richter et al., 2011). Higher borderline and abnormal SDQ scores have been correlated with other questionnaire and interview measures, and clinician diagnoses of child mental disorders (A. Goodman & Goodman, 2009; R. Goodman et al., 2000). The 25 SDQ items are divided into 5 domains: conduct problems, hyperactivity, emotional symptoms, peer problems, and prosocial behavior. A total difýculties score, which sums items on the 4 problem subscales (all domains except prosocial behavior) was used as the outcome of interest. In our analysis, the difýculties scores ranged from 0-40 and were categorized as normal (0–15), borderline (16–19), or abnormal (20–40) as in previou04studies of mental health assessments of children (Anmyr et al., 2012). Abnormal and borderline individual domain scores were combined into a single outcome due to small numbers.

Adolescent 9/11-Exposure

Adolescent 9/11-related exposures were assessed using information from the adolescentôs Wave 1 questionnaire as reported by a parent proxy, the Wave 3 parent questionnaire, and the Wave 3 adolescent questionnaire. Exposures included direct exposure, family WTC exposure, and a combined index. Direct exposure, reported at Wave 1, was deýned as having experienced two or more

of the following on 9/11: (1) witnessed one or more disturbing events during and after the WTC attacks (airplane crashing into a tower, buildings collapsing, people running away from a cloud of smoke, or people being injured, killed, falling, or jumping from one of the towers), (2) sustained an injury as a result of the attacks (burn, broken bone, concussion, cut, sprain, or other injury), (3) was caught in the dust cloud that resulted from the collapse of the WTC towers, (4) evacuated from school, and (5) thought loved one might be injured or killed on 9/11. Family exposure, reported by the parent on the Wave 3 survey, was deýned as having a family member (mother, father, sibling, grandparent or any other family member) who was injured or killed in the attacks, or was in the WTC disaster and escaped unharmed. At Wave 3, adolescent reported fear for personal safety on 9/11 was also assessed in addition to direct and family exposures.

Parental Health Measures

In Wave 3, parent-enrollees were asked whether they had ever been told by a doctor that they had any of the listed health conditions. Chronic health conditions selected in this analysis have

Smith et al., 1999) and it has demonstrated strong psychometric properties (sensitivity=0.94ï0.97, speciýcity=0.86ï0.99) in other populations using a cutoff of 44 (Blanchard et al., 1996; Ruggiero et al., 2003). Comorbidity of chronic conditions and PTSD was deýned as co-occurrence of any of these six types of self-reported diagnosed chronic conditions and probable PTSD.

Parental Quality Of Life Measures

Quality of life (QoL) for the parent enrollees was measured at Wave 3 by the number of days the parent reported poor physical or mental health out of the past 30 days. Consistent with other studies (Caramanica et al., 2014; Zahran et al., 2005), respondents were classiýed as having poor QoL if they reported 14 or more days in the past 30 days in which their physical or mental health was not good.

Statistical Analyses

Bivariate associations between SDQ score categories and demographic indicators were assessed using Pearsonôs chi-squared test. For the ýrst phase of analysis on the 449 adolescent-parent survey pairs, multivariable logistic regression was used to estimate associations between 9/11-exposures and SDQ score, adjusting for demographic variables that were signiýcantly associated with SDQ score in bivariate analyses. The second phase of analysis on the 176 parent-adolescent enrollee dyads, examined the associations parental health and QoL measures and adolescent SDQ score using multivariable logistic regression models comparing individuals scoring in the abnormal or borderline range with those scoring in the normal range. All analyses were performed using SAS software version 9.4 (SAS Institute, Inc., Cary, NC), and tests were 2-sided with a signiýcance level of $P < 0.05$.

RESULTS

Demographics and SDQ Status

Demographic characteristics, household information, indication of health care need and utilization, and adolescentsô SDQ score are presented in Table 1 for phase one analysis of 449 pairs. This analysis included adolescents aged from 10-18 at Wave 3, with approximately two-thirds (62.1%) in age group 10-14 years. Boysô and girlsô sample size are about the same (50.3% and 49.7% respectively). Over half of the sample population was non-Hispanic white (53.7%), and about two-thirds of them reported household income of more than $75,000 in 2010 (62.9%). Only 15.5 % of adolescents lived in one-parent household, and 7.8% parents reported unmet health need for the children while one-ýfth (18il

to a professional about the childrenôs mental or emotional problem during the preceding year. Twenty-one percent of adolescents reported having ever smoked, drank alcohol, or used marijuana. In addition, 2.9% of adolescents screened positive for PTSD.

Among 449 adolescents in the study, 393 (87.5%) had normal SDQ scores and 56 (12.5%) had abnormal/borderline SDQ scores. Two sociodemographic characteristics were signiýcantly associated with SDQ score: lower household income at 2010 (Ò$75,000 per year, P-value=.0046) and living in a single-parent household (P=.0126). Parent report of the child having unmet health care need in last 12 months (P<.0001) and having talked to a professional about childôs mental or emotional problem in last 12 months (P<.0001) was associated with SDQ score. In addition, SDQ score was associated with adolescents with probable PTSD (P < 0.001).

Adolescent SDQ and 9/11-Exposure

Almost 81% of adolescents had severe/moderate WTC exposure (Table 2). Among the 449 adolescents, 34.7% had a family exposure with 1.3% having a family member who died in the attacks. Fourteen percent of adolescents thought that their parent(s) might be hurt or killed in the attacks. For adolescents with mild WTC exposure, 5.8% had abnormal/borderline SDQ scores, compared to 14.0% of adolescents with severe/moderate exposure. Among those adolescents with a family exposure, 16.0% had abnormal/borderline SDQ while 10.6% had abnormal/borderline SDQ scores among those without a family exposure. Among adolescents who reported fearing that their parent(s) might be hurt or killed in the attacks, 20.6% had abnormal/borderline SDQ scores, compared to 11.1% of adolescents who did not report fearing for their parentsô safety (Table 2).

The adjusted odds ratio (AOR) for the association between more severe 9/11-exposure index and abnormal/borderline SDQ score was 2.4 compared with those with milder exposure (95% Conýdence interval (CI): 1.1-6.4) (Table 2). After 10 years, direct 9/11-exposure was not associated with SDQ, but having any family exposure to the 9/11-attacks was associated with abnormal/borderline SDQ score compared to those adolescents who did not have a family exposure (AOR:2.0; 95% CI: 1.1-3.7). Also, adolescents who reported fearing for their parent(s) safety on 9/11 were 2.3 times more likely to have an abnormal/borderline SDQ score compared to those adolescents who did not fear for the safety of their parent(s) (95% CI: 1.1-4.8) (Table 2).

Adolescent SDQ In Relation To Parent Health

In part II of the analysis, using the 176 parent-adolescent enrollee dyads, we examined parental factors that inþuenced SDQ among adolescents. Adolescent SDQ was not associated with a parent who had either PTSD-only or at least one chronic condition (Table 3). However, having a parent with both PTSD and at least one chronic condition had a signiýcant four-fold odds of having abnormal/borderline SDQ score compared to those adolescents whose parent had no health conditions (AOR=4.2; 95% CI:1.4-13.2). Moreover, in a more general measure of parental health status, parents who reported 14 or more days of poor mental health in the past 30 days were three times more likely to have adolescents with abnormal/borderline SDQ scores, as compared to those whose parent reported 13 or fewer days (AOR=3.4; 95% CI: 1.2-9.5). There was no signiýcant association between parents reporting 14 or more days of poor physical health a month and adolescentôs SDQ score (Table 3).

Limitations

Among the limitations is that the 449 adolescents represent

problems in adolescents, such as parenting style, parent substance use, or peer inþuence.

of mothers with only one disorder (Nomura & Chemtob, 2009). Healthcare practitioners should be aware of the relationship between parent health and adolescent behavior and refer children with problem behavior to health professionals provding interventions. It is recommended that medical doctors receive education about how illness can impact families and how to treat behaviors and emotional problems of family members (Gorter et al., 2010).

A number of theories that may help to explain the association between parental exposure to traumatic events and their childrenôs reactions have been proposed. These include the childôs biological predisposition, impaired parenting connected to mental health problems, childôs modeling from parentsô actions, and mutually experienced social milieu, such as SES and inadequate social support, or other environmental exposure or factors (Schwartz et al., 1994). It is also known that parents with a psychiatric disorder are more likely to exhibit maladaptive behavior, which is associated with psychiatric symptoms in their children (Johnson et al., 2001). According to the stress and coping theory, the threat of worsening parental health is considered a continuous stressor exceeding childrenôs coping resources and increasing the probability of problem