FINAL PROGRESS REPORT

Project Title:

Mental Health Impact and Service Use among Asian Survivors and Rescuers Exposed to the WTC Attack

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List of Terms and Abbreviations

WTC – World Trade Center

9/11 – September 11, 2001

The Registry – The World Trade Center Health Registry

PTSD – Post-traumatic stress disorder

LRS – Lower Respiratory Symptoms

Whites – Non-Hispanic White Americans

Asians – Asian Americans

UMHCN – Unmet mental health care need

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Abstract

The impact of the World Trade Center (WTC) attack on those directly exposed to it is long-lasting, and affects their day-to-day living. Asian Americans constituted a sizeable proportion of those exposed due to the proximity of Chinatown to the disaster site and a large number of South Asians working around WTC. However, the number of studies that examined the impact on Asian Americans' mental health and mental health service use remains small.

Based on the WTC Health Registry (the Registry) data we compared between Asians and Whites. We found that Asians showed persistently high prevalence of short-, medium- and long-term diagnosable PTSD throughout the 3 waves of data collected (2-3, 5-6 and 10-11 years post 9/11), ranging from 15.6% to 17.6%, which were 5 times higher than in a non-clinical community population (3.5%). For short-term PTSD, Asians showed a significantly higher prevalence than Whites (14.6% vs 11.7%). Comparing short- to medium-term PTSD change, Asians showed a higher proportion of "chronic" PTSD (which persisted over time; 8.6% vs. 7.4%), but a lower proportion of being resilient (no PTSD at both times, 76.5% vs 79.8%). However, long-term PTSD prevalence did not show significant racial difference (15.1% vs 14.4%).

The risk and protective factors for PTSD indicated racial difference in relation to socioeconomic status. Asians had significantly lower socioeconomic background, with less coping resources. Risk factors which increased the odds of PTSD included low income, having job loss due to 9/11, and being immigrants. However, some factors which decreased the odds of PTSD for Whites were not protective of Asians – higher education and being employed were protective of Whites but increased odds for or had no effect on Asians. Higher disaster exposure and the presence of lower respiratory symptoms, e.g. shortness of breath or persistent coughing, were universal risk factors of PTSD for both races.

Regarding mental health service use, Asians showed a much lower prevalence within the past 12 months (15.8% vs. 26.6%). Service use was greatly driven by individuals' mental health conditions: having 14 or more poor mental health days in the past month, having serious psychological distress, and having a mental health diagnosis after 9/11 increased their odds for

service use. Previous mental health access and having routine medical checkup also increased Asians' mental health service use.

Our study clearly points to the need for outreach efforts to Asian Americans who had persistently high PTSD prevalence, low coping resources, and low mental health service use. Our findings signals specific Asian subgroups to target such efforts: those who had low household income, job loss due to the attack, immigrant status, high WTC exposure, and pre 9/11 mental health diagnosis (including depression and anxiety disorder). Given the low mental health service use among Asians due to strong stigma, inadequate bilingual mental health services, and their tendency to seek help for physical manifestations of psychological distress, a "bridge" between medical and psychiatric services whereby both services are available on one site could promote mental health service use.

Section 1

Key Findings

Diagnosable PTSD prevalence and PTSD risk factors among Asian Americans: Based on the World Trade Center Health Registry data, we found that Asian Americans exposed to the WTC attack, had a significantly higher *shorter-term PTSD prevalence (2-3 years* after the attack) compared to the White counterpart (14.6% vs 11.7%). In investigating factors associated with PTSD, we found some striking racial contrasts related to socioeconomic status. While higher education and being employed reduced the odds of having diagnosable PTSD for Whites, it increased such odds for Asians. However, being immigrants was a risk factor for Whites but had no effect for Asians. Lower income levels, higher exposure to the disaster, and the presence of Lower Respiratory Symptoms (including shortness of breath, severe coughing, and wheezing) were all universal risk factors associated to the increased odds for PTSD in both races.

We also investigated the short to medium term *PTSD change pattern (from 2 to 6 years after the attack)*. Asians, compared to Whites, had a lower proportion of being "resilient" (having no PTSD at both time points) (76.5% vs. 79.8%), but a higher proportion of "chronic" pattern (having PTSD at both times; 8.6% vs. 7.4%), while a similar proportion showed "delayed-onset" (with PTSD only at the latter time; about 9%). At 5-6 years following the attack, still a high proportion of Asians (17.6%) had diagnosable PTSD. For factors associated with the PTSD change pattern, we found that while in general higher socioeconomic status was protective against poorer outcomes of chronic or delayed-onset PTSD for both races, education and employment had no significant effect on Asians (same situations as in shorter-term PTSD). However, being an immigrant, having higher direct disaster exposure, and the presence of Lower Respiratory Symptoms were universal risk factors for both races. We also found that Asians who had depression/anxiety disorder before the attack had a higher risk than Whites to have delayed-onset of PTSD.

For *longer-term diagnosable PTSD* (10-11years after the attack), the prevalence rate between Asians and Whites was comparable (15.13% vs. 14.36% respectively). For Asians, risk factors for PTSD included job loss due to 9/11, immigrant status, disaster exposure, Lower Respiratory Symptoms, prior PTSD change pattern, and previous mental health service use. While these risk factors were also significant for the White group, there were significant protective factors which helped to decrease the odds of PTSD for Whites, including older age, social support, and higher education, but they conferred no protection for Asians.

Mental health service use among Asian Americans: A much lower proportion of Asians than Whites had used mental health service within the past 12 months 5-6 years after the attack (15.8% vs. 26.6%). Results indicated that for Asians who had 14 or more poor mental health days in the past month, serious psychological distress, diagnosable PTSD, a mental health diagnosis after 9/11, and routine medical check-up significantly increased their odds of receiving mental health service in the past 12 months; women compared to men, and those <u>not</u> in a conjugal relationship compared to otherwise, were also more likely to have used mental health service. While these factors also significantly enhanced service use for Whites, there were some factors that enabled mental health service use for Whites but had no significant effect on Asians, namely, higher education and higher income.

Translation of Research Findings and Public Health Relevance

Our study findings indicated that Asian Americans were greatly impacted by the World Trade Center attack, exhibiting much higher prevalence of diagnosable PTSD short term (2-3 afterwards), medium term (5-6 years) and long term (10-11 years) at 15%-18%, which is much higher compared to that of the general population (3.5%). We found a significantly higher rate for Asians than the White counterpart in short-term PTSD in the comparison study. The short to medium term PTSD change pattern also indicated poorer outcome for Asians, with higher proportions of chronic and delayed-onset PTSD, and a lower proportion of being resilient compared to Whites. All these findings point to the need for *outreach efforts* to target Asian Americans exposed to the WTC attack and other disasters to bring them to mental health treatment in order to reduce the long term psychological distress. Our study on mental health service use also showed a significantly lower prevalence compared to Whites. This is in line with the entrenched and well-known tendency of Asian Americans to underutilize mental health service compared to all other racial groups as highlighted in the Surgeon General Report in 2001 on culture, race and ethnicity in mental health, and in many recent studies.

Our findings also revealed the overall vulnerability of Asians in terms of their more disadvantaged socioeconomic status which left them with less coping resources in face of the trauma. Some socioeconomic factors such as higher education and employment status did not confer the same protection to them compared to Whites, likely attributable to immigrant status and significantly higher proportion with very low income. Outreach effort together with free or low-cost service provision would be important to bring them to treatment and to ensure follow up, since premature dropout is another cause of Asians' underutilization of service use. Targeted outreach efforts can be directed to risk factors that we found significantly associated with diagnosable PTSD and to barriers to service use. They include: 1) the large percentage of individuals from very low household income or those who were not fully employed; 2) those with high direct disaster exposure; 3) those who lost their jobs due to the WTC attack; 4) those with previous mental health disorders, including depression, PTSD and anxiety disorder; and 5) those with Lower Respiratory Symptoms.

Based on the higher proportion of Asians than Whites in reporting the somatic manifestation of the PTSD symptoms, the strong association between PTSD and Lower Respiratory Symptoms, and the higher odds of those with routine medical check-up to receive mental health treatment in our study, the role of primary care physicians to detect mental disorder is vital. This is especially important to Asians due to their strong cultural stigma against mental illness and mental health treatment. Furthermore, an effective "bridge" between medical and psychiatric services could be built whereby both services are available on one site to facilitate referral and to reduce the stigma in mental health service use among Asians.

Due to the very high long-term PTSD prevalence among Asians (as well as Whites), outreach efforts such as the WTC Health Registry's Treatment Referral Program should be continued for an extended period, and staffed with bilingual personnel given the high percentage of Asians being immigrants (76.4%) and many non-English-speaking. Bilingual mental health services are also needed to engage them in treatment. While the finding that previous mental health service use (5-6 years before) was associated with higher risk of PTSD may indicate seriousness of symptoms warranting treatment earlier on, it may also shed doubt on the effectiveness of the treatment. Competent, effective bilingual mental health services are needed for Asian Americans.

Section 2: Scientific Report

Study Background

The impact of the World Trade Center (WTC) attack on those directly exposed to it is long-lasting and affects their day-to-day living. Due to the proximity of Chinatown to the disaster site and a large number of South Asians working in the WTC and nearby buildings (Asian American Federation of New York, 2003), Asian Americans constituted a sizeable proportion of those exposed to the attack. While dozens of studies have investigated the mental health impact of the attack on the survivors, few have included Asians in their study samples. Since a majority of Asian Americans in New York City are immigrants, acculturation stress and the prolonged economic setbacks around Chinatown following the attack might aggravate the stress they experienced (Asian American Federation of New York, 2003).

Asians Americans also showed a striking pattern of underutilization of mental health service for decades compared to all other races (U.S. Health and Human Services, 2001). The WTC attack offers a unique test case to understand the impact of PTSD among Asians, to see if the wide recognition of the devastating consequences of WTC attack had ameliorating effect on service use, and if 9/11-designated programs offered to the public succeeded in reaching out to Asians. This project targets the Asian community and attempts to assess factors related to the mental health impact of the trauma to individuals directly exposed to the attack, and to understand their mental health service use patterns in order to be more effective in targeting outreach efforts to bring needed care to them. To address these questions we employed the secondary data from the largest multi-wave longitudinal study, the WTC Health Registry (the Registry), which has over 70,000 individuals enrolled (over 4,800 Asians) at baseline, who were directly exposed to the attack.

Culture influences how mental health issues are experienced by shaping symptom manifestation when faced with trauma (Kung & Lu, 2008). Asian culture was noted for its tendency to embody experiences of psychological distress (Kleinman, 1982) and ascribe greater legitimacy and less stigma towards the use of primary care physicians to address physical symptoms arising from emotional distress. Comorbidity of physical and mental health symptoms may also increase their help-seeking behavior (Kleinman, 1982).

Specific Aims

The following specific study aims were set:

Aim 1. To assess the short-, median-, and long-term mental health impact of the WTC attack on Asian Americans, its course and related risk factors, and make comparisons to those of the Whites.

Aim 2. To examine patterns of mental health service use and identify enabling factors vs. barriers affecting service use among Asian Americans, and compare them with these factors among Whites, to better understand racial disparities.

Aim 3. To examine the relationship between psychological distress and medical care use among Asians vs. Whites, and the impact of comorbidity of psychological and physical distress on their use of medical care service, to illuminate processes underlying racial disparities.

Since the Registry data we use only indicate health care use under the categories of specific disorders, such as Lower Respiratory Syndrome, heart problems and mental health problems, we investigate Aim 3 directly and separately. Instead, we manage to address this aim by comparing between the two races on the physical manifestations of PTSD symptoms, and the association between PTSD and Lower Respiratory Symptoms which were increasingly noted to have co-occurrence in studies of the WTC attack.

Aim 1

To assess the short-, medium-, and long-term mental health impact of the WTC attack on Asian Americans, its course and related risk factors, and make comparisons to those of the Whites.

Efforts Summary

To attain aim 1, our team conducted three separate independent empirical studies to examine: (1) Probable PTSD prevalence and PTSD risk factors among Asian Americans 2-3 years after the WTC attack; (2) PTSD change pattern from 2 to 6 years after the attack among Asian Americans. (3) Probable PTSD prevalence and PTSD risk factors among Asian Americans 10-11years after the WTC attack. In addition to understanding the conditions of Asians in order facilitate outreach efforts to high risk groups, comparing their conditions against Whites as a reference group could also facilitate discernment of the risk and protective factors that may be race-specific to Asians.

Study 1

Purpose

This study examines the probable PTSD prevalence and PTSD associated factors among Asian Americans 2-3 years after the WTC attack, and comparing them to those of Whites. The baseline data was chosen since it preserves the largest number of participants before dropouts in subsequent waves.

Method

Analytic Sample

We employed data collected 2-3 years after the attack by the Registry. We excluded deceased enrollees (information was provided by proxies thus lacking information on PTSD), those with pre 9/11 PTSD diagnosis (high recurrence risk following another trauma overshadows more recent factors [Cukor et al., 2011]), without imputable score measuring PTSD, and of $\geq$90 years of age (with no specific age given) from originally 4,885 Asian and 43,712 White participants aged $\geq$18 years. The final sample consisted of 4,721 Asian and 42,862 White study participants.

Measures

PTSD. The major mental health outcome was based on the PTSD Checklist (PCL, Weathers, Litz, Herman, Huska, & Kea, 1993) specifically worded about the 9/11 event. The scale is a self-report 17-item validated measure inquiring about symptomology in the last 30 days. Response ranged from "1" to "5"; higher scores indicated more PTSD symptomology. A cut-off score of ≥44 as used, which demonstrated the highest levels of diagnostic efficiency (sensitivity=94%, specificity=96%, and diagnostic efficiency=90%; Blanchard et al., 1996).

Disaster exposure. It was based on 6 dichotomous variables: 1) located in a collapsed/damaged building during the attack; 2) dust cloud exposure; 3) witnessed ≥3 horrific events (e.g., saw a plane hit a tower, someone falling from the tower, etc.); 4) sustained any injury (excluding eye irritation); 5) was a rescue, recovery or cleanup worker; 6) evacuated from residence for ≥48 hours.

Lower Respiratory Symptoms (LRS). It was defined as positive if respondents reported new or worsening symptoms for one of the following: shortness of breath, persistent coughing, and wheezing since 9/11.

Statistical Analyses

We calculated summary statistics to describe participants' characteristics and the proportion of probable PTSD together with specific somatic symptom manifestations for the Asian and White groups, and compared across race using chi-square and t-tests. We examined the bivariate associations between each variable and PTSD by racial group using chi-square tests and examined for racial difference for the associations. We then employed logistic regression models to examine the associations between PTSD and the risk and protective factors of interest for each race. Adjusted odds ratio (AOR) and 95% confidence interval (CI) were derived from the estimated model parameters. We used the Wald test to detect racial difference for each of the model parameters for associations between PCL and the factors. P-values were adjusted for multiple tests using the Hochberg method (Hochberg & Benjamini, 1990) to control for family-wide error rate. We set the significance level at 0.05.

Results

Participants' characteristic: **(1) Social demographic characteristics:** Asians generally have a poorer pattern of socioeconomic characteristics than Whites. Compared to the White group, Asians had larger proportions of younger and older (≥ 65) participants, had more female, and were somewhat less likely to be married/cohabiting. Asians were less educated overall, particularly having greater proportions of high-school graduates or less (30.1% vs 20.0%), and lower proportions with "some college/technical training" (13.6% vs 22.9%). Asians reported more than twice the proportion as Whites earning <$50,000 (42.9% vs 19.9%). The unemployment rate among Asians (27.6%) nearly doubled that of Whites (14.0%). Lastly, 1/3 of Asians were immigrants, which contrasted with 5.4% of Whites. **(2) Disaster exposures:** Asians and Whites had similar proportions of being "in collapsed/damaged buildings" , "amidst dust cloud", and "witnessing ≥3 horrific events". However, Asians had a larger proportion of being "evacuated from their residence" than Whites (4.3% vs. 2.6%), while a smaller proportion were injured (12.9 % vs. 16.8%). Half of White participants were "rescue or recovery workers" compared to 15.4% for Asians. **(3) Mental health and health conditions:** Asians reported a

higher proportion of having probable PTSD (14.6% vs. 11.7% in Whites) and Serious Psychological Distress (SPD; 8.0% vs 5.7% in Whites). No racial difference was found for Lower Respiratory Symptoms (LRS, 51.7% Asians vs. 51.9% Whites). For somatic manifestations within the PCL, a higher proportion of Asians had physical symptoms such as heart pounding and trouble breathing when reminded of the disaster compared to Whites (18.3% vs. 13.3%, respectively, $p<0.0001$). For sleep disturbance, Asians' higher proportion vs. Whites' was marginal (28.8% vs. 27.5% respectively, $p=0.06$).

Bivariate associations of factors with PTSD: **(1) Overall associations for both races:** Higher proportions of probable PTSD were found in individuals who were of middle age, female, lower income, "divorced/separated/widowed", immigrants; having experienced direct exposures of being "in collapsed/damaged buildings", "in dust cloud", "having witnessed horrific events" and "sustained injury"; and having LRS. **(2) Racial differences:** Asians had higher proportions of probable PTSD than Whites in those whose ages were from 45-64, those with higher education, higher income, employed, US-born, and those who were married/cohabiting. However, Asians who were "never married" had a lower proportion of probable PTSD than Whites. Striking racial contrasts were particularly noted in education and current employment status, whereby generally speaking, less proportions of better-educated and employed Whites had PTSD compared with Asians. Higher proportions of immigrants had PTSD than their US-born counterparts for both races, but the difference was greater for Whites than Asians**. (3) Disaster exposures:** Asians tended to have higher proportions of probable PTSD than Whites in all exposure categories except for evacuated residence. **(4) LRS:** Participants having LRS were highly associated with PTSD for both groups but showed no racial difference.

Associations with PTSD in regression models*:* **(1) Associated factors for Asians:** Among Asians, probable PTSD was related to age, sex, education, income and marital status. Being in the youngest and the oldest group compared to the prime years of 25-44 were significantly protective; while being female, having low income, and having education more than high school education were at higher risk. Compared to those married/cohabiting, the odds of probable PTSD were higher for "divorced/separated/widowed" individuals while lower for those "never married". Immigration status and recruitment source were unrelated to probable PTSD. Having LRS and having exposure related to "injury", "witnessed ≥3 horrific events," and "in dust cloud" increased odds of probable PTSD**. (2) Racial comparisons on socio-demographics:** After adjusting the p-values to control for family wide error rate due to multiple tests, we found that education, current employment and immigration status were significantly different at the 0.05 level in their associations with probable PTSD. For Whites, higher education was clearly protective, with a risk reduction for "college graduates" (42%) and "graduate training" (51%), relative to high-school education or less. To the contrary, for Asians, several higher education categories elevated the odds for PTSD, including "some college/technical training"(33%) and "college graduates" (40%). The effect of being employed continued to be contrasted between races – being employed had no significant impact on Asians but attenuated PTSD risk by almost half for Whites. Finally, being an immigrant remained a risk factor for Whites (AOR=1.61) but had no significant impact for Asians. **(3) Disaster exposures as universal factors:** The highest impact from exposure for both races came from injury (Asians: AOR=2.69, Whites: AOR=2.21). Having "witnessed ≥3 horrific events" and "being caught in the dust cloud" were also significant for both races. "Being rescue or recovery workers" attenuated the risk for Whites significantly though did not reach significance for Asians. None of the exposure factors showed racial

differences. **(4) LRS:** Of all the factors, having LRS showed the greatest odds for PTSD (AOR=3.55 for Asians; 3.86 for Whites), but with no racial difference.

Discussion

Unique Study Contribution: This study is unique compared to other Registry's studies in that it focuses on addressing the mental health impact of the WTC attack among Asian Americans specifically, with a focus on understanding the significant factors affecting PTSD in Asians. Also, unlike other studies on Asians (De Bocanegra & Brickman, 2004; De Bocanegra, Moskalenko & Kramer, 2006) we used Whites as an explicit reference group. This investigation examined participants across different eligibility groups who were exposed, such as responders or residents of Lower Manhattan, thereby providing a more comprehensive picture of affected populations within the two races.

High prevalence of probably PTSD among Asians: Asians reported a very high proportion of having probable PTSD (14.6%), more so than Whites (11.7%), and is comparable to the 15% of civilian survivors from the two collapsed WTC buildings (Digrande, Neria, Galea, Brackbill, & Pulliam, 2011) and higher than the rescue and recovery workers (Perrin et al., 2007), indicating a very high mental health impact on this group. Our study supports the general finding in other Registry studies that being Asian was a risk factor for PTSD compared to Whites (Bowler et al., 2010; Digrande et al., 2011; Nair et al., 2012). However, our findings differ from other WTC studies which indicated that being Asian was protective of developing PTSD (Bonanno, Galea, Bucciarelli, & Vlahov, 2007; Galea et al., 2002), likely due their broader sampling frames including individuals not directly exposed to the attack and Asians being more acculturated as indicated by English being the language interviewed.

"Model minority" myth of Asians challenged: Our findings also reveal a very different picture from large-scale epidemiological studies (Asnaani, Richey, Dimaite, Hinton, & Hofmann, 2010; Roberts, Gilman, Breslau, Breslau, & Koenen, 2011) whereby lifetime PTSD and the risk of developing PTSD after a traumatic event were the lowest in Asians among all races. Our study, which has the methodological advantage of comparing a sizeable sample of Asian Americans and Whites following the same traumatic event, thus challenges the "model minority" myth of Asians having better mental health relative to other races (Sue, Chu, Cheng, & Saad, 2012).

"Race-specific" differential association of socioeconomic status with probable PTSD: Asian participants clearly came from more disadvantaged socioeconomic background than Whites and may have less resources to cope with the tremendous stresses following the disaster. Moreover, some demographic factors that were related to economic resources showed striking racial contrasts: **(1) Education:** Higher education was risk factors for Asian Americans but protective of the Whites. For Whites, more education might be associated with more resources in terms of knowledge and social capital to cope with aftereffects of the trauma. For the mostly immigrant Asians, their educational attainments often do not positively correlate with economic or occupational accomplishment since their qualifications and work experiences are not recognized in their host countries (Kim & Sakamoto, 2010; Zeng & Xie, 2004). **(2) Employment status:** Being employed may not confer the same protection for Asians as it does for Whites, likely due to underemployment and the menial nature of their jobs (e.g., restaurant, service industry), as reflected in their much greater proportion earning less than $50,000 household income compared to Whites. **(3) Immigrant status:** The larger Asian immigrant communities in New York City likely provided more social support than was available for White immigrants so that the

immigration status posed higher risk for the Whites but no significant impact on Asians when other factors were controlled for.

"Universal" impact of direct exposure and LRS on probable PTSD: The following two factors seemed to be universal factors associated with PTSD without significant racial differences: **(1) Direct exposure:** As expected, direct exposure increased the odds of probable PTSD with no racial differences. Although being rescue or recovery workers could have exposed individuals to higher risk, their training might have better prepared them to deal with such impact (Bowler et al., 2010) resulting in this being more of a protective factor which attained significance for Whites but not Asians (which has smaller n, and the AOR was protective in nature). **(2) LRS:** the association of LRS with PTSD was found to be strong in both races (increasing the odds by more than 3 times), as was reported in other Registry studies (Friedman et al., 2013; Shiratori & Samuelson, 2012). Despite our hypothesized racial difference in the association of somatic and psychological symptoms as manifested in LRS and PTSD, our results did not reflect such differences, although Asians had a higher proportion of disaster-related somatic manifestation of PTSD symptoms than Whites. Perhaps the mutually reinforcing nature of PTSD and LRS resulted in an intensification of both illnesses (Friedman et al., 2013) thus outweighing Asian culture's tendency to focus on their somatic expression of distress and to downplay their psychological distress to avoid stigma.

Summary and Conclusions

The economically disadvantaged Asian Americans directly exposed to the 9/11 attack had higher prevalence of probable PTSD compared to Whites. Socioeconomic factors which were protective for the Whites either had no effect on or became a risk factor for Asians, thus leaving them with less resources to cope with the trauma and more vulnerable for psychological distress. Targeted effort to reach out to Asians is essential for prevention and follow up treatment given this group's striking history of underutilization of mental health services.

Translation of Research Findings and Implications for Public Health

The overall vulnerability for Asians, in terms of their more disadvantaged positions and their relatively higher proportion of probable PTSD, signals needed attention and help for this population after the WTC attack and after disaster in general. Targeted effort to reach out to this economically disadvantaged population to ensure follow up treatment is very important both due to their high risk for PTSD and their low tendency to seek and sustain treatment effort (U.S. Department of Health and Human Services, 2001).

Our study findings suggest ways to identify and target higher-risk Asian groups. The large percentage of individuals from very low household income needs to be targeted for outreach. The level of employment and earned income is important in identifying Asians at risk for PTSD, not just employment status alone. Although the association between LRS and PTSD for Asians was not higher than Whites, the heightened risk by 360% for Asians with LRS offers an important inroad to screen for potential PTSD given the population's tendency to seek help for physical ailments (Kung & Lu, 2008). An effective "bridge" between medical and psychiatric services whereby both services are available on one site could help to reduce the stigma and ensure service utilization (Chen et al., 2003). Likewise, targeting those with direct WTC exposure is essential given the higher risk for PTSD. Outreach efforts such as The Registry's Treatment Referral Program should be continued, and staffed with bilingual personnel given the

high percentage of Asians being immigrants (76.4%), many of whom have low English proficiency (U.S. Census Bureau, 2014). Bilingual services are also needed to engage this population in treatment. We hope that these findings will serve as a call to action to address the mental health risks for this group that likely remains in great need for help. Such outreach effort to disaster victims among Asians could be applied to other future disasters given their long-standing reluctance to use mental health help.

Study 2

Purpose

This study examined the patterns of PTSD and factors associated with these patterns among Asian Americans 2-3 years and 5-6 years after the WTC attack and compared these findings to Whites using the WTC Health Registry data. This investigation is in response to the paucity of longitudinal studies around the disaster (Neria, DiGrande, & Adams, 2011), and aims to understand Asians' short and medium term PTSD to prevent long-term psychopathology in order to facilitate targeting of outreach efforts to this group which showed reluctance to acknowledge mental health needs (Leong & Lau, 2001).

Method

Analytic Sample

This study was based on wave 1 (2-3 years following the attack) and wave 2 data (5-6 years following the attack) from the Registry. We adopted the same exclusion criteria as in Study 1 but also ruled out those who did not participate in both waves. The final analytic sample for this study comprised 2,431 Asians and 31,455 Whites.

Measures

PTSD pattern. Based on the PCL scores at the two time-points, we conceptually identified four PTSD groups informed by previous studies (e.g., Pietrzak et al., 2014). To classify cases into PTSD groups that indicate status in both wave 1 to wave 2, participants who had PCL scores <44 in both waves were considered "resilient"; those with ≥44 in wave 1 but <44 in wave 2 were considered "remitted"; those with <44 in wave 1, but ≥44 in wave 2 were considered "delayed-onset"; and those with ≥44 in both waves were considered "chronic".

D**isaster Exposure.** In Study 2 we used a composite score to quantify the dichotomous direct disaster exposure items: located in a damaged/collapsed building during the attack, witnessed ≥3 horrific events (e.g., saw a plane hit a tower), exposed to dust cloud, sustained any injury (excluding eye irritation), was a rescue/recovery worker, and feared being injured/killed, which was then grouped into 0-1, 2-3, and 4-6 exposures based on its distribution in the study sample. Three additional dichotomous exposure variables collected at wave 2 were examined: *loss of job* attributed to events of 9/11, *lost someone* (a relative, friend, or coworker) in the disaster, and *tangible loss* which included damage to home, workplace, and evacuation from home for ≥48 hours.

LRS, Pre-9/11 depression/anxiety diagnosis. They were also examined as factors of interest related to the PTSD pattern.

Statistical analyses

We calculated summary statistics to describe participants' demographic, disaster-related, and clinical characteristics separately for each race and used chi-square tests to detect racial differences in the distribution of these variables. We also examined the distribution of PTSD status group by each of the wave 1 factors of interest and used chi-square tests to detect bivariate associations for each race separately. To further examine the independent association between the different factors and PTSD status group, we applied multinomial logistic regression models

for Asians and Whites separately. From the estimated model, we derived covariate-adjusted odds ratios (AOR) and 95% confidence intervals (CI) comparing each PTSD group to the resilient group as the reference. We used the Wald test to detect racial differences in the model parameters for the AOR and then adjusted p-values for multiple testing to control for family-wide error rate using the Hochberg method (Hochberg, 1988; Hochberg & Benjamini, 1990). Significance level of statistical tests was set at 0.05.

Results

Participants Characteristics: **(1) sociodemographics**: Generally, Asians were from a lower socioeconomic status at wave 1. Relative to the White group, Asians had larger proportions of younger (18-24) and older (≥65) participants, females, and those who had never married. A smaller proportion of Asians were married/cohabiting. Overall, Asians were less educated when compared with Whites, with a higher proportion of high-school educated or less (24.3% vs. 19.0%), and a lower proportion with "some college/technical training" (14.6% vs. 23.1%). Asians reported more than twice the proportion as Whites earning <$50,000 (38.0% vs. 18.3%), and had a lower proportion employed than Whites (77.2% vs. 86.6%). Lastly, half of Asians were immigrants which contrasted with only 6.0% among Whites. **(2) Disaster exposures and clinical characteristics:** Asians had fewer direct disaster exposures compared to Whites (54.0% vs. 61.0% with ≥2 exposures). A larger proportion of Asians lost their jobs (11.6% vs. 6.8%) as well as their possessions (13.0% vs. 11.3%), but Whites had a higher proportion who had lost a relative/friend/coworker due to 9/11 (28.8% vs. 15.5%). About 53% of both races had Lower Respiratory Symptoms (LRS) at baseline, while Asians had a lower proportion of those reporting a pre-9/11 depression/anxiety disorder than Whites (3.4% vs. 9.8%). **(3) PTSD pattern:** Racial difference was noted for the overall PTSD group distribution ($p<0.001$). Over 3/4 of participants from both races were resilient, although slightly lower proportion among Asians than Whites (76.5% vs. 79.8%, $p<0.0001$). Asians had a higher proportion in the chronic (8.6% vs. 7.4%) and remitted groups (5.9% vs. 3.4%) than Whites. A considerable proportion of participants had delayed-onset in both races (9.1% Asians vs. 9.4% Whites).

Distribution of PTSD group relative to factors of interest: PTSD group was significantly associated with all factors for both races ($p\leq0.01$), with the exception of gender and employment status for Asians. **(1) PTSD group and sociodemographic factors:** For Asians, higher proportions of resilience were noted among the youngest (85.3% in age 18-24) and the oldest (82.3% for ≥65), those with higher education and income, those never married (83.5%) and "married/cohabiting" (75.6%), and "US-born" (80.3%). In contrast, the proportion of those with chronic PTSD was highest in ages 45-64 (11.9%), with lowest income (<$50,000, 11.4%), being "divorced/widowed/separated" (13.5%), and of immigrant status (10.2%). Similar trends were found for delayed-onset PTSD. **(2) PTSD group and disaster exposure:** Among Asians, greater disaster exposure was associated with lower prevalence of resilience, with the proportion in the resilient group falling from 85.9% to 52.4% as the number of direct exposures increased from 0-1 to 4-6. Exposure to 9/11-related job loss was also associated with a lower proportion in the resilient group than otherwise (51.8% vs. 80.0%) but a higher proportion in the chronic (23.8% vs. 6.5%) and delayed-onset (15.3% vs. 8.1%) groups. A similar trend was observed for having lost someone or experiencing tangible loss in 9/11, although the difference in proportions between those exposed and the unexposed to these experiences was smaller. **(3) PTSD patterns**

and clinical status: For Asians, having LRS or pre-9/11 depression/anxiety disorder was associated with a lower prevalence of resilience vs. not having such health or mental health issues, while the opposite was true in the chronic and delayed-onset groups. **(4) Racial comparison**: For Whites, similar to Asians in general, having advantaged socioeconomic status was associated with being resilient, and having disadvantaged status was associated with poorer trajectories. However, the associations were stronger and the patterns clearer in Whites than Asians. For example, in both races the proportion of the resilient group increased with education, but the decreasing trend in the proportion of the chronic group with increasing education was apparent in Whites but not in Asians.

***Associations of PTSD group in logistic regression**:*

(1) Odds of chronic PTSD vs. resilient group: The association between education and chronic PTSD (vs. resilience) differed between races. The odds of chronicity significantly decreased with education in Whites (e.g. for college graduates AOR=0.57; 95% CI=0.50-0.64), but the direction of the association was opposite for Asians and non-significant (AOR=1.09; 95% CI=0.67-1.76). For Asians, significant protective demographic factors against chronic PTSD included age ≥65 (AOR=0.34, 95% CI=0.14-0.81), annual household income ≥$50,000 (AOR range=0.32-0.52, all $p<0.05$), and never married vs. married/cohabiting (AOR=0.61; 95% CI=0.37-0.99). Exposure-related factors were significantly associated with increased odds of chronic PTSD among Asians: Direct disaster exposure incurred the highest odds for those with 2-3 and 4-6 exposures vs. 0-1 exposure (AOR=4.14, 95% CI=2.68-6.42 and AOR=10.19, 95% CI=6.14-16.93 respectively); other exposures doubled the odds, including job loss due to 9/11 (AOR=2.64, 95% CI=1.76-3.96), having lost someone (AOR=1.99, 95% CI=1.34-2.94), and having had a tangible loss (AOR=1.81, 95% CI=1.18-2.76). Having LRS (AOR=4.59, 95% CI=3.02-6.97) and pre-9/11 mental disorder diagnoses (AOR=2.38, 95% CI=1.04-5.43) were also associated with increased odds of chronic PTSD. For Whites, all baseline factors were significantly associated with odds of chronic PTSD vs. being resilient with patterns similar to Asians for most factors. However, the impact of 9/11-related job loss appeared more profound in Whites than in Asians (AOR=4.30, 95% CI=3.77-4.89 vs. AOR=2.64, 95% CI=1.76-3.96), although tests for racial differences became non-significant when adjusting for multiple-testing.

(2) Odds of delayed-onset PTSD vs. resilient group: T the only factor that showed a significant racial difference after multiple-testing adjustment was pre-9/11 mental disorder diagnoses (p=0.05), which showed a stronger association among Asians than among Whites (AOR=4.77, 95% CI=2.62-8.66 vs. AOR=1.92, 95% CI=1.69-2.18). For Asians, in addition to the significant factors of income, marital status, disaster exposure, and other health and mental health issues identified in the chronic vs. resilient comparisons above, having a college degree or graduate training was significantly protective (AOR=0.49, 95% CI=0.32-0.75 and AOR=0.51, 95% CI=0.31-0.83); being an immigrant (AOR=1.41, 95% CI=1.04-1.92), having lost someone in 9/11 (AOR=1.64, 95% CI=1.10-2.42) or having job loss due to 9/11 (AOR=1.78, 95% CI=1.18-2.69) were also significantly associated with having delayed-onset. These patterns were similar for Whites, but the association between pre-9/11 depression anxiety and delayed-onset PTSD was stronger for Asians (AOR=4.77, 95% CI=2.62-8.66) compared to Whites (AOR=1.92, 95% CI=1.69-2.18).

In an additional analysis examining the association between these factors and having chronic vs. delayed-onset PTSD (not shown in tables), higher income and being employed was associated

with lower odds of chronic vs. delayed-onset PTSD and direct exposure and LRS were associated with higher odds of chronic vs. delayed-onset PTSD in both racial groups. However, higher education was associated with greater odds of chronic vs. delayed-onset PTSD for Asians, but was associated with lower odds of chronic vs. delayed-onset PTSD for Whites. Being an immigrant was associated with greater odds of chronic PTSD among Whites, but was not associated with chronic PTSD among Asians.

Discussion

Contribution to study on PTSD short to medium term pattern: The unique contribution of this study is that it provides information on factors associated with short-term to medium-term PTSD status change on Asian Americans after the WTC attack using a large sample and a comparison group. This is important since PTSD can emerge and linger for many years after a traumatic event (Bowler et al., 2012). Using wave 1 data, we are better able to test factors associated with PTSD group membership, which can inform outreach efforts to vulnerable subgroups for future prevention and follow-up treatment. This is especially important for Asian Americans, given patterns of substantial underutilization of mental health services in this population (U.S. Department of Health and Human Services, 2001).

Although all of the participants had been exposed to the WTC attack, the large majority was resilient to developing PTSD 5-6 years after the attack, consistent with previous studies (Brackbill, et al., 2009). Still, 17.7% of Asians and 16.8% of Whites were suffering from PTSD (including those with chronic and delayed-onset conditions) at 5-6 years post-9/11, which is an increase compared to the prevalence 2-3 years following the attack, due to higher delayed-onset than remitted PTSD. Worth noting is that close to 10% of participants (Asian: 9.1%; Whites: 9.4%) had delayed-onset PTSD. This points to the importance of early outreach and follow-up treatment even when initial PTSD symptoms do not reach the clinical threshold. We found that the delayed-onset group had higher PCL score at baseline compared to the resilient group for both Asians and Whites (32.4 vs. 25.3 and 32.8 vs. 34.5 respectively, $p<0.001$ for both, not shown in tables), also consistent with previous studies (Bowler, et al., 2012).

PTSD pattern racial comparison*:* Significant though small differences in PTSD status group were detected between the races, with Asians having a slightly lower proportion in the resilient, and a higher proportion in the chronic group, compared to Whites. This finding, although concordant with results from our wave 1 cross-sectional study indicating a higher PTSD prevalence among Asians, contrasted with general epidemiological studies that have indicated a lower proportion of PTSD among Asians compared to all other racial groups (Alegria, et al., 2013; Roberts, Gilman, Breslau, Breslau, & Koenen, 2011). Our findings thus challenge the "model minority" myth which states that Asians are less likely to have mental health issues or other social problems (Sue, et al., 2012). Our contrasting findings might partly be attributed to the greater inclusion of less acculturated Asians with lower socioeconomic status that was achieved in this study through more outreach efforts using interviewers with Asian language capability than used in many general epidemiological studies (Sue, et al., 2012).

Factors associated with PTSD pattern:

(1) Socioeconomic factors: The socioeconomic status of Asian and White participants at baseline were significantly different, with Asians having lower education and income, a lower proportion being employed, and a higher proportion being immigrants, putting them in a more

disadvantaged position to cope with the disaster. As hypothesized, the general trend of our findings for both races pointed to the association between advantaged socioeconomic status and resilience and disadvantaged status with chronic and delayed-onset PTSD. While larger proportions of individuals with higher ***education*** were in the resilient group across racial groups, the protective effect of education against chronic and delayed-onset PTSD was significant for Whites only when other factors were controlled for in regression analyses. For Asians, not only was higher education not protective against chronic PTSD, having a college degree or graduate training was associated with slightly greater odds of chronic PTSD, although this did not reach statistical significance. Racial difference was marginally significant in the chronic group after adjusting for multiple-testing. The general lack of protective effect of education for Asians reflects previous findings, and may indicate that educational attainment of many immigrants were not positively correlated with their occupational accomplishment as their qualifications were not recognized in their host country (Zeng & Xie, 2004) and that these individuals may be less able to access mainstream resources through the social capital that comes with higher education. Being an ***immigrant*** was associated with greater odds of poorer PTSD patterns among Asians and Whites, potentially due to compromised access to resources, opportunities and support (Derr, 2016).

Higher household ***income***, especially reporting a yearly income of ≥$100,000, was a significant protective factor for both the chronic and the delayed-onset groups for both races. In general, the lower odds associated with higher income appeared somewhat greater for Asians than Whites across PTSD groups, although this difference did not reach statistical significance. It is possible that monetary resources were more beneficial among more deprived groups by alleviating stress that could cause or reinforce mental health issues. However, ***employment*** was not significantly associated with any PTSD group for Asians, although it reduced the odds of chronic PTSD by 45% for Whites. The result, while counterintuitive, echoed our previous wave 1 finding, and could be explained partly by the underemployment or low-wage manual work of Asians in restaurants or service industries, as reflected in a high proportion earning annual income of <$50,000. Another work-related factor, although also exposure-related, was ***job loss due to 9/11***, which significantly increased the odds of both chronic and delayed-onset groups for both races. Such job loss among the economically deprived Asians may have undermined coping resources, particularly for those who also experienced the lasting economic devastation in the Chinatown area (Asian American Federation, 2008). Additionally, a high percentage of Whites were rescue and recovery workers, who were found to have a greater tendency to experience premature exit from the labor force in later years through early retirement or chronic health conditions, especially those with PTSD comorbidity (Niles et al., 2011; Yu, Brackbill, Locke, Stellman, & Gargano, 2016).

The impact of ***marital status*** in general showed a different pattern between races across PTSD status groups although this difference did not reach statistical significance. For Asians, in both chronic and the delayed-onset groups, “never married” was a protective factor; and for Whites “divorced/widowed/separated” was a risk factor relative to “married/cohabiting.” The cultural norm of Asians for unmarried adult children to live with their families of origin (Logan & Bian, 2004) may provide more social and economic support. Western culture, which subscribes greater importance to the marital relationship and independence among unmarried adults (Billari & Liefbroer, 2016), may provide less protection for being never married but greater harm associated with the dissolution of marriage among Whites.

(2) Disaster exposure factors: The level of ***direct disaster exposure*** elevated the odds of poorer PTSD status over time to the greatest extent among all factors for both races, consistent with previous findings (Pietrzak, et al., 2014), with the highest impact in the chronic group. Exposure to imminent danger such as being in a collapsed/damaged building or dust cloud, or having "witnessed horrific events" could be very traumatizing with lasting effects. ***Losing someone and tangible loss in 9/11*** also elevated the odds of both chronic PTSD and delayed-onset for both races with no racial difference detected.

(3) Lower Respiratory Symptoms (LRS): Having ***Lower Respiratory Symptoms (LRS)*** also emerged as a factor strongly associated with higher odds of poor PTSD status for both races, particularly for chronic PTSD. The association between LRS and PTSD was found to be strong in both races on our previous study and as reported in other studies (Shiratori & Samuelson, 2012). It has been suggested that the two disorders had mutually reinforcing nature resulting in an intensification of both illnesses (Friedman, et al., 2013).

(4) Pre-9/11 mental health diagnosis: It included depression or anxiety disorder, which significantly increased the odds of chronic and delayed-onset PTSD, with significantly higher odds of delayed-onset PTSD among Asians compared to Whites, even after multiple-testing adjustment; this was the only significant racial difference detected in this study. This finding may indicate a more vulnerable initial mental health status among Asians who had a pre-9/11 mental disorder diagnosis compared to Whites who also had such a condition. Having a prior mental disorder diagnosis may indicate more severe symptoms among Asians, which forced them to reach out for services, even as this group has a low tendency to seek mental health help (U.S. Department of Health and Human Services, 2001).

Summary and Conclusion: To summarize, exposure-related variables, especially direct disaster exposure, greatly elevated the odds of poorer PTSD outcome for both Asians and Whites, but the impact seemed to be universal with no racial difference. Comorbid LRS and prior mental health diagnosis also considerably increased individuals' vulnerability for poorer PTSD patterns for both races. The impact of socioeconomic status seemed to put Asians in a more disadvantaged position. While higher socioeconomic status was generally associated with the resilient group and lower socioeconomic status with poorer PTSD outcomes, race modulates the impact such that some protective factors such as education and employment benefited Whites, but did not confer protection for Asians. The higher proportion of Asians being immigrants and having lower socioeconomic status were overall associated with significantly less desirable PTSD outcomes 5-6 years after the 9/11 attack.

Translation of Research Findings and Implications for Public Health

Outreach to Asian Americans*:* The sizeable group of Asian Americans in the chronic and delayed-onset groups still suffering from probable PTSD 5-6 years after the WTC attack signified the persistent impact an event that resulted in substantial human suffering and socioeconomic costs. The more disadvantaged socioeconomic status of Asians may have rendered them more vulnerable in their mental health status over time relative to the non-Hispanic White group. Together with their well-documented, lower tendency to seek mental health treatment (Abe-Kim et al., 2007), outreach efforts to Asians are needed to ensure follow-

up treatment and prevention. Because nearly 10% of Asians had a delayed onset of PTSD between 3-6 years between the 2 waves, outreach should also target individuals with elevated PTSD symptoms even if they do not reach the clinical threshold.

Target higher-risk Asian sub-groups*:* Our study findings suggest ways to identify and target higher-risk Asian subgroups for treatment and prevention, particularly those with high direct disaster exposure and those with LRS. In addition to those with pre-9/11 PTSD diagnosis, individuals with previous depression or other anxiety disorder diagnosis should also be attended to in prevention and outreach efforts. Given the tendency of Asians to not acknowledge psychological distress, but to seek help for physical ailments (Kung & Lu, 2008), an effective "bridge" between medical and psychiatric services whereby both services are available on one site could help to reduce the stigma in mental health service use (Chen, Kramer, & Chen, 2003). This is especially pertinent given the high comorbidity and possible mutual reinforcement of LRS and PTSD. Routine inquiry about their previous disaster exposure and current and previous psychological functioning in primary care settings would be of great help.

Asian Americans with very low household income should also be targeted for intervention. Level of employment and earned income should be explored beyond employment status. Attention should also be paid to immigrants since such status significantly elevated odds or poorer PTSD patterns. Outreach efforts such as the Registry's Treatment Referral Program should be continued and staffed with bilingual personnel since the majority of Asians are immigrants and many have limited English proficiency (United States Census Bureau, 2014). Additional bilingual services are critical to engage this population in treatment.

Study 3

Study Purpose

This study aims to describe the prevalence of probable PTSD and examine its related factors among Asian Americans 10-11 years after the WTC attack, and compare against those of non-Hispanic Whites. Given the lingering effect of PTSD (Bowler et al., 2012) and lower coping resources of immigrant Asian American communities (Gruebner, 2015), this investigation of long-term PTSD is vital to understanding the impact of the disaster.

Method

Analytic Sample

In this study we employed the same exclusion criteria as in Study 2, but included only those participants who completed all 3 waves of data collection (10-11 years after the disaster) by the Registry. Our final study sample included 2,712 Asian and 25,011 White Americans.

Measures

PTSD. We employed the same PCL measure for Wave 3, and the Waves 1-2 PTSD group of short to medium term pattern in Study 2. The PTSD group was used to examine its predictive power for the long-term PTSD status.

Disaster Exposure. We used all the items related to direct and indirect exposure in Studies 1 and 2 to form the composite score as a continuous variable.

Post 9/11 Trauma Events. This dichotomous variable was defined as positive if one of the following life-threatening events occurred after 9/11 by Wave 3 interview: natural or human-made disaster; serious accident at work, in a car, or somewhere else; attacked with a gun, knife, or some other weapon; attacked without weapon but with intent to kill or seriously injure; forced sexual contact; witnessing a situation with someone injured or violently killed; a life-threatening illness; and any other situation the person was seriously injured or feared being killed or seriously injured. This variable was used both as control and as a variable of interest in predicting Wave 3 probable PTSD.

Post 9/11 Stressful Events. This dichotomous variable was defined as positive if one of the following stressful life events occurred after 9/11 by Wave 3 interview: could not pay for food, housing, or other basic necessities for a period of 3 months or longer; serious problem at work or lost a job; serious family problems involving one's spouse, child, or parent; took care of a close family member or friend with a serious or life threatening illness; serious legal problem; and lost someone close due to accidental death, murder, or suicide. This variable was used both as control and as a variable of interest in predicting W3 probable PTSD.

Social Support/Integration. This composite from Wave 2 was derived by summing up endorsement of the 5 domains: have one or more close friend; get together with friends or relative more than once a month; been in communication with a friend or relative more than once a month; attended a religious service more than once a month; and was a very/fairly active member of one or more volunteer group. This variable was used as a moderating variable between stresses individuals experienced and current probable PTSD status.

Previous Mental Health Service Use. This dichotomous variable was defined as positive if respondents endorsed one of the following Wave 2 variables: 'seen or talked to a professional' or 'took prescribed medication' for a mental or emotional problem during the last 12 months. This variable was used to examine if it has a moderating effect on current PTSD status.

Lower Respiratory Symptoms (LRS) and other sociodemographic variables were also examined as factors of interest as indicated in our studies reported in previous pages.

Statistical analyses

We used descriptive statistics to summarize characteristic of Asian American and Whites in the sample. We utilized independent t-tests and chi-square test to detect any racial differences and any bivariate association between probable PTSD and factors of interest separately for each racial group. Binary logistic regression models were used to identify significant risk and protective factors of probable PTSD for each race. Adjusted odds ratio (AOR) and 95% confidence interval (CI) were derived from the estimated model parameters. We set the significance level at 0.05.

Results

Participants Characteristics*:* The characteristics differed between the Asian and the White participants. Asian Americans tend to be younger: approximately 34.35% of Asians were between 25-44 years old compared to the 24.48% of Whites in this age group. There were less male participants among Asians than Whites (52.80% vs. 67.08%.) Two-thirds of Asian Americans reported being born outside of the United States compared to the 7.41% in Whites. In terms of socio-economic status, Asians had less education, less income, lower proportion being employed, and higher proportion with job loss due to 9/11. The proportion of probable PTSD among Asians was 15.13%, which was not significantly different than Whites (14.36%, $p=0.37$). Further examination revealed that the average number of exposure to 9/11 events were generally lower among Asians (2.14 vs. 2.51, $p<0.001$), but the proportion of having delayed-onset (9.35% vs 9.15%), or chronic (8.26% vs. 7.00%) PTSD from short to medium term was higher, while being resilient with no probable PTSD at both Waves 1 and 2 was lower among Asians than Whites. Furthermore, the proportion of individuals with no previous mental health service use was higher among Asian than Whites (84.35% vs. 74.24%, $p<0.001$).

Bivariate associations of factors with PTSD: Many factors associated with probable PTSD in Asians were also significant in White participants. The common significant factors included: age, income, employment, marital status, job loss due to 9/11, immigration, disaster exposure, short to medium term probable PTSD pattern, LRS, exposure to post-9/11 traumatic and stressful life events, social support/integration, and previous mental health service use. Higher education was associated with lower probable PTSD only in Whites but not Asians.

Associations with PTSD in the regression model: **(1) Asians:** For Asians, significant risk factors for ten-year prevalence of probable PTSD included job loss due to 9/11 (AOR=1.80; 95% CI=1.12-2.90), immigrant status (AOR=1.94, 95% CI=1.23-3.07), exposure to disaster (AOR=1.20, 95% CI=1.06-1.35), short to medium term probable PTSD pattern (delayed-onset: AOR=7.26, 95% CI=4.56-11.56; chronic: AOR=34.10, 95% CI=19.79-58.76; remitted:

AOR=5.67, 95% CI=3.20-10.04), LRS (AOR=2.92, 95% CI=1.99-4.30), and previous mental health service use (AOR=1.76, 95% CI=1.14-2.71).

(2) Whites: Significant risk factors for ten-year prevalence of probable PTSD included unemployment (AOR=1.85, 95% CI=1.56-2.19), job loss due to 911 (AOR=1.51, 95% CI=1.35-1.68), immigrant status (AOR=1.21, 95% CI=1.02-1.43), disaster exposure (AOR=1.17, 95% CI=1.14-1.20), short to medium term PTSD pattern relative to resilience (delayed-onset: AOR=8.06, 95% CI=7.19-9.04; chronic: AOR=21.92, 95% CI=19.05-25.21; remitted: AOR=4.84, 95% CI=4.04-5.79), LRS (AOR=2.74, 95% CI=2.49-3.03), exposure to post-disaster traumatic events (AOR=1.34, 95% CI=1.22-1.48), exposure to post-disaster stressful events (AOR=1.90, 95% CI=1.68-2.24) and previous mental health service use (AOR=1.43, 95% CI=1.30-1.58). Furthermore, significant protective factors for Whites included older age, social support/integration (1-2: AOR=0.58, 95% CI=0.41-0.83; 3+: AOR=0.42, 95% CI=0.29-0.59) and professional/graduate education (AOR=0.79, 95% CI=0.68- 0.92). The protective factors among Whites did not contribute significant protection for Asians.

Discussion

Since the WTC attack, this is the first comprehensive examination of the long-term psychological impact among Asian Americans. More than a decade later, approximately 15.13% of Asian participants still met the criteria for probable PTSD, which is a much elevated proportion compared to the 3.5% in the general non-clinical population (Kessler, Chiu, Demler, Merikangas, & Walters, 2005). The comparable prevalence between the races was contrary to our prediction that Asians would have higher PTSD relative to Whites. However, some of the significant associated factors with long-term probable PTSD seemed to differ between the two groups.

When the number of WTC exposure and PTSD status were controlled for, higher education, job loss due to 9/11, immigrant status, LRS, and previous mental health service use were significantly associated with probable PTSD at Wave 3. This study finding indicates that the economic effects may be more expansive and more enduring to the Asian group. Much of the existing literature on post-disaster recovery documented Asian communities, generally of one particular ethnic group, living in closed enclaves that are culturally and geographically isolated (Gruebner, 2015). The cultural and geographical isolation may have delayed the physical and financial recovery of the community and its residents. Although New York City communities are much more geographically proximal, our study findings suggest proximity may not be enough to be protective of the effects of economic isolation, and that recovery progress was differential within communities of New York City, or both.

Mental health service use in Wave 2 (5 years before the current study) was found to increase the odds of probable PTSD could be interpreted as very high symptomatology or vulnerability in those individuals at that point which pushed Asians to seek mental health help despite their well-documented tendency to refrain from treatment (US Health and Human Services, 2001). However, the fact that such service use did not ameliorate the odds of PTSD in the subsequent wave leads to the question of the effectiveness of such treatment, implying that their mental health service need might still be unsatisfied with such visits.

Translation of Research Findings and Implications for Public Health:

The fact that 10-11 years following the WTC attack, as high as 15.13% of Asian Americans were still suffering from probable PTSD is alarming, thus calling for greater continued outreach effort to this group. Despite having lower levels of WTC exposure, probable PTSD levels among Asian Americans were comparable to Caucasian Americans.

Economic risk factors played an important role in predicting probable PTSD among Asian participants. This supported initial studies with Asian American subgroups and findings from Asian American survivors of other disasters and points to the importance of targeting the lower socioeconomic group within the community in the outreach effort to bring mental health to them.

The quality of mental health service to Asians needs to be evaluated for its effectiveness in keeping those who need mental health help to stay in treatment; bilingual service would be imperative for Asians since the majority of them are immigrants, and many of whom have limited English proficiency. Efficacious mental health treatment is also needed so as to ensure that such service use makes a difference in people's mental well-being.

Aim 2

Study Purpose:

To examine patterns of mental health service use and identify enabling factors vs. barriers affecting service use among Asian Americans, and compare them with these factors among Whites, to better understand racial disparities.

Efforts Summary

To attain Aim 2, our team completed one study on mental health service use among Asian Americans 5-6 years after the WTC attack, using Whites as a comparison group. We plan to further compare within the Asian Americans their mental health service use between 5-6 years and 10-12 years after the attack and examine if the enabling factors and barriers differ with the passage of time. Further, in exploring the literature, we noted that reported mental health service use is a helpful objective measure to gauge the disparity in service provision across race and other sociodemographic factors. However, we also found that the investigation of unmet mental health care need (UMHCN) is another important avenue through which we can gauge individuals' subjective perception of the extent to which their mental health care needs are satisfied, since we cannot assume that mental health service use equates to mental health needs being met (Nelson & Park, 2006; Mojtabai, 2009). We plan to investigate in this aspect about Asian Americans in our next study, comparing against the White group.

Study 1

Study Purpose

This study aims to investigate the extent to which professional mental health services were utilized among Asian Americans being exposed to the WTC attack, and the enabling factors and barriers towards treatment, and compared against Whites. Such understanding could shed light on the disparity of service use and elucidate avenues through which such gap could be abridged.

Methods

Analytic Sample

This study was based on data collected by the Registry at Wave 2, 5-6 years after the WTC attack, which provided information on participants' mental health service use not available in Wave 1, and had the highest number of participants before the number dwindled in subsequent waves. After excluding participants who had missing values for service use and those that used proxies in the interviews indicating that they were deceased, 2,513 Asians and 32,030 Whites were included in this study.

Measures:

Mental health service use: defined as whether or not participants reported having used any counseling, prescribed medication, or both in relation to mental or emotional issues in the preceding 12 months.

Mental health status: captured by two specific and two global measures. Specific measures are: 1) *Probable PTSD* using PCL as delineated above. 2) *Serious Psychological Distress*: measured by the Kessler 6 scale, a screening tool for major mental illness (Kessler, Andrews, Colpe, et al., 2002), with 13 being the cut-off score. Global measures are: 1) *Poor mental health days:* defined as self-report of having ≥14 days of poor mental health from the health-related quality of life measure (Zahran, et al., 2005). 2) *Functional impairment* referred to self-report of having ≥14 days in the last 30 days in which one's usual activities were curtailed due to poor physical or mental health (Zahran et al., 2005).

Post-9/11 mental health diagnoses: indicated if the participant reported having received diagnoses of generalized anxiety, PTSD and depression from a doctor or other health professional.

Routine medical check-up: indicated by participants' report of whether or not they had a general check-up visit with a health professional in the past 12 months, used as an indicator for periodic contact with the health care system.

Social support/integration: as delineated in Aim 1 Study 3 and other **sociodemographic variables** are included in the analyses.

Statistical Analyses

We calculated summary statistics to describe participants' characteristics separately for Asians and Whites and compared between them using Chi-square tests. The proportion of mental health service users by each variable was computed for each race, and again using Chi-square tests we detected differences among categories for each variable for each race. We employed multinomial logistic regression models to investigate the associations between service use and the various factors of interest for each race. We entered factors that were significant in bivariate analyses in the race-specific models for each race. With larger sample size in Whites and thus more significant findings in bivariate analyses, we also ran the same White model for the Asian group for clearer comparison. Adjusted odds ratios (AOR) and 95% confidence intervals (CI) were derived from the estimated model parameters.

Results

Participants characteristics: **(1) sociodemographic characteristics**: For Asian participants, nearly half were in the younger groups (48.6% of age 18-44), 38.9% did not have a college degree, and their annual household income distribution was skewed towards the lower spectrum (37.8% with <$50,000). Over 2/3 were married/cohabiting, and half were immigrants. The most marked racial contrast was Asians' higher proportion of low income and immigrant status: More than twice the proportion of Asians reported earning <$50,000 than Whites (37.8% vs 18.4%) while only a slightly lower proportion of Asians had a college degree than Whites (38.9% vs 41.8%). Half Asians were immigrants contrasted with the 6.0% in Whites. **(2) Mental health status and social integration**: Asians, compared to Whites, had higher proportions of both probable PTSD (17.8% vs. 17.1%) and serious psychological distress (11.5% v. 9.2%). However, poor mental health days and functional impairment days showed no racial difference with missing values excluded. A lower proportion of Asians than Whites reported having post-9/11 mental health diagnosis of depression or anxiety disorder other than PTSD (10.9% vs 17.5%). There was no racial difference in routine medical check-up in the past year excluding

missing (over 2/3 for both races). Asians reported less social integration than Whites in the last 30 days, with 45.7% vs. 61.6% having 3-4 sources. (3) **Mental health service use**: The outcome variable contrasted greatly between the two races with a much lower proportion of Asians having used mental health service in the past 12 months (15.8% vs. 26.6%).

***Bivariate associations of factors with mental health service use*: (1) Sociodemographic factors:** The pattern in bivariate associations differed by race for all demographic variables except gender and marital status. In both races, a higher proportion of female used mental health service and the highest proportion of users were among divorced/widowed/separated individuals ($p<0.0001$ for both variables and races). Asians did not show significant age difference in service use though there was a slight trend towards higher use with increasing age; Whites, in contrast, differed significantly by age, with the lowest proportion of service users in the oldest group of 65 or more. Asians had non-significant association for education and immigration status with service use, while more educated and native-born Whites had significant though slightly higher proportions of service users compared to less educated and immigrant participants respectively. Similarly, racial contrast was noted on income: a higher proportion of low-income Asians used mental health service while there was a lower proportion among Whites, both associations were significant ($p<0.009$ for Asians and <0.0001 for Whites). **(2) Mental health status and social integration**: All four current mental health measures and post 9/11 mental health diagnosis were significantly related to mental health service use in both races ($p<0.0001$) with higher proportions of those having mental health issues being service users. Likewise, routine medical check-up was related to higher prevalence of service use for both races. Although lower social integration was associated with higher proportion of mental health service use in both races, the association was not statistically significant for Asians but significant for Whites.

***Association with mental health service use in the regression models:* (1) Asian-specific model:** Female participants, compared to male, had 30% greater odds to receive counseling or medication for their mental health issues (AOR=1.30, CI=1.01-1.68). Compared to those in conjugal relationships, those who were divorced/widowed/separated also had higher odds to use service (AOR=1.63, CI=1.13-2.37), and so were those never married (AOR=1.53%, CI=1.11-2.11). Three of the four current mental health status measures significantly increased the odds of service use: Asians' report of having 14 or more poor mental health days in the past month had the strongest association, namely three times greater odds (AOR=3.04; CI=2.18-4.23); having serious psychological distress almost doubled the odds of service use (AOR=1.97; CI=1.35-2.87), while having probable PTSD increased it by 43% (CI=1.02-2.00). The other global measure of 14 or more days of curtailed daily functioning, together with income were the only two factors that attenuated to be non-significant in the model. Among all the factors, having a mental health diagnosis after 9/11 had the highest impact on service use, increasing the odds by six times (AOR=6.03, CI=4.43-8.22) after adjusting for all other factors. Individuals who had routine medical check-up in the past 12 months also increased the chance of receiving mental health treatment considerably (AOR=1.60, CI=1.19-2.15).

(2) White-specific model and racial comparison:

For Whites, all the factors conceptually pertinent to service use were significant in the bivariate analyses, and maintained their significance in the logistic regression model, with the exception of social integration. The pattern of significant associations for gender and marital status were the same as in the Asian subpopulation, with women and those not currently married or cohabiting being more likely to receive mental health treatment. College or higher education increased the

odds of service use for Whites by 41% (CI=1.32-1.49), but income higher than $50,000 decreased such use slightly yet significantly (compared to the lowest income group those with income $50,000-$75,000 AOR=0.81, CI=0.74-0.89; and those in the highest income group AOR=0.90, CI=0.83-0.98). Education had no significant effect on service use even in the Asian comparison models, while having college or higher education had greater odds of service use than otherwise for Whites (AOR=1.41, CI=1.32-1.49). White immigrants were less likely to seek treatment than the native born (AOR=0.72; CI=0.64-0.82); the direction of the relationship was the same for Asians, but was weaker and non-significant (AOR=0.85; CI=0.65-1.10). Positive scores in the mental health status measures significantly increased the odds of service use for Whites, as in Asians, with the exception of the global measure of functional impairment, which was significant in Whites but not Asians, contrary to what was hypothesized. Having 14 or more poor mental health days increased the highest odds for service use for Whites (AOR=2.42; CI=2.23-2.63) compared to other current mental health measures, much like Asians. Also similar to Asians, post-9/11 mental health diagnosis increased the highest odds of service use (AOR=4.98; CI=4.65-5.34). However, the magnitudes of increase in odds of service use was lower for Whites than Asians for having probable PTSD, serious psychological distress, 14 or more poor mental health days, and pre-9/11 mental health diagnosis in both the Asian-specific model and the Asian-comparison model with all other pertinent variables entered.

Discussion

(1) the prevalence of mental health service use: The significantly lower proportion of Asians having used mental health treatment compared to that of Whites in the past 12 months is in line with the persistent pattern of service underutilization among Asian Americans in the literature (U.S. Department of Health and Human Services, 2001; Sue et al., 2012). The contrast was noteworthy and concerning given the significantly higher rates of Asians than Whites having severe psychological distress (11.3% vs 9.2%; $p<0.0001$). It is also interesting to note that while the specific mental health distress measure showed a significantly higher proportion in Asians than Whites, the global measure of having 14 or more poor mental health days showed a slightly reverse phenomenon though non-significant. This echoes what was suggested in the literature that Asians were less likely to acknowledge their psychological distress (Kung & Lu, 2008).

(2) The impact of mental health status on service use: Individuals' current mental health status had strong associations with service use in the past year in the final model in both races. For Asians, having 14 or more poor mental health days increased the odds of service use by three times, exerting one of the highest impact among all factors. Such relationship is stronger than specific measures of severe psychological distress and probable PTSD, which also elevated the odds of service use by 97% and 60% respectively. These mental health measures had significant impact on service use among Whites as well, though to a lesser extent than Asians. Although the literature suggests that Asians are less likely to acknowledge their psychological distress (Kung & Lu, 2008), when recognized it may be a driving force to seek treatment. It highlighted how recognition of poor psychological well-being could lead to greater willingness to seek help.

(3) Potential impact of post-911 outreach mental health programs on service use: In the context of post-911, the greater willingness to use mental health service among Asian Americans with poor mental health status may partly be attributable to the more widely publicized traumatic impact of the disaster post 9/11 which helped to educate and destigmatize mental distress. Preventive outreach mental health programs such as Asian LifeNet and Project Liberty, and case management programs provided by non-mental health settings working closely with affected

individuals staffed by bilingual professionals targeting the Asian communities 2-3 years after the attack [Asian American Federation of New York, 2003] probably facilitated the identification of potential needs for help. We teased out the two components of the service use measure and noted was a higher proportion of Asians having received counseling than medication for their mental health needs (13.7% vs. 8.1%), which might reflect effects of such outreach efforts, and contrasted with their purported tendency to seek mental health help through medical doctors as they attend to physical manifestations of their psychological distress (Kung & Lu, 2008; Sue et al., 2012).

(4) Impact of post-9/11 mental health diagnosis on current service use: The post-9/11 mental health diagnosis of depression, anxiety disorder and PTSD increased the odds of service use by 6.03 times for Asians, the highest facilitating factor in service use after controlling for other factors, which was similar to Whites though again to a lesser extent (AOR=4.98). It is likely that a history of mental disorder clinically diagnosed by a professional reflected a perception of the need for treatment (Mojtabai, Olfson, & Mechanic, 2002), or had more serious or long-standing problems which drove them to seek treatment before. Mental health diagnosis could also be the "entry point for treatment" (Blackbill et al., 2013) signifying knowledge of access, thereby increasing the chance of recent service use when conditions necessitated it. Having routine medical check-up also increased the odds of mental health treatment by about 60% for both races affirming previous findings that regular contacts with the health care system enhanced mental health service use (Stuber et al., 2006). This may also be a proxy to having health insurance, which was unavailable in our data.

(5) The impact of sociodemographic characteristics on service use: In the study sample, while Asians contrasted with their White counterpart in all the sociodemographic variables, income and immigration status stood out as the biggest contrast: Many more Asians were from the lowest household income category (<$50,000), doubling that of Whites (37.8% vs. 18.4%); and half of Asians were immigrants compared to 6.0% in Whites. One would expect that these factors might account for the lower service use among Asians due to financial constraint to pay for needed service, and the lack of knowledge of access to and availability of providers who would match them culturally and linguistically (Abe-Kim, 2007; Le Meyer, 2009; Kung, 2016). However, neither of these factors were significant in the Asian models. For income, Asians with the lowest income of less than $50,000 had the highest proportion of service users in bivariate analysis. It was possible that some Asians with low income qualified them for Medicaid, or received free services offered by government or non-government organizations such as Project Liberty or Red Cross (Felton, 2002; Kapucu, 2007). In addition, the highest proportion of Asian service users being 65 years of age or older might also suggest their use of service through Medicare thus attenuating the impact of limited financial resources in the final model. Similar explanation could be put forth for the non-significant findings with immigration status with outreach programs in Asian communities after the WTC attack. The uniquely large Asian communities in New York City with more health and mental health professionals who were of similar cultural and linguistic background as service recipients might also reduce the disadvantage of being immigrants, which was not attainable for Whites immigrants.

Translation of Research Findings and Implications for Public Health

(1) Increased acknowledgement of mental health needs among Asian Americans: This study highlighted the importance of prior access to the health and mental health care system to current

service use especially for Asians. Having a mental health diagnosis reflected their prior contact and knowledge of access, so that when the condition so requires they are more likely to seek help. Further, their knowledge of having a diagnosis could also increase the awareness of their mental health need so that they are more willing to seek treatment later. This points to the value of practitioners informing service recipients of their mental health condition in clear diagnostic terms, which is also an education process and an acknowledgement of potential future need. Due to the strong cultural stigma towards mental illness sensitive timing of the disclosure is important to avoid denial (Kung, 2001). The fact that having regular access to the health care system through routine medical checkup increased the chance of mental health service use pointed to its role as an avenue or a "bridge" to mental health care. Thus, establishing routine screening of patients' mental health condition in regular medical check-up, and alerting physicians to attend to patients' mental health needs are important in providing treatment or seamless referrals when necessary (Chen, 2003).

(2) The need for culturally sensitive education and outreach programs*:* The fact that Asians' subjective recognition of psychological distress seemed to play an important role in leading them to treatment reiterates the value of public mental health education especially in destigmatizing service use for this population. Such public education effort should be tailored to the languages, needs and cultures of these minority communities (Norris, 2005). Attention needs to be given to those who have mental health symptoms but have not made any contacts with the health care system (Brackbill, 2006; Stuber, 2006). Outreach efforts to individuals likely to have higher symptomatology due to disaster exposure needs to be continued through culturally and linguistically sensitive programs [Norris, 2005 #31], such as in the WTC Health Program. The importance of massive public mental health education and outreach efforts is also applicable for possible future disasters.

(3) The importance of low cost mental health service: Although in this study socioeconomic status was found unrelated to mental health service use for Asians which contrasted with Whites, likely because of the especially low income which qualified them for Medicaid and Medicare benefits and free services during the post 9/11 period, it highlighted the importance of these entitlements and free services to this underprivileged group for mental health care access. The fact that immigration status did not seem to deter Asians from receiving mental health service was also a rather unique situation in New York City given the large Asian immigrant communities, the benefit of which was not attainable among Whites with smaller immigrant communities. It points to the value of ethnic sensitive mental health services provided in the City and the need to ensure its availability in other areas for Asians and other ethnic minorities.

Conclusions

All in all, regardless of the facilitating or deterring factors that we can observe from our analyses among Asians, and the possible positive impact in connecting this population to the mental health system through massive outreach efforts post 9/11, the strikingly lower rate of service use within this group compared to Whites which continued in the past 40 years speaks to the still much needed work that needs to be done in order to educate, outreach and effectively treat this population.

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