Storm Impact and Depression Among Older Adults Living in Hurricane Sandy–Affected Areas

Jo Anne Sirey, PhD; Jacquelin Berman, PhD; Ashley Halkett, MPhil; Nancy Giunta, PhD, MSW; Janice Kerrigan, MSW; Elmira Raeifar, MA; Amanda Artis, MS, MPH; Samprit Banerjee, PhD; Patrick J. Raue, PhD

ABSTRACT

Objective: Research on the impact of natural disasters on the mental health of older adults finds both vulnerabilities and resilience. We report on the rates of clinically significant depression among older adults (aged ≥60 years) living in areas affected by Hurricane Sandy in 2012 and the factors associated with mental health need.

Methods: The Sandy Mobilization, Assessment, Referral and Treatment for Mental Health (SMART-MH) program integrates community outreach and needs assessments to identify older adults with mental health and aging service needs. Older adults with significant anxiety or depressive symptoms were offered short-term psychotherapy. Social service referrals were made directly to community agencies. All SMART-MH activities were offered in Spanish, Russian, Mandarin/Cantonese, and English.

Results: Across the full sample, 14% of participants screened positive for depression. Hurricane Sandy stressors predicted increased odds of depression, including storm injury, post-storm crime, and the total count of stressors. Outcomes varied significantly by age group, such that all Sandy-related variables remained significant for younger-old adults (aged 60–74 years), whereas only the loss of access to medical care was significant for older-old adults (aged ≥75 years).

Conclusions: Storm-affected communities show higher rates of depressive symptoms than seen in the general population, with storm stressors affecting mental health needs differentially by age group. (*Disaster Med Public Health Preparedness*. 2017;11:97-109)

Key Words: community mental health services, needs assessment, vulnerable populations, public health practice, mental disorders

Hurricane Sandy made landfall in New York on October 29, 2012. Prior research suggests that the detrimental effect of hurricanes and other natural disasters on mental health may persist for several years, especially among vulnerable or underserved populations.[1-3] Annual rates of weather-related disasters have increased over the past decades, up 44% from the 1994–2000 average.[4] Beyond the potential contribution of climate change, epidemiological data find more people living on flood plains, low-lying coastal regions, and other high-risk areas as the result of global patterns of population growth.[4] These growth trajectories parallel the growth of the aging population in the United States such that older adults represent an increasingly large segment of the overall population.[5] National projections estimate that over 20% of the US population will be 65 years or older by 2030.[6] In New York City (NYC), 18.3% of the population is currently 60 years or older.[7]

The aftermath of Hurricane Sandy in NYC included $19 billion in damages with $15 billion not covered by private insurance.[8] There were 52 Sandy-related fatalities reported with nearly half (48%) of the deaths among the older adult population.[9] Two-thirds of homes damaged by the storm were located outside the original NYC flood zones, prompting the Federal Emergency Management Agency to redefine the flood zone boundaries.[10] In addition, the urban geography of NYC is such that many immigrant, low-income, and older adult populations live in apartment buildings on the coast. NYC is home to the largest number of people living in a flood zone of any city in the United States, with 6 times the density of New Orleans and nearly twice as many residents considered at risk.[11]

Disaster research consistently finds that for a substantial minority of people, mental health issues persist for months and even years after a destructive hurricane, highlighting the need to identify those groups most at risk for long-term distress.[3] Depression and post-traumatic stress disorder (PTSD) are the 2 most common mental health disorders that occur after a disaster.[12] After Hurricane Katrina, Kessler et al[2] surveyed 815 adults 5 to 8 months after the storm and

again 1 year later. Those authors reported increases in symptoms of PTSD, serious mental illness, and suicidality that were unrelated to gender, race, ethnicity, or health insurance coverage.[2] Another study of adults (mean age, 48 years) assessed both 6 and 30 months after Hurricane Andrew found that depression remained stable over the course of 2 years, whereas avoidance and numbing actually increased among affected participants.[13]

Data are mixed on age differences in the prevalence and persistence of mental health disorders following a natural disaster. Older adults are sometimes described as being less susceptible to post-disaster psychopathology owing to their lived experience with prior hardship, wisdom, and reduced formal obligations (eg, full-time work, childcare).[14,15] By contrast, other research indicates that symptoms of depression, anxiety, and PTSD remain present throughout recovery for older adults and may even increase in severity over time. Higher rates of PTSD and adjustment disorders have been found for older adult victims of natural disasters compared with younger victims.[16,17] Low social support further reinforces these barriers to recovery among older adults.[18] One study of coping resources following the 2004 Florida hurricanes[19] found that a high level of pre-disaster social support was the best protective factor against continued health declines; however, older age was associated with both reduced social support and poorer self-rated health.

Most older adults manage at least one chronic disease or serious health condition[20] and may rely on critical services disrupted by storms, such as dialysis or home meals delivery.[16] Impaired mobility and physical limitations hinder evacuation or relocation in poor weather. This problem is exacerbated in NYC, where nearly one-third of older adults live alone.[21,22] In addition, lower social connectedness and greater reluctance to seek help among older adults may increase vulnerability to post-disaster mental health costs.[23,24] Access to recovery services may be impeded by disability or frailty.[20] In the less densely populated borough of Staten Island, New York, the loss of personal vehicles due to flooding prevented many older adults from traveling to receive disaster aid after Hurricane Sandy.[25] Forced evacuation may lead to a shattered sense of community, confusion, or even relocation trauma that accelerates psychological decline.[26,27]

Post-disaster mental health may be associated with age, medical burden, and mobility within the older adult population. Post-disaster symptom profiles have been found to vary such that older-old adults (aged ≥75 years) report significantly lower levels of disaster-related rumination than do younger-old adults (aged 55–74 years) with control for exposure.[28] Younger-old adults may be less prone to arousal or physical reactivity but more susceptible to intrusive, "re-experiencing" symptoms (such as flashbacks).[29,30] Thompson et al[14] found greater disaster-related distress and adverse outcomes in the late middle-age group (aged 50–64 years)

1 year after Hurricane Hugo than in older adults (aged ≥65 years). Although physical stress (ie, stress related to health issues) was notably higher in the oldest age group, adults in late middle-age reported greater stress in nearly every other domain, including financial, filial, occupational, and parental responsibilities. Greater distress among younger-old adults may be due in part to multiple competing obligations and pre-storm caregiving responsibilities.

Even without experiencing the trauma of a disaster, older adults in aging social service settings report higher rates of depression than does the general population. The mental health needs of older New Yorkers have been monitored over the past 10 years by the NYC Department for the Aging (DFTA). They found that nearly 1 in 10 older adults in senior centers (9.8%) suffers from clinically significant depressive symptoms[31] as measured by the 9-item Patient Health Questionnaire (PHQ-9).[32] Providers in the National Aging Network, an array of agencies and programs sponsored by the Older Americans Act and headed by the US Administration for Community Living (http://www.aoa.acl.gov/), face mounting rates of depression among NYC's older adults[33-35] and are increasingly aware of the biological and psychosocial costs of depression. Depression in later life is associated with declines in cognition and medical status,[36] increased disability,[37] greater risk of falling,[38] and increased risk of suicide[39] as well as nonsuicide mortality.[40]

In a unique partnership between the NYC government and an academic medical school, we implemented a novel service delivery program designed to reach older adults living in hurricane-affected areas. The program, called SMART-MH for Sandy Mobilization, Assessment, Referral and Treatment for Mental Health, was funded by a New York State Block Grant with the twin goals of identifying older adults with mental health and social service needs and connecting them with services. Designed in collaboration with multiple agencies, the SMART-MH program integrates (1) community outreach, (2) case identification, (3) needs assessments, (4) social service links within DFTA's network, and (5) clinical services (free, short-term community-based psychotherapy) for older adults with anxiety or depression. Although Lowe et al[41] found that only 7.8% of New Yorkers (mean age 45 years) endorsed mental health needs 1.5 years after Hurricane Sandy, those authors used one binary self-report item of perceived need for mental health care. Among older adults who are reluctant to seek help owing to stigma or other barriers, self-report measures may underestimate their actual symptoms or impairment in functioning.[24,42]

In this article we report on the assessment of mental health symptoms, functioning, hurricane impact, and their potential relation among older adults living in Hurricane Sandy–affected areas. We hypothesized that older adults (aged ≥ 60 years) living in flood zones would report higher rates of clinically significant depression compared with average

community rates, with the older-old adults (aged ≥ 75 years) having the highest mental health needs. In addition, we hypothesized that greater storm stressors would be associated with increased odds of depressive symptoms for both age groups after accounting for demographic factors.

METHODS

Partnership

Faculty from Weill Cornell Medicine's Department of Psychiatry partnered with NYC DFTA, the Aging in New York Fund (the charitable 501(c)(3) arm of DFTA), and the Silberman School of Social Work at Hunter College for this service delivery program. DFTA is the largest Area Agency on Aging in the United States.

Participants

A convenience sample of older adults (aged ≥ 60 years) residing within NYC flood zones 1 and 2 were considered eligible for participation. Older adults were interviewed beginning 24 months after the storm if they reported being in an affected area or experiencing any personal impact of Hurricane Sandy during or right after the storm. To ensure that information and support services were available to all interested older adults, needs assessment data were collected from all clients regardless of Hurricane Sandy exposure intensity or existing psychiatric disorders (beyond depression). Only individuals unable to understand interview questions as a result of acute psychosis or cognitive impairment were excluded. Interviews were conducted in English, Russian, Spanish, Mandarin, and Cantonese.

Data Collection

SMART-MH staff consisted of a multidisciplinary team with backgrounds in psychiatry, social work, counseling, community engagement, and emergency response. After training designed by Weill Cornell Medicine on community outreach techniques and assessment administration, SMART-MH staff partnered with local agencies such as senior services providers (senior centers, naturally occurring retirement communities, case management programs) and faith-based organizations to reach out to affected older adults. Innovative outreach strategies, such as music, salsa for seniors, origami, and Age-tastic, an instructive health and wellness game developed by DFTA,[31] were used to introduce the SMART-MH project in a manner that minimized the stigma commonly associated with mental health outreach.[24,42] Permission for assessment and data entry were consistent with DFTA's standard procedures and were implemented by staff from all collaborating institutions.

Ethical Approval

Following DFTA's protocol for client consent when delivering services, verbal permission was obtained from clients to conduct an assessment and enter information into DFTA's Senior Tracking, Analysis and Reporting System (STARS), the electronic data management system used by all DFTA contractors. All participants were also asked if they were interested in learning more about free or low-cost social support services available in their area and were provided with information or referrals when requested. A de-identified dataset was provided to Weill Cornell for analysis and approved under Weill Cornell Medical College IRB protocol #1504016137.

Measures

The SMART-MH needs assessment includes standardized scales to assess clinically significant symptoms of depression, anxiety, and PTSD as well as questions to identify social support needs and the short- and long-term effects of Hurricane Sandy. Basic demographic variables included age, gender, race/ethnicity, and education. Clients were asked if they received food stamps or Medicaid to indicate financial status. Social support was defined as the number of close friends and relatives reported by the client. Referrals for requested social services were made directly through the STARS database.

The mental health needs assessment included the following. Depressive symptoms were assessed by using the PHQ-9, a validated screening tool for depression.[32] All clients who endorsed suicidal ideation (passive or active) were immediately administered the Suicide Risk Assessment[43] to evaluate risk level, which was performed by a senior clinician on the SMART-MH team. Anxiety screening was conducted by using the DSM-V (*Diagnostic and Statistical Manual of Mental Disorders* [fifth edition]) cross-cutting symptom measure for anxiety and panic.[44] Participants who endorsed any symptoms were administered the full Generalized Anxiety Disorder scale (GAD-7).[45] Single-screening items from the DSM-V cross-cutting symptom measure were used to assess symptoms of PTSD (eg, flashbacks) and to detect the presence of psychosis, mania, or cognitive impairment. Clients were also asked if they were currently receiving or had ever received mental health treatment.

Physical health was by assessed using a widely administered self-report item of overall health ("In general, how would you rate your health").[46] This question has been consistently validated as a reliable way of measuring health status among older adults.[47] In addition, clients were asked if they had sought treatment in the past 6 months for diabetes, heart disease, hypertension, or cancer, which represent the leading causes of death among older adults in the United States.[5] To assess functional mobility, clients were asked if they needed help from others with respect to housework, grocery shopping, and traveling out of walking distance. Pain was assessed by using the pain interference item from the Short-Form Health Survey (SF-36) ("During the past 4 weeks, how much did pain interfere with your normal work?").[48]

Storm impact was assessed by using questions administered to Hurricane Katrina survivors to maximize the opportunity for comparison data.[49,50] Major stressor categories included loss of property or basic necessities, home damage, forced evacuation, and disruption of needed services. Consistent with prior research, a total count of storm stressors was calculated for each client.[50,51] Death of a loved one, injury during the storm, and being a victim of post-storm crime (eg, assault, fraud) were classified as traumatic events that were distinct from other storm experiences[2] and were thus analyzed independently.

All clients with significant symptoms of depression or anxiety (PHQ-9 or GAD-7 ≥ 10) were invited to participate in Engage, a psychotherapy designed to promote participation in enjoyable activities to improve reward processing.[52-54] Referrals were made by using the Open Door strategy to improve links to mental health services; clients also received up to 3 follow-up phone calls to support treatment engagement.[34] To minimize barriers to care, all licensed clinicians delivered 6 weekly sessions of psychotherapy in the older adult's preferred location at no cost to the client. Most clients opted to receive mental health services at their local senior center in a private space made available by the center director specifically for SMART-MH activities. Clinicians also delivered psychotherapy in-home for clients with significant mobility issues and occasionally met clients in community settings (such as a public library) when a specific location was requested. Psychotherapy was offered in all languages. Participants who were symptomatic but already in treatment were encouraged to return to their providers for possible treatment intensification.[55] Individuals with mental health needs beyond the scope of SMART-MH clinical services were linked to specialty mental health services within the community.

Data Analysis

Descriptive analyses examined the rates of significant depressive and anxiety symptoms among the sample. Collinearity among all covariates was evaluated by calculating variance inflation factors for each variable and using a cutoff of 10.[56] Variance inflation factors for all variables were less than 2 and hence used for model fitting.

Logistic regression models were developed separately for the full sample and for each of the 2 age cohorts, younger-old adults (aged 60–74 years) and older-old adults (aged ≥ 75 years). Backward elimination with a significance level of 0.1 for retention in the model was used to select a subset of relevant and nonredundant variables. The dependent variable was a binary indicator of clinically significant depression (PHQ-9 ≥ 10). The models were developed to evaluate the relative contribution of common factors known to be associated with depression among older adults ("depression correlates") and storm stressors ("Sandy impact variables") in predicting clinically significant depression. The 2 groups of covariates were fitted in a nested manner in addition to key demographic variables. First, depression correlates (self-rated health, pain, mobility, chronic disease, income, social support, and prior history of mental health treatment) were entered into the model. Afterward, the total count of storm stressors, traumatic storm events, and lost access to medical care were entered into the model. Likelihood ratio tests were employed to test the difference between these 2 sets of predictor variables. Effect modification was investigated by refitting the model including the main effects and a single interaction term between age group (younger-old vs. older-old) and each predictor. This analysis was conducted for variables that were included in either of the 2 age group stratified models, but not both. Overall model predictive ability was evaluated by computing the area under the receiving operating characteristic curve, or AUROC. All analyses were conducted by using PROC LOGISTIC of SAS (version 9.4; SAS Institute Inc, Cary, NC).

RESULTS

From October 31, 2014, through July 21, 2015 (24 to 33 months after the storm), a total of 1512 needs assessments were conducted with older adults. Most (45%) were conducted with residents of Manhattan, followed by Brooklyn (30%), Queens (13%), Staten Island (11%), and the Bronx (1%). The majority of assessments (56%) were conducted in English, with an additional 33% in Chinese, 6% in Spanish, and 5% in Russian. Sample characteristics are summarized in Table 1.

Impact of Hurricane Sandy

Rates of exposure to Hurricane Sandy are described in Table 2. The majority of interviewees reported living in an affected area during the storm (87%), but some were not in their residences at the time of impact. Most participants reported losing access to basic supplies such as electricity (74%). More than one-third (35%) were forced to leave their homes, and 209 (14%) reported that their homes were damaged or destroyed. Another 256 older adults (16%) were stuck in their homes or apartments and unable to leave during the storm, whereas 1 in 10 lost access to medical care. One-third of older adults (37%) reported that Hurricane Sandy was "moderately" to "extremely" stressful. About 20% indicated losing their peace of mind or sense of security as a result of the storm, whereas one-quarter (25%) endorsed a change in their quality of life. Just under one-half of the participants (48%) did perceive some positive impact (eg, strengthened community, bringing people together) resulting from Hurricane Sandy.

Rates of Depression

Across the full sample, 213 older adults (14.1%) reported clinically significant depressive symptoms (PHQ-9 ≥ 10) and 5.0% (76 individuals) reported suicidal ideation. The prevalence of depressive symptoms was significantly higher than the rate of 9.8% previously reported in NYC senior centers[31] ($z = 2.31$, $P = 0.02$). Rates of depression differed

TABLE 1

Sample Characteristics				
Demographic Characteristics	Full Sample (Aged 60–100 Years), N = 1512	Younger-Old (Aged 60–74 Years), N = 734	Older-Old (Aged ≥75 Years), N = 778	Significance (P value)
Age, mean (SD), y	75.1 (8.3)	67.9 (4.0)	81.8 (5.1)	0.000[a]
Female, %	75.7	76.4	75.1	0.536
Hispanic, %	13.5	15.0	12.0	0.006[a]
Race, %				
Black	8.6	8.6	8.7	0.944
White	46.2	39.7	51.6	0.000[a]
Asian	42.9	47.9	38.6	0.001[a]
Other	2.3	3.8	1.1	0.001[a]
Language of interview, %				0.320
English	55.9	54.3	57.5	
Chinese	33.4	35.3	31.6	
Spanish	6.1	6.4	5.8	
Russian	4.6	4.0	5.1	
Education, %				0.082
Less than 8th grade	22.4	20.3	24.5	
Some high school	44.1	45.7	42.5	
Completed GED	26.2	25.5	26.9	
Higher education	7.3	8.5	6.1	
Health, %				0.198
Poor	7.4	6.6	8.3	
Fair	35.5	37.7	33.6	
Good	35.7	33.6	37.7	
Very good	14.6	14.8	14.4	
Excellent	6.7	7.4	6.0	
Chronic diseases, %				
Hypertension	52.6	51.2	53.9	0.292
Heart disease	22.9	19.1	26.5	0.001[a]
Diabetes	28.1	28.0	28.2	0.933
Cancer	6.6	6.1	7.1	0.451
Pain interference, %				0.792
Not at all	53.1	52.1	54.0	
Somewhat	30.2	32.7	27.9	
Quite a bit	10.6	10.1	11.0	
Extremely	6.2	5.1	7.2	
Help needed with activities, %				0.000[a]
None	62.3	74.4	51.0	
One activity only	12.3	9.2	15.2	
Two or more	25.4	16.4	33.9	
On Medicaid, %	46.4	48.8	44.2	0.075
On food stamps, %	45.7	47.1	44.4	0.299
Had prior mental health treatment, %	9.6	13.4	6.0	0.000[a]

[a]$P < 0.01$.

significantly by age group: 17.5% of younger-old adults screened positive for depression compared to 11.3% of older-old adults ($\chi^2(1) = 11.59$, $P < 0.001$). Among depressed older adults, 1 in 4 (55/213; 26%) reported suicidal ideation; this rate did not differ significantly between age groups.

Rates of depression also varied significantly by assessment language ($\chi^2(3) = 54.58$, $P < 0.000$). Spanish-speaking clients had the highest rate of clinically significant symptoms, with fully one-third (34%) screening positive for depression. Rates were reduced for English-speaking (17%) and Russian-speaking (13%) clients, with the lowest rates found among Chinese-speaking clients (7%).

In addition, nearly one-quarter of the sample (24%) reported having Hurricane Sandy–related flashbacks "often" or "all the time" when hearing about other storms. A similar percentage (23%) endorsed worrying "often" or "all the time" about future storms.

Factors Associated With Depression

In the full sample, age and language were significantly associated with depression and were thus included as potential covariates in all models. Of the variables known to be associated with late-life depression (see Methods), self-rated health, pain interference, social support, prior mental health treatment, and heart disease all predicted a greater probability of being depressed (see Table 3 and Figure 1). Among Hurricane Sandy impact variables, injury during the storm, greater number of storm stressors, and post-storm crime were associated with a higher

TABLE 2

Percentage of Storm Stressors Endorsed by the Total Sample and by Each Age Group

| Hurricane Sandy Stressors	Full Sample (Aged 60–100 Years), N = 1512	Younger-Old (Aged 60–74 Years), N = 734	Older-Old (Aged ≥75 Years), N = 778	Significance (P Value)
Living in affected area, %	87.6	88.0	87.3	0.664
Relocation time, %				0.518
Did not leave area	64.8	66.2	63.4	
Left for less than 1 week	18.4	17.8	19.1	
Left 1 week or more	16.8	16.0	17.5	
Was stuck in home, %	16.5	16.8	16.2	0.768
Lost possessions, %	11.3	13.5	9.3	0.009[a]
Lost access to medical care, %	10.2	12.9	7.6	0.001[a]
Trauma, %				
Death of loved one	1.5	1.5	1.4	0.891
Was injured during storm	1.7	2.3	1.0	0.078
Was the victim of a crime	3.9	4.2	3.6	0.531
Flashbacks of the storm, %				0.000[a]
Not at all	43.4	37.2	49.3	
Sometimes	32.0	33.3	30.7	
Often or all the time	24.6	29.5	20.0	
Worrying about storms, %				0.000[a]
Not at all	43.6	38.4	48.7	
Sometimes	32.8	33.8	31.8	
Often or all the time	23.6	27.8	19.5	
Number of stressors, mean (SD)	3.3 (2.1)	3.5 (2.3)	3.1 (2.0)	0.000[a]

[a] $P < 0.01$.

TABLE 3

Odds Ratios (ORs) and 95% Confidence Intervals (CIs) Predicting Depression by Age Group and in the Total Sample

Effect	Full Sample (Aged 60–100 Years) OR (95% CI)	P Value	Younger-Old (Aged 65–74 Years) OR (95% CI)	P Value	Older-Old (Aged ≥75 Years) OR (95% CI)	P Value
Demographic variables						
Age group (younger-old vs older-old)	1.76 (1.20,2.58)	0.004				
Primary language						
Chinese vs English	0.41 (0.25,0.67)	<0.001	0.38 (0.19,0.76)	0.0066	0.44 (0.23,0.87)	0.018
Russian vs English	0.19 (0.07,0.53)	0.002	0.05 (0.00,0.49)	0.0107	0.31 (0.09,0.99)	0.049
Spanish vs English	1.68 (0.95,2.98)	0.073	2.61 (1.21,5.62)	0.0147	0.93 (0.36,2.40)	0.875
Correlates of depression						
Self-rated health	0.62 (0.50,0.78)	<0.001	0.54 (0.40,0.72)	<0.0001	0.68 (0.49,0.93)	0.018
Pain	1.50 (1.31,1.72)	<0.001	1.48 (1.22,1.80)	<0.0001	1.66 (1.36,2.02)	<0.001
Social support	0.71 (0.63,0.80)	<0.001	0.65 (0.55,0.77)	<0.0001	0.74 (0.62,0.89)	0.001
Prior mental health treatment	2.22 (1.38,3.59)	0.001	2.79 (1.51,5.17)	0.0011		
Help needed with activities	1.12 (1.00,1.26)	0.055			1.21 (1.04,1.41)	0.016
Heart disease	1.54 (1.03,2.32)	0.037			1.75 (1.00,3.07)	0.052
Assistive device needed					0.57 (0.30,1.07)	0.078
Sandy impact variables						
Injury during storm	3.89 (1.49,10.14)	0.006	4.85 (1.53,15.39)	0.0073		
Post-storm crime victim	2.33 (1.17,4.63)	0.016	4.70 (1.75,12.59)	0.0021		
Count of storm stressors	1.12 (1.02,1.21)	0.013	1.12 (1.00,1.25)	0.0539		
Loss of access to medical care					2.92 (1.40,6.12)	0.005

probability of depression. No other Hurricane Sandy events were found to be independently associated with depression.

The addition of Hurricane Sandy impact variables significantly improved model fit ($\chi^2(3) = 25.38$, $P < 0.0001$). The model with demographic variables and correlates of depression had an

FIGURE 1

Odds Ratios for Predictors of Depression Risk and 95% Wald Confidence Intervals for the Full Sample.
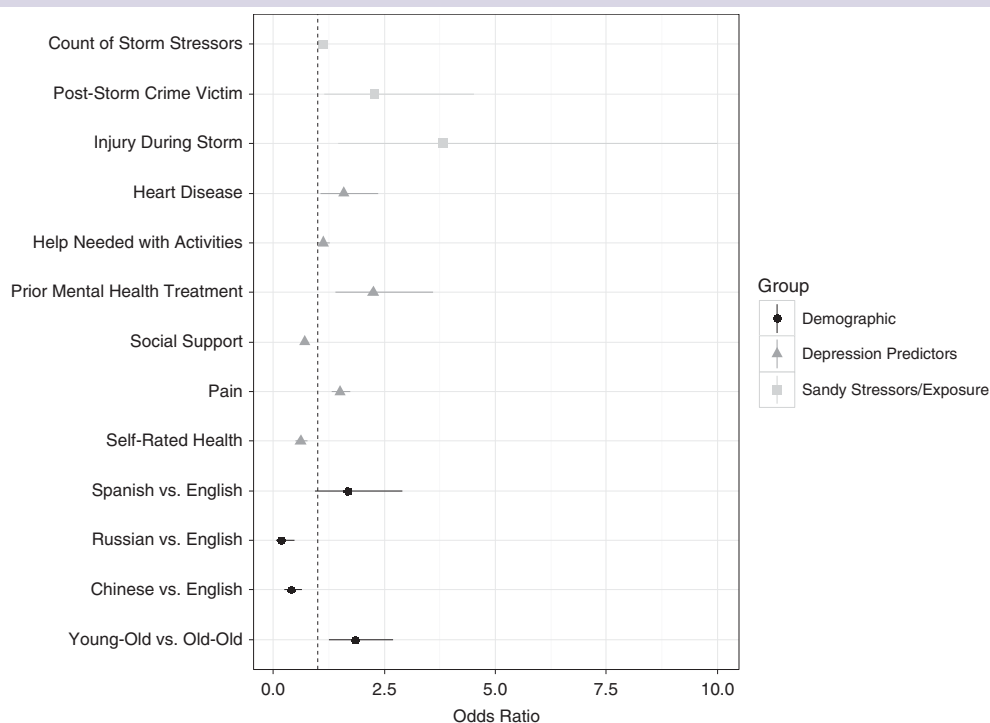
Predictor variables shown in the *y*-axis of the figure are grouped into demographic, depression predictors, and Hurricane Sandy stressors and represent the selected predictors obtained through backward elimination.

estimated AUROC of 0.82 (95% confidence interval [CI]: 0.79, 0.86) and the AUROC estimate after the addition of Hurricane Sandy impact variables was 0.83 (95% CI: 0.80, 0.86), both showing good operating characteristics. As younger-old adults were 1.77 times (95% CI: 1.20, 2.58, $P = 0.004$) as likely to be depressed as were older-old adults after adjustment, we constructed separate models for each age group to identify group-specific predictors of depression.

Younger-Old Adults (Aged 60–74 Years)

For younger-old adults, most variables significantly associated with depression in the full sample analysis were also significant in the younger-old group model, with the exception of heart disease (see Table 3 and Figure 2). The total number of Hurricane Sandy stressors also dropped to marginal significance ($P = 0.054$). Correlates of depression and the addition of Hurricane Sandy impact variables to the younger-old cohort model had estimated AUROCs of 0.85 (95% CI: 0.81, 0.89) and 0.86 (95% CI: 0.82, 0.90), respectively.

Older-Old Adults (Aged ≥75 Years)

In contrast to the full sample, prior mental health treatment, heart disease, storm injury, post-storm crime, and the total count of stressors were all unrelated to depression among

older-old adults. Only needing help with activities and losing access to medical care during Hurricane Sandy significantly increased the odds of current depression (see Table 3 and Figure 3). Correlates of depression had an estimated AUROC of 0.80 (95% CI: 0.75, 0.85). The addition of lost access to medical care improved the AUROC to 0.81 (95% CI: 0.77, 0.86) and significantly improved overall model fit ($\chi^2(1) = 7.50$, $P = 0.0062$).

Interaction Between Predictors

To examine the potential interaction between factors predictive of depression for each age group, separate models were constructed with interactions of depression correlates and Hurricane Sandy impact variables by age group. The only significant interaction was being a victim of post-storm crime ($\chi^2(1) = 4.5342$, $P = 0.03$). Among younger-old adults only, post-storm crime victims were nearly 5 times as likely to report clinically significant depression (odds ratio [OR] = 4.7; 95% CI: 1.83, 12.09), whereas crime had no significant mental health impact on the older-old group (OR = 1.03; 95% CI: 0.36, 2.97).

DISCUSSION

SMART-MH was designed to identify the mental health and social service needs among older adults living in NYC areas

FIGURE 2

Odds Ratios for Predictors of Depression Risk and 95% Wald Confidence Intervals for the Younger-Old (Aged 60–74 Years) Subsample.
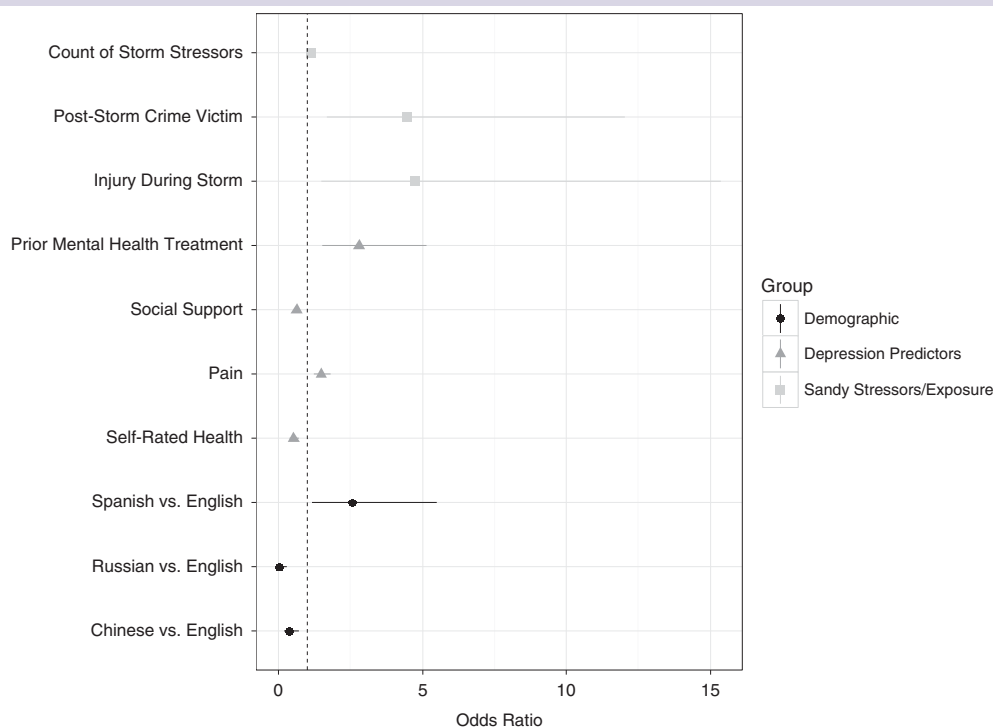
Predictor variables shown in the *y*-axis of the figure are grouped into demographic, depression predictors, and Hurricane Sandy stressors and represent the selected predictors obtained through backward elimination.

affected by Hurricane Sandy. As expected, older New Yorkers still felt the storm's impact 24 to 33 months later. The rate of depression among these individuals (14.1%) was higher than the rate in the general older adult population seen at senior centers; the younger-old (aged 60–74 years) also had significantly higher rates of depression than did the older-old (aged ≥75 years) in this sample. In the English-speaking group alone, the rate of depression rose to 17%.

Consistent with reports in the late-life depression literature,[36-40] depression was related to chronic pain, limited mobility, and poor health among older adults, with storm incidents significantly contributing to the likelihood of depression 2 to 3 years later. Although nearly half of our clients were stuck in their homes or evacuated, it was the accumulation of stressors and specific traumas that most strongly predicted current depression. These findings are consistent with previous reports of mental health need after Hurricane Katrina[12,50,57] as well as emerging research suggesting that losing access to medical care was among the most stressful consequences of Hurricane Sandy,[25] which closed 37 health care facilities and required the evacuation of nearly 6300 patients.[58] In addition, this loss of services may be compounded by the disproportionately low levels of governmental help and assistance received by older adults after a disaster.[14,25]

Given the 40-year span of this sample, it is not surprising that mental health outcomes differed by age group. Among the younger-old, those with poor health or pain, limited mobility, and prior mental health issues may have been most vulnerable to added storm stress and trauma. In stark contrast, only storm-related loss of medical care was significant in predicting depression among the older-old group. These findings are consistent with the hypothesis outlined by Solomon et al and subsequent researchers[14,15,59] whereby disaster-related stress is greatest among those aging adults with more formal responsibilities and obligations to provide for others, such as paying for offspring education while also caregiving for aging parents.

Limitations

The primary limitation to this study was our reliance on a community-based convenience sample of older adults, who both self-reported impact from Hurricane Sandy and agreed to participate in a needs assessment when staff conducted outreach. This sample was not random and likely was not representative of the full NYC older adult population. Because SMART-MH was designed as a service delivery project rather than a controlled research study, we did not collect any data on older adults who attended participating centers or outreach

FIGURE 3

Odds Ratios for Predictors of Depression Risk and 95% Wald Confidence Intervals for the Older-Old (Aged ≥75 Years) Subsample.
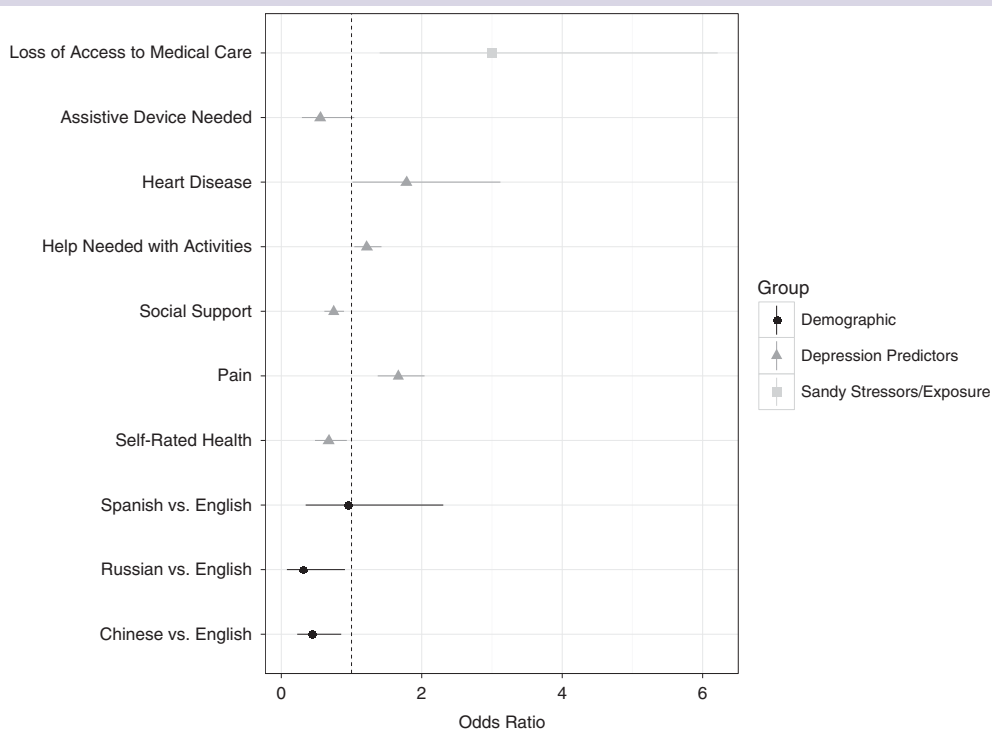
Predictor variables shown in the *y*-axis of the figure are grouped into demographic, depression predictors, and Hurricane Sandy stressors and represent the selected predictors obtained through backward elimination.

activities but declined to participate in our assessment. As such we cannot rule out the possibility of systematic differences between those clients and our own sample that could influence post-disaster mental health outcomes. Despite these limitations in generalizability, we hoped this approach would allow us to interview individuals living on the NYC coastline who might not otherwise participate in traditional research despite being hard-hit by the storm.

In addition, we were limited in our ability to ensure that all clients with mental health needs did initiate the treatment recommended by SMART-MH, although we endeavored to promote treatment engagement whenever possible. To link clients to mental health services, we used Open Door engagement strategies found to be effective in our previous randomized controlled research.[34,60] We also attempted to contact clients with mental health needs at least 3 times to identify goals for treatment, encourage follow-up on the referral, and promote treatment engagement. When clients were receiving psychotherapy services from SMART-MH staff, treatment initiation was recorded along with the number of missed or rescheduled sessions. We are currently examining mental health outcomes for clients who were offered 6 sessions of the brief SMART-MH psychotherapy.

A final limitation to note is that we did not have data collected from our specific sample prior to the impact of Hurricane Sandy. Our assessment combined health measures with disaster questionnaires used in past research with hurricane victims[49,50] in order to facilitate comparison of our data with similar samples, including depression rates among older adults attending NYC senior centers. However, we cannot attest to the pre-disaster medical or mental health characteristics of those older adults attending specific senior centers hit hardest by Hurricane Sandy, especially in hard-to-reach communities such as Coney Island or the Far Rockaways.

Implications
As we witness the increase in these types of events and the rapidly aging population, service delivery models are essential both to identify community-based older adults in need of help after a disaster and to facilitate their preparation for impending disasters. In NYC, this challenge includes reaching a large geographic area that is home to a diverse population with varied needs. The partnership between government aging services and mental health expertise allowed SMART-MH to work within the community and assess for a wide range of psychosocial issues. Early work with

Hurricane Sandy survivors in New Jersey found that older adults were the least likely group to access mental health care, accounting for 43% of the sample but only 19% of reported visits.[61] The SMART-MH model brings multilingual, culturally sensitive, systematic assessment and evidence-based treatment to where it is needed by breaking down common barriers to mental health care.[62-64] The success of this model has led to its use as the template for mental health service delivery in senior centers as part of a new ThriveNYC mayoral initiative to improve mental health care (https://thrivenyc.cityofnewyork.us/).

Several suggestions for targeted service delivery may be drawn from this project to guide future disaster response and resource management for older adults. First and foremost, the success of the SMART-MH service delivery model is contingent upon collaboration between academic researchers, local government, and community members, including community leaders, gatekeepers, and older adults with lived experience. This program built upon the experiences documented by REACH NOLA, a community-academic partnership developed after Hurricane Katrina.[65] We learned that extensive collaboration and cooperation are essential both to identify specific needs and to target the priorities of each affected neighborhood. Collaboration increased the reach of our services by establishing trust between our providers and the population they were attempting to serve. For example, SMART-MH outreach workers found that many older adults readily accepted information or referrals offered by providers who were also residents of their community but remained skeptical or disinterested when "outsiders" attempted to help. It is critical to involve members of affected communities in the development and implementation of disaster relief programs, which may otherwise be perceived as too far removed from residents' concerns.

Our findings also contribute to the growing literature highlighting the importance of offering mental health and social support services to disaster victims in community-based settings, including continued outreach to ensure sustainability.[25,66] For older adults in particular, stigma remains a significant barrier to seeking mental health care, notwithstanding logistical challenges such as transportation and limited finances.[42,67,68] By bringing an array of outreach activities, educational talks, and health-related programming directly to senior center members, we found that older adults were willing to speak with us about their experience and consider seeking treatment for mental health symptoms (if needed). Disaster relief programs should strive to integrate direct mental health assessment and referral into disaster-related outreach or services when targeting older adults in community-based settings. In addition, the potentially long-standing psychological impact of disasters should be acknowledged in outreach or relief efforts. While many community staff thought that Hurricane Sandy concerns were resolved (eg, "that ship has sailed"), we found that shame and embarrassment tended to accompany the ongoing symptoms or reactions endorsed by affected older adults. A culture shift may be needed to recognize that for some, full recovery may take several years in the wake of a serious natural disaster.

A related lesson is the critical importance of finding bilingual and culturally competent providers who can understand and affirm the unique challenges faced by non-English-speaking and immigrant older adults. These groups may be particularly vulnerable to poor post-disaster outcomes given the language barriers and common disparities in health care access and coverage. We found that hiring and training staff who could assess and deliver services to clients in their native language helped to strengthen communal trust in the usefulness of SMART-MH. Furthermore, once there was an established bond between the community and SMART-MH staff, clients themselves often became a valuable referral resource in informal networks of older adults. In Chinatown, for example, outreach workers reported that senior center clients eventually started arriving to scheduled assessments with friends in tow, bringing along other members they thought could benefit from services. Our staff thus provided an outlet for important health and disaster education that this community may have had trouble accessing. Our staff likely enabled the treatment of some individuals who would have remained isolated without our clients acting as gatekeepers.

One final implication is the clear need to distinguish between different age groups even within the older adult demographic. Much of the literature treats "older adults" as a monolithic category despite the enormous amount of heterogeneity observed across a 40-year age span. Our results suggest that a number of distinct stressors from natural disasters remain significant in predicting later depression among the older adult population, with their relevance varying significantly based on age. For younger-old adults (aged 60–75 years), current mental health symptoms were associated with storm-related injury and post-storm crime, with the total number of reported stressors retaining marginal significance. For older-old adults (aged ≥75 years), however, only the loss of access to medical care predicted a greater likelihood of depression 24 to 33 months later. Disaster relief programs should consider conducting both acute and long-term needs assessments with older adults over time to identify which components of aid may provide the greatest benefit to different affected age groups.

With respect to planning for future disasters, our findings suggest that it is important to locate outreach and educational activities in community-based settings, offering programs in multiple languages to reach older adults who may not understand English. Little is known about how prepared the older adult population is for future natural disasters, in particular, preparation among immigrant older adults. Fostering collective awareness and education offers a strategy

for reaching large numbers of older adults and encouraging community members to view each other as neighbors and resources, for social support as well as knowledge of local services. At the same time, disaster agencies should work to develop individualized plans for older adults that take into account issues such as mobility limitations, medical conditions, or the need for durable medical equipment. At a minimum, all older adults should have a bag packed with emergency necessities, including a list of their medications and an evacuation plan in the event of an emergency. In the current project, we provided a SMART-MH "go bag" to every client who participated in an assessment, offering a small incentive that doubled as a tangible means of preparation.

Future research should investigate the longitudinal course of depression and related psychopathology among older adults following a disaster, including the immediate aftermath as well as long-term follow-up. Given the differing rates of need by age group in our sample, research should also consider identifying specific concerns and risk factors for more narrow segments of the older adult population. Future work with the SMART-MH data will explore the rates of depressive symptoms and related factors by language and examine the impact of SMART-MH service delivery in these communities.

CONCLUSION

Our findings can contribute to the growing body of mental health research documenting potential long-term effects among older adults living in areas damaged by natural disasters. By using a novel service delivery strategy that combined outreach and assessment conducted by a nonstigmatizing social service agency, SMART-MH was able to reach some of the more isolated and racially diverse populations living in NYC flood zones, including older adults who do not have telephones or speak English. Our data also support the differential impact of storm-related stressors on subgroups of older adults. To our knowledge, this is the first post-disaster study of older adults that included monolingual Russian, Chinese, Spanish, and English speakers. Future work will explore factors associated with need within these specific subgroups and the impact of participation in community-based psychotherapy as part of the SMART-MH program.

About the Authors

Department of Psychiatry, Weill Cornell Medical College, New York, New York (Dr Sirey, Ms Halkett, Dr Raue); New York City Department for the Aging, New York, New York (Dr Berman, Ms Kerrigan); Silberman School of Social Work, Hunter College, New York, New York (Dr Giunta); Department of Clinical Psychology, Long Island University, Brooklyn, New York (Ms Raeifar); and Department of Healthcare Policy & Research, Weill Cornell Medical College, New York, New York (Ms Artis and Dr Banerjee).

Correspondence and reprint requests to Jo Anne Sirey, PhD, Cornell Institute of Geriatric Psychiatry, Weill Cornell Medical College, 21 Bloomingdale Rd, White Plains, NY 10605 (e-mail: jsirey@med.cornell.edu).

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