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The Lasting Impacts of Superstorm Sandy: An Analysis of Those Suffering With Poor Mental Health After the Storm

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Abstract

In October 2012, Superstorm Sandy struck landfall in the U.S., affecting large areas of coastal New York and New Jersey, devastating communities, killing more than 180 people, and causing tens of billions of dollars in property damage (AP-NORC 2014). Research of previous natural disasters has found survivors of large-scale natural disasters can experience post-traumatic stress disorder and other serious mental health conditions that can last for months or years after the event, with certain situational, demographic, and social factors increasing the likelihood of experiencing distress. In 2014, the AP-NORC Center conducted a survey of 1,009 residents of 12 neighborhoods that were highly impacted by Superstorm Sandy. The survey included a battery of self-reported mental health measures that make up the validated and frequently-used Kessler 6 mental health scale. It also collected responses to assess the social resources in each neighborhood including social cohesion, informal social control, social exchange, and general trust. Findings show that, even nearly two years after the storm, those impacted by Superstorm Sandy report serious mental distress at a rate nearly twice that of the rest of the country (as measured by the National Health Interview Survey (NHIS)). It also finds that, after controlling for personal impact of the storm, perceived neighborhood impact, neighborhood recovery, and demographic factors, living in a neighborhood with lower levels of social control, social exchange, and general trust is associated with higher levels of reported psychological distress. These findings highlight the importance of social bonds and the need for policymaking that accounts for differences in social resources in recovery efforts following a disaster.

Research Purpose

On October 29, 2012, Superstorm Sandy made landfall in the New York-New Jersey area. It brought with it heavy rain, high winds, and rising water levels. In the end, the storm resulted in 182 deaths and caused over \$65 million in damages, making it the second costliest hurricane in U.S. history (AP-NORC 2014). Over the next days, weeks, and months, communities suffered the effects of massive flooding, property damage, power outages, disrupted communication, and lost homes. The damage was not limited to just the physical environment; individuals were left to cope with the mental and emotional stress that comes from disrupted lives, unsettled communities, lost loved ones, relocation, and personal injury.

In 2014, two years after the storm, The Associated Press-NORC Center for Public Affairs Research (AP-NORC Center) conducted a survey of 1,009 residents of twelve neighborhoods in New York and New Jersey that were highly impacted by the storm. It set out to learn more about the recovery in the region. How much have these neighborhoods recovered? What neighborhood characteristics were associated with recovery? How can social resources and social connections like social cohesion, informal public order, community cooperation, and trust influence recovery efforts and perceived resilience after the storm?

The study found that while self-reported recovery levels were generally high across the twelve neighborhoods surveyed, many people lived in neighborhoods that were still working toward full recovery. They expressed skepticism that their neighborhood will ever fully recover. But, independent of expected resources for recovery like wealth, neighborhoods that scored higher in social resources were more likely than those lower in social resources to say their neighborhood was extremely or very well prepared to handle a future disaster and had more confidence that their community would recover after a future disaster. The presence of social resources conditioned the effect of the socioeconomic status of the neighborhood; in neighborhoods low in social resources, socioeconomic status had a much bigger effect on perceived resilience, but in neighborhoods high in social resources, there was little difference in perceived resilience between neighborhoods with high socioeconomic status and those low in socioeconomic status (Cagney et al. 2016).

This paper seeks to continue research into the impact of social cohesion, informal social control, social exchange, and general trust – which, more broadly, can be classified as social resources – on resilience by studying the mental health of residents living in the same twelve neighborhoods that were hit hard by Superstorm Sandy. This research will look into two main questions. First, were those in the areas affected most by Superstorm Sandy still experiencing psychological distress as a result of the storm? And second,

do neighborhood social resources act as a protective factor against psychological distress following a natural disaster?

We will first review the existing research on social resources and mental health in the wake of disasters. Next, we will discuss the data used for the analysis, including details on the measures of social resources and mental health used for analysis from the 2014 AP-NORC survey and the 2012 National Health Interview Survey (NHIS) data used for comparison. Then, we will describe the analysis and results, which show that psychological distress was high in the affected region and that those who live in neighborhoods higher in certain social resources are less likely to show psychological distress two years after the storm. Finally, we will discuss implications of these findings and potential future research.

Literature Review

Those who experience natural disasters can be susceptible to several forms of psychological impairment and psychopathology (Goldmann and Galea 2014; Norris et al 2002). Among the most prevalent are post-traumatic stress disorder (PTSD), major depressive disorder, substance use disorder, and anxiety disorders (Neria et al 2008; Norris et al 2002; van der Velden and Kleber 2009; McFarlane et al 2009). General measures of psychological distress have been used to evaluate mental health in the aftermath of disasters. One of the most common is the Kessler 6 (K6) screening scale, a validated measure often used in surveys where direct clinical examination cannot be conducted. It assesses the frequency of nervousness, helplessness, and other measures to form a three-level scale of psychological distress (Kessler et al 2002; Kessler et al 2003; Furukawa et al 2003; Galea et al 2007). These measures of psychological distress have been used to assess how disaster conditions and pre-disaster factors can affect emotional wellbeing.

Psychological distress following a major disaster is often conditioned on how one experienced the event and its aftermath. Factors like intensity of exposure to the event, including bereavement, injury to self or a family member, threat to one's life, panic during the disaster, horror, property damage or financial loss, and relocation all can influence the impact to mental health (Neria and Shultz 2012, Norris et al. 2002). For example, exceptionally high levels of PTSD were observed after Hurricane Katrina in 2005, potentially due to high levels of displacement (Voelker 2006).

Additionally, many demographic characteristics have been shown to be associated with psychological distress in the wake of disasters (Goldmann and Galea 2014). Age is one, with older people being less likely to show symptoms of PTSD, depression, anxiety, and substance abuse issues following a disaster, while those of middle age appear to be more susceptible (Galea et al 2005; Galea et al 2007; Norris et al

2002). Research has also found a strong association between psychological distress and gender. While men are more likely than women to suffer from alcohol and substance abuse disorders (van der Velden and Kleber 2009), women are more likely than men to suffer from PTSD, anxiety, and depression (Galea et al 2005; Neria et al 2008; Galea et al 2007; Norris et al 2002). Employment status is also tied to psychological distress after disasters, with those who are unemployed more likely to show distress (Norris et al 2002; Galea et al 2007). Racial or ethnic minorities have “inconsistently” shown more distress (Galea et al 2005). Though blacks and some Hispanics have reported lower levels of distress in non-disaster situations (Bratter and Eschbach 2005), evidence suggests that differential exposure and differential vulnerability each play a role in higher levels of distress in these groups and other racial and ethnic minorities in post-disaster situations (Galea et al 2005; Norris et al 2002; Perilla et al 2002). Links between psychological distress and education, income levels, marital status, and having children have also been demonstrated in some instances (Bonanno and Gupta 2009; Galea et al 2005; Galea et al 2007; Norris et al 2002; Maguen et al 2009; van der Velden and Kleber 2009; Erdem et al 2016).

This study seeks to understand how social resources can help strengthen mental health by studying differences in psychological distress based on the presence of social cohesion, informal social control, social exchange, and general trust. Social cohesion refers to a broad sense of attachment to the community, including a sense of trust and solidarity among community members, and a belief about how the community might respond in a time of need (Sampson et al. 1997; Browning and Cagney 2002). By contrast, informal social control is about how well a community regulates its members, how it maintains public order, and the willingness of community members to intervene on each other’s behalf (Sampson et al. 1997; Sampson et al. 2002). Social exchange, which is sometimes referred to as reciprocated exchange, is about sociability – the actual interactions between members of a community, measured by the frequency of helping behaviors and social interactions between residents (Sampson et al. 1999; Cagney et al 2016). General trust involves a connectedness and engagement with the broader community and is often related to the concept of social capital (Putnam 1995; Verba et al 1995; Inglehart 1997). The presence of these characteristics in a community can determine a community’s capacity to manage problems or implement shared goals – key needs in the aftermath of a natural disaster (Sampson et al 1997; Browning and Cagney 2002; Browning et al 2004; Browning et al 2006).

The benefits of social resources are wide-reaching. Research demonstrates that in non-disaster situations, communities with higher levels of social resources show lower crime rates, higher levels of physical activity, and a general sense of emotional well-being (Sampson 2012; Cagney et al 2007). The link between social resources and mental health has been studied extensively, often finding positive relationships (Almedom 2005; De Silva et al 2005). Of the resources studied in this paper, the literature

on social cohesion and mental health is particularly rich, with much of it showing that social cohesion can lead to more positive reports of mental health (De Silva et al 2005; Rios et al 2012). Higher levels of social cohesion have been associated with a decrease in psychological distress using the Kessler scale, even among individuals with low socioeconomic status (Rios et al 2012; Erdem et al 2015; Erdem et al 2016). Social exchange can also have a positive impact on mental health, particularly reducing depressive symptoms in women (Mair et al 2010). General trust underlies these factors. The belief that others around you can be trusted can provide the “crucial mechanism through which social capital affects aggregate outcomes” (Helliwell and Putnam 2004). Trust has been found to relate positively to life satisfaction, happiness, and health status (Helliwell and Putnam 2004), and low levels of trust can present a risk of ill mental health (Harpham et al 2002). Research in The Netherlands suggests that low levels of informal social control is associated with mental health issues in children, but little research has been done on the effects of social control on mental health in adults (Drukker et al 2003; Almedom 2005).

In the aftermath of disaster situations in particular, a lack of social support and social resources can have adverse effects on mental health (Aldrich 2012; Galea et al 2005; Neria et al 2008; Tucker et al 2000). When it comes to the specific factors studied in this paper, social cohesion has been found to be associated with lower levels of distress in regions of England affected by flooding in 2007 (Greene et al 2015), but little has been done to study the link between mental health following a disaster and social control, social exchange, or general trust.

Psychological impairment in the immediate aftermath of Superstorm Sandy was extensive, with conditions like PTSD and major depression affecting broad swaths of the population across many neighborhoods impacted by the storm (Boscarino et al 2013). The AP-NORC Center study covered a diverse array of neighborhoods, and while it was conducted nearly two years after the storm, symptoms of mental stress can last for months or even years (Goldmann and Galea 2014; Norris et al 2002). Along with studying to what extent psychological distress remains a problem in the region affected by Superstorm Sandy, this paper will fill the need for greater research into how the specific factors of social cohesion, social control, social exchange, and general trust relate to mental health in a post-disaster context. Based on work demonstrating that these social resources can have positive impacts on mental health in non-disaster situations, we expect to find a positive relationship between their presence in neighborhoods impacted by Superstorm Sandy and the psychological wellbeing of residents of those neighborhoods.

Data

The data used here to study mental health in the wake of Superstorm Sandy come from a survey conducted by The AP-NORC Center between June 28 and September 9, 2014. Interviews were conducted with 1,009 residents of 12 neighborhood areas in New York and New Jersey that were severely impacted by the storm. The survey was conducted using a multi-mode address-based (ABS) approach, and the sample frame was based on an extract of the U.S. Postal Service delivery-sequence file. Interviews were conducted by telephone, web, or in-person. The survey could be completed in either English or Spanish in all modes, depending on respondent preference. Telephone and in-person interviews were conducted by professional interviewers trained specifically for this study. Field interviewers targeted those who did not respond to the survey via telephone or the web. In households that included more than one adult resident age 18 or older, one eligible member was randomly selected via the computer-assisted interviewing process. The final set of completed interviews includes 300 respondents who completed the survey via the web, 316 who completed by telephone, and 393 respondents who completed in-person interviews (AP-NORC Center 2014). Field interviewers increased the response rate, particularly for hard to reach populations such as those living in lower income or more racially diverse neighborhoods. The final response rate was 24 percent based on the American Association of Public Opinion Research (AAPOR) Response Rate 3 method.

The 12 neighborhood areas were selected through a rigorous data-informed process. In order to control for storm impact, neighborhood selection occurred only among neighborhoods designated as highly impacted by Superstorm Sandy based on the number of FEMA loan applications. From there, two factors—recovery status and neighborhood socioeconomic status—were central to neighborhood selection. As shown in Table 1 below, our approach resulted in a 2x2 design with median household income (measured using data from the U.S. Census Bureau via the American Community Survey) and recovery status (which was measured using data from a 2013 AP-NORC study of Superstorm Sandy recovery and key informant interviews) as key selection factors.

Table 1. Selected neighborhoods/community areas categorized on income and recovery status

	Higher Recovery	Lower Recovery
Mid-High Income	NJ: Hoboken (north of 7th St.) NY: Long Beach NY: Islip (southern portion)	NJ: Monmouth Beach NY: Breezy Point-Belle Harbor-Rockaway Park NY: Babylon (southern portion)
Low Income	NJ: Jersey City (Bergen Lafayette) NY: Gravesend NY: Lower East Side	NJ: Long Branch NY: Midland Beach/New Dorp Beach (Staten Island) NJ: Point Pleasant-Point Pleasant Beach

Recovery: measured using Phase 1 data and through verification interviews with key informants in each neighborhood.

Income: measured using Census information at tract level. Low Income defined as median annual household income less than \$73,600; Mid-High

Income defined as \$73,601 or greater.

Initially, 41 neighborhood areas in New York and New Jersey deemed highly impacted were selected for potential inclusion in the study. Rather than selecting neighborhoods that would be overall representative of affected neighborhoods, neighborhoods were selected in each of our four recovery status/income cells based on their diversity across several other stratification variables. These included population, county-level social vulnerability scores (SoVI, which measure the vulnerability of counties to environmental hazards), number of Small Business Association (SBA) loans made in the neighborhood area, percent white, percent foreign born, percent of the population under the poverty line, and the percent of residents who have moved in or out of the neighborhood area. This diversity helped ensure that the neighborhoods selected varied across a number of dimensions.

We obtained data on these measures for each neighborhood area, then grouped the neighborhoods into quartiles for each measure and stratified the neighborhoods on recovery status, median income levels, the number of loans made in the area, percent moved, and percent of residents below the poverty line. This process demonstrated how the preliminary neighborhood selections varied not only on recovery status and median income, but in other important ways that are related to recovery and resilience. This was done to control for factors besides income that could influence recovery. Using these factors as well as verification interviews with key informants in each neighborhood area, we were able to refine the list of 41 neighborhood areas down to the 12 used in the study.

For a baseline comparison of mental distress, we use data from the 2012 NHIS. The Centers for Disease Control and Prevention (CDC) have conducted the NHIS annually since 1957. Administered by the U.S. Census Bureau, the study collects a wide range of information on health status, health care access, and other health-related opinions including the Kessler 6 scale. Interviews are conducted in person in respondents' homes, with some follow-ups conducted over the telephone. NHIS imputes income data for

the less than 20% of respondents who did not provide this information. According to the CDC, the annual response rate of the NHIS is approximately 80 percent of the eligible households in the sample. (CDC – National Center for Health Statistics 2016). The 2012 survey was conducted before Superstorm Sandy struck, providing a look at mental health conditions across the country prior to the disaster (National Center for Health Statistics 2012).

Measures

Mental Health and Resilience

Existing literature offers several approaches to measuring mental health and resilience. Some research suggests that showing one or no symptoms constitutes recovery (Bonanno et al 2006), while other research suggests it means bouncing back to pre-disaster levels of functionality (Goldmann and Galea 2014; Klein et al 2003). Our approach in this study will incorporate both perspectives by including measures of mental health in neighborhoods following the storm and measures of mental health at the national level prior to the storm.

Respondents were asked to report on the six measures of mental health used to make up the Kessler 6 mental health scale – nervousness, feeling that everything was an effort, restlessness or fidgetiness, hopelessness, feeling so depressed that nothing could cheer you up, and worthlessness. For each of these six feelings, they answered, “During the past 30 days, about how often did you feel [ITEM], all of the time, most of the time, some of the time, a little of the time, or none of the time?” Responses of “all of the time” received a score of 5, “most of the time” scored a 4, “some of the time” scored a 3, “a little of the time” scored a 2, and “none of the time” scored a 1. The scores for each of the six feelings were added up for each respondent, with possible scores ranging from 6 to 30. Respondents who scored between 20 and 30 were categorized as having serious psychological distress, those who scored between 12 and 19 were categorized as having mild to moderate distress, and those who scored 11 or less were categorized as having no distress. This measure has been shown to provide consistent measurement of non-specific psychological distress (Kessler et al 2002).

The NHIS also asked these questions about mental health, and 2012 data from that survey will be used as a comparison point.

Impact and Recovery

The AP-NORC survey measured how residents of these neighborhoods perceived the impact of the storm on them personally and their neighborhood, as well as how well their neighborhood has recovered since the storm. Exact question wording and coding for these variables can be found in Appendix A.

Social Resources

The AP-NORC survey measured four categories of social resources – social cohesion, informal social control, social exchange, and a measure of general trust. The first three categories were asked about in their own separate batteries of questions, while general trust was measured by a single question. These batteries of questions have been tested and validated in previous research (Sampson et al 1997; Sampson et al. 1999). To create measures for analysis for the social cohesion, informal social control, and social exchange, a factor score was computed for each respondent for each respective battery of questions. Factor scores for each battery were coded from 0 (low in that measure of social resources) to 1 (high in that measure of social resources).

- The social cohesion battery, which examined how connected people are within their neighborhood, asked respondents whether they agree or disagree about things like whether or not people in their neighborhood can be trusted, share the same values, and get along with each other.
- The social control battery, which examined the informal ways people in the neighborhood maintain public order, asked about things like how likely people in their neighborhood would be to do things like stop children from spray-painting graffiti on a local building or break up a fight in front of their house.
- The social exchange battery, which examined how neighbors help each other out, asked about things like how often people in their neighborhood visited the homes of their neighbors, had parties or get-togethers, did favors for each other, or asked each other for advice.

The general trust measure asked how much the respondent trusts people overall. Exact wording for these questions can be found in Appendix A.

Demographics

Demographic data for age, race and ethnicity, education, income, gender, and employment status from both AP-NORC and NHIS data were used for analysis. Additionally, the analysis included marital status

and parent status information from the AP-NORC data and census region information from the NHIS data. Exact wording for these questions can be found in Appendix A.

Analysis

We first analyze the 2014 data to determine aggregate levels of psychological distress in the region affected by Superstorm Sandy. Then, we use the 2012 national data as a baseline to see if levels of distress can be reasonably assumed to have returned to pre-Sandy levels. Two-sample z-tests are used to determine differences in psychological distress between the samples.

We then compare the sample compositions by age, race, education, income, gender, and employment status and run two-sample z-tests to determine differences in demographic groups between the samples. We make inferences about the effects of those differences through the results of an ordered logistic regression predicting psychological distress based on those demographic and census region variables.

To examine how the presence of social resources is associated with psychological wellbeing in the aftermath of a disaster, we run ordered logistic regressions to predict psychological wellbeing using a separate model for each of the four types of social resources: social exchange, social control, social cohesion, and general trust. In each model, we control for age, education, race, income, gender, employment status, marital status, whether someone is a parent, self-reported personal impact of the storm, self-reported neighborhood impact of the storm, and self-reported neighborhood recovery from the storm. Standard errors are clustered by neighborhood to control for similar experiences of storm impact and recovery.

Results

Psychological distress in region affected by Superstorm Sandy compared to national estimates

The AP-NORC data shows that, even nearly two years after Superstorm Sandy, 6 percent of residents of the affected neighborhoods can be categorized as having serious psychological distress as measured by the Kessler scale. An additional 11 percent have mild to moderate distress. Eighty-three percent have no psychological distress. In comparison, the NHIS data from 2012 shows that just 3 percent nationwide have serious psychological distress, 6 percent have mild to moderate distress, and 91 percent of people nationally have no distress based on the Kessler scale (See Table 2). These national findings are similar to when the data is aggregated from 2009-2013 (see Weissman et al 2015).

Table 2. Higher rates of psychological distress were found in the 2014 post-Sandy affect region than in the nation overall two years earlier.

	NHIS 2012 data	AP-NORC 2014 data
No psychological distress	91%	83%***
Mild to moderate psychological distress	6%	11%***
Serious psychological distress	3%	6%***
N	34,306	973

p<.10=+, p<.05=*, p<.01=**, p<.001=***

To see whether these differences could be a result of demographic differences, we compare the makeup of the national sample and the affected region sample by demographic groups. Table 3 shows that the affected neighborhood sample is slightly older, less white, more educated, and has higher incomes.

Using an ordered logistic regression, we find that all of these demographic factors are significant predictors of mental health in the national sample. As shown in Table 4, the 2012 national NHIS data confirm results from prior literature that middle-aged individuals are more likely to feel general psychological distress as measured by the Kessler 6 compared to younger and older individuals. Whites, those with lower incomes and lower formal education, employed individuals, and men are less likely to report distress. Additionally, no regional differences between the northeast (which includes New York, New Jersey, and seven other states as categorized by the U.S. Census) and the Midwest, south, or west were observed. This helps alleviate concerns about regional differences driving observations of higher distress in the affected neighborhoods.

Table 3. Comparing demographics for the NHIS data set to the AP-NORC data set.

	NHIS 2012 data	AP-NORC 2014 data
Age (%)		
18-29 years old	22	12***
30-49 years old	35	40**
50-64 years old	26	25
65 and older	18	22**
Race and Ethnicity (%)		
Black	11	10
Hispanic	15	17+
Non-Hispanic White	66	60***
Other/more than one race	7	14***

	NHIS 2012 data	AP-NORC 2014 data
Education (%)		
Less than high school degree	14	9***
A high school degree	26	29*
More than a high school degree	60	61
Household income (%)		
Family income less than \$20,000	17	17
Family income between \$20,000-\$50,000	31	25***
Family income more than \$50,000	52	58***
Gender (%)		
Female	52	52
Male	48	48
Employment status (%)		
Employed	61	59
Not employed	39	41

p<.10=+, p<.05=*, p<.01=**, p<.001=***

In most cases, these demographic correlates suggest the national sample should be more seriously distressed than the affected region given the composition of the population. We find the opposite, however, which provides a strong confirmation of the literature predicting that the traumatic stress of Superstorm Sandy led to higher levels of psychological distress in the affected region.

In the affected region, few demographic factors were predictive of psychological distress. Those age 65 and older and those who were employed were less likely to report psychological distress, as were whites compared to blacks, but no differences were observed based on education, income, or gender. However, when we include a measure of the personal impact of Superstorm Sandy, we see a significant impact on psychological distress. Holding all other variables at their mean or median value, the predicted probability of severe psychological distress among those reporting the highest level of personal impact is 0.10, compared to 0.04 among those reporting the lowest levels of personal impact from the storm.

Table 4. Results for ordered logistic regression predicting psychological distress.

Predicting Kessler-6 3-Level Scale	NHIS 2012	AP-NORC 2014	AP-NORC 2014
Personal impact	-	-	0.259* (0.121)
30-49 years old	0.322*** (0.085)	-0.169 (0.461)	-0.215 (0.467)
50-64 years old	0.278** (0.084)	-0.320 (0.465)	-0.366 (0.473)
65 and older	-0.846*** (0.092)	-1.163* (0.514)	-1.078* (0.534)

Predicting Kessler-6 3-Level Scale	NHIS 2012	AP-NORC 2014	AP-NORC 2014
Black	-0.419*** (0.069)	0.878+ (0.473)	0.795+ (0.480)
Hispanic	-0.240** (0.081)	0.434 (0.345)	0.472 (0.350)
Other/more than one race	-0.052 (0.098)	-0.193 (0.622)	-0.066 (0.597)
A high school degree	-0.355*** (0.076)	-0.346 (0.419)	-0.384 (0.432)
More than a high school degree	-0.524*** (0.068)	0.086 (.422)	0.039 (.422)
Family income between \$20,000-\$50,000	-0.419*** (0.062)	0.265 (0.405)	0.208 (0.395)
Family income more than \$50,000	-1.032*** (0.072)	-0.504 (0.525)	-0.526 (0.495)
Male	-0.265*** (0.053)	-0.053 (0.292)	-0.045 (0.285)
Employment status	-1.027*** (0.058)	-0.952** (0.322)	-0.893** (0.325)
South	0.090 (0.076)	-	-
Midwest	0.083 (0.081)	-	-
West	0.076 (0.092)	-	-
N	34,166	776	756

Reference categories for logistic regressions: Less than a high school degree; Family income less than \$20,000; Age 18-29 years old; Non-Hispanic White; Northeast.

p<.10=+, p<.05=*, p<.01=**, p<.001=***

Effect of social resources on psychological distress in Sandy-affected region

Before considering the effect of social resources on psychological distress in the region affected by Superstorm Sandy, we examine how demographic factors predict Kessler scores after controlling for the impact of the storm on the neighborhood and how well the neighborhood was recovering. These findings are displayed in Model 2 in Table 5. Again we find that age and employment status were associated with psychological wellbeing in the affected region. Increased age (coefficient= -0.017, p<.05) and being employed (coefficient= -0.726, p<.001) were both associated with lower levels of psychological distress. Those who reported greater levels of neighborhood recovery reported lower levels of psychological distress (coefficient= -0.555, p<.001). We also see that the effect of personal impact of the storm drops out once accounting for neighborhood impact and recovery. These findings fit with previous research on risk factors for psychological distress following natural disasters.

Table 5. Ordered logistic regression predicting Kessler scale psychological distress by neighborhood storm factors and four measures of neighborhood social resources.

Predicting Kessler 3-Level Scale	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Social cohesion	-	-	-1.220* (.526)	-	-	-
Social control	-	-	-	-0.625 (.408)	-	-
Social exchange	-	-	-	-	-0.721* (0.336)	-
General trust	-	-	-	-	-	-0.368+ (.208)
Neighborhood impact	-	0.078 (.129)	0.149 (.114)	0.013 (.143)	-0.024 (.118)	0.073 (.132)
Neighborhood recovery	-	-0.555*** (.104)	-0.517*** (.114)	-0.643*** (.115)	-0.593*** (.129)	-0.555*** (.098)
Personal impact	0.247*** (.058)	0.072 (.078)	0.017 (.097)	0.145+ (.082)	0.151 (.083)	0.056 (.076)
Age	-0.015+ (.009)	-0.017* (.008)	-0.021* (.009)	-0.016 (.009)	-0.019* (.008)	-0.016+ (.008)
Education	-0.060 (.060)	-0.044 (.059)	-0.092+ (.054)	-0.027 (.065)	-0.035 (.063)	-0.044 (.057)
Black	0.288 (.351)	0.277 (.357)	0.078 (.374)	0.174 (.507)	0.194 (.409)	0.246 (.357)
Hispanic	0.189 (.319)	0.444 (.350)	0.078 (.454)	0.471 (.352)	0.261 (.368)	0.356 (.349)
Other race	-0.319 (.351)	-0.305 (.377)	-0.439 (.498)	-0.410 (.414)	-0.314 (.383)	-0.336 (.379)
Household income	-0.132+ (.068)	-0.136 (.073)	-0.069 (.069)	-0.089 (.083)	-0.120 (.084)	-0.126+ (.069)
Male	0.022 (.270)	0.073 (.265)	-0.007 (.295)	0.096 (.263)	0.045 (.282)	0.048 (.270)
Employed	-0.820*** (.206)	-0.726*** (.205)	-0.757** (.244)	-0.838** (.262)	-0.615* (.259)	-0.715** (.212)
Married	-0.136 (.208)	-0.181 (.202)	-0.311 (.256)	-0.263 (.268)	-0.145 (.230)	-0.129 (.191)
Parent	0.315 (.316)	0.299 (.310)	0.020 (.373)	0.359 (.352)	0.307 (.315)	0.303 (.331)
N	747	731	603	649	685	717

Reference categories for logistic regressions: Non-Hispanic White; Female.

p<.10=+, p<.05=*, p<.01=**, p<.001=***

In addition to these demographic and situational risk factors, we find that three of the four measures of social resources - social cohesion, social exchange and general trust - are predictive of psychological distress. When controlling for demographic factors, personal impact, and neighborhood impact and

recovery, we find that individuals residing in neighborhoods low in social cohesion reported higher levels of psychological distress than those in neighborhoods high in social cohesion (coefficient= -1.22, $p < .05$). The predicted probability of severe psychological distress among those reporting the lowest level of social cohesion in their neighborhood is 0.12, compared to 0.04 among those reporting the highest levels of social cohesion, holding all other values at the mean. We also find that those in neighborhoods low in social exchange reported higher levels of psychological distress than those in neighborhoods high in social exchange (coefficient= -0.721, $p < .05$). The predicted probability of severe psychological distress among those reporting the lowest level of social exchange in their neighborhood is 0.09, compared to 0.05 among those reporting the highest levels of social exchange, holding all other values at the mean. And finally, those who say people can be generally trusted reported lower levels of psychological distress than those who say most people cannot be trusted (coefficient= -0.368, $p < .10$). The predicted probability of severe psychological distress among those without general trust is 0.08, compared to 0.06 among those with general trust, holding all other values at the mean. Social control was not found to be associated with differences in psychological distress in our models (coefficient=-0.625, ns). Full results of regression analysis can be found in Table 5.

Predicted probabilities based on social resources also vary by neighborhood recovery status. Those who say their neighborhoods have not recovered at all show much higher probabilities of psychological distress than those who say their neighborhood has recovered almost completely. This is true for neighborhoods both high and low in social resources, though those high in social resources report lower distress than those low in social resources. Full results for predicted probabilities by social resource level and recovery status can be found in Table 6.

Table 6. Predicted probabilities of serious psychological distress for each social resource by neighborhood recovery level.

	Social cohesion		Social control		Social exchange		General trust	
	Low	High	Low	High	Low	High	Low	High
Low recovery	.334	.139	.353	.235	.312	.188	.252	.193
High recovery	.067	.021	.046	.026	.046	.023	.039	.028

Discussion

We find that, two years after the storm, those in the region affected by Superstorm Sandy show nearly double the rate of mild or moderate and serious psychological distress compared to the nation overall in 2012, suggesting a lingering effect of Superstorm Sandy on the mental and emotional wellbeing of those impacted by the storm. While the national sample does differ from the affected region sample in its demographic makeup, many of these differences – like the affected region being less white, more educated, and higher-income – would suggest the affected region should report lower distress, indicating that something beyond demographics, like the devastating impact of the storm, was influencing the higher levels of distress in the area. Indeed, we find that once we include the personal impact of the storm into our model, it is predictive of distress. Finding no significant difference in levels of psychological distress between the northeast (where Superstorm Sandy struck) and the south, Midwest, or west in 2012 provides evidence that the higher levels of distress observed among the affected region were not a result of typical regional differences.

Previous research found that age and employment status can be associated with psychological distress in the aftermath of a natural disaster. Studying the demographic landscape in the affected area two years after Superstorm Sandy, our results fit with this literature, showing that those who are younger and those who are unemployed are more likely to report psychological distress both before and after controlling for personal impact, neighborhood impact, and neighborhood recovery. When controlling only for personal impact, differences also emerge by income, but when controlling for neighborhood impact and recovery, these differences vanish. Additionally, in the models displayed in Table 4, blacks show higher levels of psychological distress in the post-Sandy aftermath than whites, both before and after controlling for personal impact. This supports previous literature that differential vulnerability by minority status can impact psychological wellbeing in the aftermath of a disaster. However, this difference drops out once controlling for marital status and parental status in Table 5.

We did not find evidence of differences by gender, education, marital status, or parent status either before or after controlling for neighborhood impact and recovery. In the past, literature has found links between distress and each of those factors. The lack of difference we observed here could be a result of differences in on-the-ground conditions in the aftermath of Sandy compared to other disasters. It could also be due to the time between the disaster and data collection. Future research could look at the effect of time on demographic differences in psychological distress.

Most importantly, we find a positive impact of neighborhood social resources on mental health in a post-disaster periods like the aftermath of Superstorm Sandy. Previous research has shown how social resources are important to the process of neighborhood recovery and perceived resilience of neighborhoods in the aftermath of Superstorm Sandy (Cagney et al 2016), and these findings suggests that they are also a critical component of the psychological recovery of individuals in the wake of a disaster. Specifically, we find that social cohesion, social exchange, and trust were all beneficial to psychological wellbeing in the aftermath of storm. Even nearly two years later, people in neighborhoods impacted by the storm that were low in social cohesion, social exchange, and general trust were more likely to report higher levels of distress than those who lived in neighborhoods higher in those social resources. However, not all social resources have a uniform impact on mental health. Low social cohesion and social exchange are more significant predictors of mental distress than general trust or social control, illustrating the specific type of resource matters. But, our findings indicate that the presence of social cohesion, social exchange, and trust could help prevent serious psychological distress from setting in in the aftermath disaster. It could also mean they can help those who suffer from psychological distress recover more quickly. Parsing out the specific effects here could be done through a longitudinal study of psychological wellbeing across an extended period of recovery.

Additional research into the causal relationship between psychological wellbeing and social resources would bolster these findings. Because measures of social resources were based on individual reports, they could be susceptible to not only each individual's mental state, but also their position in the community. Those with fewer social bonds, those on the outside of an otherwise close-knit neighborhood, or those who do not regularly interact with or receive assistance from their neighbors could suffer from higher levels of psychological distress. Those with poorer mental health could also simply see themselves as more isolated, and thus evaluate the social bonds of a neighborhood differently than those with lower levels of distress. Similar concerns about causality have been addressed in research on social cohesion (Greene et al 2015), but comparable approaches could be valuable in the study of social control, social exchange, and general trust.

These findings on the value of social resources on mental health could also be bolstered by more specific detail on respondents' experience with the storm and its aftermath. We employ general measures of impact to account for difficulty of experience and measures of recovery to account for improvement of conditions in the aftermath. But, details about the intensity of exposure to the event like personal injury, injury or death of a loved one, threat to one's life, property damage, fear or panic during the storm, property damage, financial loss, or physical displacement have all been shown to impact mental health

following disasters and the addition of this information would benefit any study of the relationship between social resources and mental health.

Neighborhoods lacking in social bonds leave their populations more vulnerable to psychological distress. These neighborhoods need to shore up these resources before disaster strikes in order to protect their residents from emotional distress. In order to mitigate the hazards that come with natural disasters, the Federal Emergency Management Agency (FEMA) recommends that communities start by identifying potential hazards and assessing risks and vulnerabilities (Department of Homeland Security 2017). As susceptible communities across the country identify and address their vulnerabilities, serious consideration should be given to not only to infrastructure improvements to protect the physical well-being of residents and property, but also to ways to incorporate features that simultaneously bolster social resources. Many communities are undertaking such efforts already (Department of Homeland Security 2016). A project already in-progress in lower Manhattan, for example, involves combining storm surge protection with public spaces (Rhodes 2014). In Kansas, community safe rooms built to withstand even the most powerful tornados are popping up across the state (Thomas 2014). And in Arkansas, the state has leveraged the nature of schools as places where communities gather to start the School Shelter Program, creating 82 community shelters located in schools state-wide to provide residents with a safe site in the event of a threatening tornado (Department of Homeland Security 2008). Projects like this are critical examples of how policymakers, emergency managers, and local leaders can include social resources in their calculus when developing policies, programs, and interventions intended to prevent the lasting destruction caused by disasters, improve the psychological wellbeing of residents in the aftermath of disasters, and strengthen community resilience.

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Appendix A

Personal impact –

- Variable: III_r
- Question: “Superstorm Sandy struck the United States on October 29, 2012 and the storm affected some areas for days after making landfall. How seriously, if at all, were you personally affected by Superstorm Sandy? Would you say you were...? Extremely affected, very affected, moderately affected, only a little affected, not at all affected.”
- Coded from 1 (not at all affected) to 5 (extremely affected).

Neighborhood impact –

- Variable: NI1_r
- Question: “Thinking about your neighborhood, how seriously was your neighborhood affected by Superstorm Sandy? Would you say your neighborhood was...? Extremely affected, very affected, moderately affected, only a little affected, not at all affected.”
- Coded from 1 (not at all affected) to 5 (extremely affected).

Neighborhood recovery –

- Variable: NI2_r
- Question: “What best describes how your neighborhood is recovering from Superstorm Sandy? Would you say your neighborhood has...? Completely recovered, mostly recovered, recovered about half way, recovered only a little, not recovered at all.”
- Coded from 1 (not recovered at all) to 5 (completely recovered).

General trust –

- Variable: gentrust
- Question: “Now thinking about people in general...Generally speaking, would you say that most people can be trusted, or that you can’t be too careful in dealing with people?”
- Coded 0 (can’t be too careful in dealing with people) and 1 (most people can be trusted).

Social cohesion –

- Variable: SocialCohesionFactor
- Question: “Now I’m going to read some statements about people in your neighborhood. Thinking about what your neighborhood is like NOW, after Superstorm Sandy, please tell me whether you strongly agree, agree, disagree or strongly disagree. How about...a) this is a close-knit neighborhood; b) People around here are willing to help their neighbors; c) People in this neighborhood generally don’t get along with each other; d) People in this neighborhood do not share the same values; e) People in this neighborhood can be trusted?”
- Coded from 0 (lowest level of social cohesion) to 1 (highest level of social cohesion).

Social control –

- Variable: SocialControlFactor
- Question: “For each of the following, please tell me if it is very likely, somewhat likely, somewhat unlikely, or very unlikely that people in your neighborhood would act in the following manner. How about...a) Do something about it if a group of neighborhood children were skipping school and hanging out on a street corner; b) Do something about it if some children were spray-painting graffiti on a local building; c) Scold a child who was showing disrespect to an adult; d) Break up a fight in front of your house in which someone was being threatened or beaten; e) Organize to try to do something to keep the fire station open if, because of budget cuts, the fire station closest to your home was going to be closed down by the city?”
- Coded from 0 (lowest level of social control) to 1 (highest level of social control).

Social exchange –

- Variable: SocialExchangeFactor
- Question: “Now I am going to ask you about some things that you might do with people in your neighborhood. For each statement, please tell me whether they happen often, sometimes, rarely, or never. How about...a) Do favors for each other such as watching each other’s children or lending garden or house tools; b) Watch over a neighbor’s property when he or she is not home; c) Ask each other for advice on personal things like child rearing or job openings; d) Have parties or neighborhood get-togethers; e) Visit each other’s homes or visit on the street?”
- Coded from 0 (lowest level of social exchange) to 1 (highest level of social exchange).

Kessler scale –

- Variable: Kessler
- Question: “The following questions ask about how you have been feeling during the past 30 days. For each question, please select the option that best describes how often you had this feeling. During the past 30 days, about how often did you feel...a) Nervous; b) Hopeless; c) Restless or fidgety; d) So depressed that nothing could cheer you up; e) That everything was an effort; f) Worthless? All of the time, most of the time, some of the time, a little of the time, or none of the time.”
- Coded 1 for no psychological distress, 2 for mild or moderate distress, and 3 for serious distress.

Employment status –

- Variable: employed
- Question: “Are you currently employed full-time, part-time, or not employed?”
- Coded 1 for full-time or part-time, 0 for not employed.

Age –

- Variable: age
- Question: “In what year were you born?”
- Coded as age in 2014

Education –

- Variable: edu
- Question: “What is the last grade of school you completed?”
- Coded from 1 (less than high school graduate) to 7 (graduate degree).

Parent –

- Variable: parent
- Question: “Are you the parent or guardian of a child who is under 18 years of age, or not?”
- Coded 0 if not a parent and 1 if parent.

Marital status –

- Variable: marital
- Question: “What is your marital status? Are you married, living as married, co-habiting; separated; divorced; widowed; or never married?”
- Coded 1 for married and 0 for all else.

Race –

- Variable: raceth
- Question: “Are you of Hispanic, Latino, or Spanish origin, or not? In addition to being of Hispanic, Latino, or Spanish origin what race or races do you consider yourself to be? What race or races do you consider yourself to be?”
- Coded as dummy variables for black, Hispanic, and other race.

Household income –

- Variable: hhincome
- Question: “Does your total household income fall below \$50,000 dollars, or is it \$50,000 or higher? And in which group does your total household income fall?”
- Coded from 1 (under \$10,000) to 9 (\$150,000 or more).

Gender –

- Variable: male
- Question: “Are you male or female?”
- Coded 1 for male and 0 for all else.