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The Effect of Hurricane Sandy on Mental Health Outcomes of New Yorkers

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by

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Abstract

In October 2012, Hurricane Sandy devastated much of the East coast of the United States. New York City was impacted particularly severely. This study's objective is to evaluate the effect of Sandy on the long-term mental health of New Yorkers. Health data spanning from 2010-2014 was obtained through NYC's Department of Health and Mental Hygiene's Community Health Survey. Difference-in-differences regressions were employed to evaluate the relationship. Based on a sample of New Yorkers, hurricane Sandy had no statistically significant effect on any key mental health variables.

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Introduction

In mid-October of 2012, weather satellites began modeling the formation of a tropical storm in the Caribbean. Over the course of the next week, this tropical storm turned into a hurricane that began to slowly make its way across the eastern coast of the United States. By October 29th, the hurricane known as Sandy made landfall in Atlantic City, New Jersey. At this time, wind speeds had reached 80 miles per hour with a wind field that was 1,000 miles in diameter (PlaNYC, 2013). When it finally ended in early November, the damage Hurricane Sandy caused made it the second costliest natural disaster in United States history. 147 people were killed, and the damage estimates were near $50 billion (Blake 2013).

New York City was affected by Sandy particularly severely. Throughout the five boroughs, there were 43 fatalities and $19 billion in property damage (PlaNYC, 2013). A report conducted by NYC's Special Initiative for Rebuilding and Resiliency outlines the effects Sandy had on New York City specifically. During the storm, coastal infrastructure and residential property was subject to intense flooding and waves that reached up to 12 feet in height. Additionally, a large number of people faced outages in power, internet and telecommunications. After the storm, various subway lines along New York's mass transit system became inundated with water. All six of the subway lines that connect Brooklyn to Manhattan were taken out of service. Furthermore, the city had to deal with a serious fuel shortage. For weeks after the storm, long lines of cars waited to fill their tanks at the few gas stations that still had fuel. Additionally, all New York City public schools were closed for one week after the storm (PlaNYC, 2013). For these reasons, it is plausible that Sandy caused psychological harm and behavioral changes to the population of New York.

In December 2012, the New York State Labor Department reported that 30,000 jobs were

lost in NYC as a result of business closures relating to damages caused by Hurricane Sandy (McGeehan, 2012). This increase in unemployment may have resulted in financial stress that could have led to depression, anxiety or other psychological disorders. A 2013 meta-analysis published in the Annual Review of Public Health found that regression results originating from 22 different studies suggest that recent job losers are 15%-30% more likely to have depression or anxiety than individuals who remain continuously employed (Catalano et al., 2011). It is also possible that New Yorkers with high exposure to Sandy changed their drinking and smoking habits as a coping mechanism for the sudden financial strain caused by Sandy. Research conducted by Bolton and Rodriguez used data from the Panel Study of Income Dynamics to show that individuals who were unemployed were associated with greater alcohol and cigarette consumption than individuals who were continuously employed (Bolton, 2009).

The purpose of this paper is to study the effect that Hurricane Sandy had on the prevalence of depression, anxiety and other psychological disorders among the inhabitants of New York City. The effect on alcohol and cigarette consumption is also analyzed. In recent years, many studies have investigated the effect of Hurricane Katrina on health outcomes of Louisiana residents. A study of Katrina's impact on mental health in New Orleans by Sastry and Gregory used multi-year survey data from the American Community Survey to conclude that women, blacks, and middle-aged individuals were more likely to develop a mental impairment due to Katrina (Sastry, 2013). Their results indicate that certain groups are more vulnerable to a deterioration in mental health as a result of natural disasters. A more recent article by Schwartz et al. analyzed the effect of Hurricane Sandy on mental health using data from a questionnaire targeting individuals in Long Island, Queens, and Staten Island. It found that individuals with greater exposure to Hurricane Sandy were more likely to exhibit short-term anxiety and PTSD

(Schwartz et al., 2017). At the time of writing, there are no studies that examine the long-term causal effect of Sandy on mental health.

This study uses restricted data from the Community Health Survey spanning from 2010-2014 and flood data from NYC Open Data. A set of difference-in-differences models are used to analyze the long-term effect of Hurricane Sandy on depression, anxiety, alcohol consumption and tobacco consumption. All the dependent variables are binary, facilitating the use of logistic regressions (Table 2). Binary variables use a categorical data structure to assign respondents either 0 or 1 to signify the presence or lack thereof of a pre-determined characteristic.

This paper continues in the following manner: First, the insight from previous literature relating to this topic is discussed. Then, data sources and summary statistics are described. Next, this paper explains the modeling techniques used to conduct the statistical analysis for this study. After that, results are discussed. Finally, concluding remarks and an outline of this study's limitations are reviewed.

Literature Review

The connection between natural disaster exposure and mental health has been extensively documented in peer-reviewed journals since at least the 1970's. Research conducted by Logue, Hansen and, Struening analyzed the health effects of the 1972 Wilkes-Barre area flood. A multi-year survey was designed to track flood exposure and long-term health outcomes among residents of the Wilkes-Barre area. The results of the study showed that the flood was associated with a statistically significant increase in the level of stress of Wilkes-Barre area residents. Additionally, the stress endured for at least five years after the flood (Logue, 1981). The researchers initially aimed to study a broad list of health outcomes, but the study was marred due to a large number of non-responses in later stages of surveying. Logue's study was one of the

first academic research papers to use a quantitative, data driven approach to analyze the effect of a natural disaster on long term public health.

In 1996, a study conducted by Bland et al. used a sample of 772 male factory workers in Naples to analyze the relationship between exposure to earthquakes and psychological distress. The circumstances under which sample data was collected created the conditions necessary for a natural experiment. In 1980, a group of factory workers were surveyed after having experienced a devastating earthquake in Naples. The portion of workers who happened to live in Pozzuoli (a suburb near Naples) continued to experience a string of earthquakes while the workers who did not live in Pozzuoli remained earthquake-free. All the workers who experienced the original earthquake in 1980 were surveyed again in 1987. The study found that the workers who experienced the continuous string of earthquakes had statistically significant increases in levels of psychological distress (Bland 1996). Although the statistical methods used in this paper were highly robust, the lack of sample diversity makes it difficult to provide insight into the effects of earthquake exposure on individuals who are not Italian male factory workers.

After Hurricane Katrina, an abundance of academic literature relating to this subject began to emerge. Research conducted in 2006 by Kessler et al. used a multi-year survey of adults affected by Hurricane Katrina to conclude that after the hurricane, individuals who lived in areas severely affected by Katrina were 10.2 percentage points more likely to have a mild-moderate mental disorder (Kessler, 2006). This sizeable effect suggests that Hurricane Katrina had a major impact on the mental health of the people of New Orleans. There exist enough differences between the impacts of Katrina in Louisiana and Sandy in New York to contend that the results of Kessler's study may not predict the results of this study. For one, Hurricane Katrina had a more severe impact than Hurricane Sandy. Katrina was a category 5 hurricane that resulted in

$116 billion in damages while Sandy was a category 3 hurricane that resulted in $65 billion in damage (NOAA, 2018). Furthermore, Sandy made landfall seven years after Katrina. It is conceivable that vital utilities such as communication services and disaster relief efforts had improved since Katrina. Additionally, the geographic difference may present enough of a social and cultural disparity to assume that residents of New York and New Orleans may react incongruously to similar types of disasters.

In 2013, research administered by Sastry used data from the American Community Survey to show that Hurricane Katrina was associated with a 4-percentage point increase in disabilities among adults in New Orleans. This increase in disability largely reflects a rise in mental impairments (Sastry, 2013). This research corroborates and adds to the work conducted by Kessler. These studies are similar in that they both utilized multi-year surveys that were conducted before and after Katrina made landfall. Sastry however focused on the effect of the hurricane on different demographic groups. The sample was segmented by age, gender, and race. It was discovered that middle aged individuals, blacks, and females were most vulnerable to developing disabilities resulting from Katrina.

Much of the academic literature relating to the impact of hurricanes on mental health in the United States has been written relatively recently. These studies typically focus on more recent hurricanes. A 2013 study from the International Journal of Emergency Mental Health and Human Resilience used an ex-post telephone survey of New Jersey residents exposed to Sandy to show that high hurricane exposure was a statistically significant predictor of mental health decline (Boscarino, 2013). The study is limited by the fact that it lacks an ex-ante survey, meaning empirical results are missing a pre-Sandy baseline. Consequently, the research provides little insight into the causal effect of Sandy on mental health outcomes. Despite this, the

descriptive statistics and associations uncovered by the researchers show that an increased presence of post-traumatic stress disorder can linger for at least six months after the hurricane.

Schwartz made a significant contribution to the subject in 2017 when she used a similar but more quantitatively rigorous method of analyzing the effect of Hurricane Sandy on mental health outcomes of New York residents. The research employed an ex-post telephone survey and a one-year follow-up of residents of Queens, Staten Island and Long Island. The results showed that symptoms of anxiety and post-traumatic stress disorder were greater among individuals who lived in areas devastated by Sandy. However, these levels decreased after eighteen months (Schwartz, 2017). Once again, the research is missing an ex-ante survey and lacks an important baseline for New York's expected mental health outcomes without the presence of a natural disaster. However, the utilization of a one-year follow-up allowed Schwartz to observe the decline in mental disorders associated with the public's post-Sandy recovery. The only long-term declines in mental health were experienced by individuals who encountered a combination of personal and property damage. One major drawback to this piece of research is that the sample size of 130 respondents is relatively small.

Data

For this study, I merged data from the restricted version of New York City's Community Health Survey with Hurricane Sandy flood data provided by NYC Open Data. Access to the restricted version of the CHS requires an Institutional Review Board exemption and a signed data use agreement between the primary researcher and the Deputy Commissioner of the Division of Epidemiology of New York City's Department of Health and Mental Hygiene. The Community Health Survey includes information on various health related characteristics of residents of New York City. The flood data acts as a proxy for a given neighborhood's level of

exposure to Hurricane Sandy.

The Community Health Survey (CHS) is an annual telephone survey conducted by New York City's Department of Health and Mental Hygiene. The survey includes a sample of about 10,000 randomly selected individuals aged 18 or older from all five of New York's boroughs (Manhattan, Brooklyn, Queens, Bronx and Staten Island). The survey asks respondents about general health, mental health, alcohol/cigarette consumption, nutrition and physical activity. It also provides demographic data including neighborhood of residence, age, gender, race, education, household size, and marital status. For this research, I utilized five years of CHS data spanning from 2010 to 2014. Typically, the Department of Health and Mental Hygiene finishes gathering data for the CHS by the end of the summer. Since Sandy occurred in October 2012, this provides three years of pre-Sandy data and two years of post-Sandy data.

Mental health characteristics were captured through the CHS's "mood" variables. The important mood variables pertain to depression and anxiety. The CHS questionnaire instructs respondents to describe how often they felt depressed in the last thirty days. Answers are recorded using a Likert scale in the following format: All of the time, most of the time, some of the time, a little of the time, or none of the time. Responses ranging from all of the time to most of the time follow the Mayo Clinic's definition of depression (Mayo Clinic, 2019). I generated a new binary variable to identify whether a respondent is depressed. I then repeated this process for anxiety. Additionally, the presence of non-specific psychological disorders among respondents is recorded within the CHS.

Drinking and smoking characteristics are also recorded by the Community Health Survey. These traits are captured through binary variables. The variable titled "smoker" indicates whether the respondent smoked cigarettes within the last 30 days since being

interviewed. The variable titled "drinker" indicates whether the respondent drank alcohol within the last 30 days. The variable titled "heavy drinker" indicates whether the respondent consumes more than two drinks per day.

NYC Open Data's Hurricane Sandy Flood Map displays post-Sandy inundation of three feet or greater (NYC OD, 2020). The restricted version of the CHS indicates a respondent's United Hospital Fund Zone. New York City is split into 34 different UHF zones. These UHF zones are typically made up of 5-7 zip codes, but some can have as many as 14 zip codes. The level of flood severity in each UHF zone was calculated by dividing the number of zip codes with the presence of flooding by the total number of zip codes in the respective UHF zone. This results in a flood severity score between 0 and 1. A score of 0 implies that a neighborhood was free of inundation greater than three feet after Hurricane Sandy. A score of 1 implies every zip code within a given UHF zone experienced inundation of three feet or greater. Table 1 shows a tabulation of severity scores. Figure 1 shows an NYC neighborhood map color coded by severity of flooding. Additionally, I generated a binary variable equal to 1 if the respondent lived in a severely flooded UHF zone and 0 otherwise. Severe flooding is defined by the presence of flooding in all zip-codes within a given UHF zone.

Five of the thirty-four neighborhoods received a flood severity score of 1. These neighborhoods are Rockaway, Coney Island, Red Hook, Greenpoint/Williamsburg, and East Harlem. Eighteen neighborhoods received a flood severity score of 0. These neighborhoods were mostly located away from the coast in Brooklyn, Queens, and Bronx. Eight neighborhoods had severity scores between .01 and .50 while three neighborhoods had scores between .51 and .99.

Of the 43,129 respondents surveyed between 2010 and 2014, 54% claimed to have consumed alcohol within the last 30 days. Of the individuals who consumed alcohol, the average

respondent drank during eight of the last thirty days. Heavy drinking is defined as having more than two drinks per day for men and more than one drink per day for women. Among the sample of drinkers, 9% of respondents stated that they drink heavily.

Based on the CHS, 14% of respondents claimed to have smoked within the last 30 days. Meanwhile, 6% of surveyed respondents claimed to be depressed. Furthermore, 6% of respondents had anxiety while 5% of respondents had other non-specific psychological disorders.

From the survey, 6% of respondents were between the age of 18 and 24, 30% were between 25 and 44, 38% were between 44 and 65, and 25% were older than 65. Women make up 59% of respondents. Additionally, 22% of the sample is black while 26% is Hispanic. 16% of the sample has less than a high school diploma while 42% has a college degree (Table 2).

Methods

In this study, I used multiple difference-in-differences models to analyze the effect of Hurricane Sandy on long-term mental health outcomes of New Yorkers. All dependent variables for drinking habits, smoking habits, and mental health outcomes exhibit a binary data structure. This means that the most appropriate regression for this research is the logistic regression. I used the following equation:

$$E(Y|T, G, X) = \Lambda(\beta_1 T + \beta_2 G + \beta_3 TG + X\theta)$$

where Λ is the logistic function and T denotes a set of binary year variables. G is a set of individual neighborhood dummies indicating treatment. Meanwhile, X is a set of control variables which include age, gender, race, and education. Y is a set of binary health and behavioral outcomes. Additionally, Y^0 denotes the outcome without the presence of treatment while Y^1 denotes the outcome with treatment. Therefore:

$$E(Y^0|T = 1, G = 1, X) = \Lambda(\beta_1 + \beta_2 + X\theta)$$

and:

$$E(Y^1|T = 1, G = 1, X) = \Lambda(\beta_1 + \beta_2 + \beta_3 + X\theta)$$

Puhani initially derived the marginal effect of treatment in a non-linear DiD model in Economics Letters. The marginal effect of treatment is captured by τ below (Puhani, 2012):

$$\tau = \Lambda(\beta_1 + \beta_2 + \beta_3 + X\theta) - \Lambda(\beta_1 + \beta_2 + X\theta)$$

The coefficient for the treatment effect is captured by β_3. This represents the difference-in-differences element of the regression specification. This ensures that treatment effects are estimated only for individuals who lived in severely flooded neighborhoods after Sandy occurred. In this way, mental health trends of those who lived in severely flooded neighborhoods can be compared with the trends of those who did not live in severely flooded neighborhoods. Additionally, β_3 can be used to interpret the sign and statistical significance of the treatment effect.

The marginal effect of the treatment variable for the logistic difference-in-differences regressions can be interpreted in the following way: living in a severely flooded UHF zone results in a percentage point change equal to the flood severity marginal effect in the likelihood of drinking, heavy drinking, smoking, depression, anxiety or non-specific psychological disorder.

It is plausible that individuals between the ages of 18 and 24 were more likely than older cohorts to have self-selected into or out of severely flooded UHF zones. Younger people are more mobile due to the decreased chance of owning a home and thus more likely to change residence due to a natural disaster. Additionally, a large portion of people within this age group are college students who may have been out of the city during the hurricane but indicated that they lived in a flooded or dry UHF zone. The survey responses from this age group are further

complicated by the fact that the legal drinking age in New York State is 21. It is unclear how the illegality of underage drinking affected responses to the drinker and heavy drinker questions within this age group. For these reasons, I dropped all observations from respondents under the age of 25 when running the regressions for this study. This resulted in a 6% decrease in the sample size. The summary statistics shown in Tables 1 and 2 exclude observations from this age group.

Results

The results of this study can be viewed in Table 3. The impact of Sandy on drinking is displayed in regression (1). Regression (2) shows the effect of Sandy on heavy drinking. The effect on smoking habits is outlined in regression (3). Regressions (4) and (5) use the presence of depression and anxiety as their respective dependent variables. Regression (6) displays Sandy's effect on the presence of non-specific psychological disorders among the population of New York City. It is important to note that Table 3 shows logistic regression coefficients rather than marginal effects. Positive effects indicate worse health outcomes while negative effects indicate better health outcomes. For instance, the female coefficient for the smoker regression is negative and statistically significant at the 1% level. This means females are less likely to smoke than males. The marginal effects of Sandy exposure are outlined in Table 4. This shows the impact of Hurricane Sandy on each of the dependent health outcomes.

The results in regression (1) show that Hurricane Sandy had no statistically significant effect on whether a person drinks based on a sample of New Yorkers. The coefficients for female, black, and Hispanic show negative and statistically significant effects on drinking habits. Individuals between 25 and 44 are associated with a higher likelihood to consume alcohol. Meanwhile, individuals over the age of 45 are less likely to drink. Furthermore, higher levels of

education are associated with a higher likelihood to drink.

The results in regression (2) reveal that Sandy had no statistically significant impact on heavy drinking among the sample of New Yorkers that consume alcohol. The coefficient for the effect of female is positive and statistically significant meaning women are more likely to heavy drink than men. The effects of being black or Hispanic are negative and statistically significant. Meanwhile, an increase in age results in a decreased probability of heavy drinking. Higher levels of education are correlated with a lower likelihood to drink heavily.

The results in regression (3) show that Hurricane Sandy had no statistically significant effect on the likelihood that an average New Yorker smokes. The coefficient for female is negative and statistically significant. Being Hispanic also results in a decreased likelihood of smoking. Adults aged 25-44 are more likely to smoke than individuals over the age of 45. Higher educational attainment is associated with a lower chance of smoking.

The results in regression (4) show that Sandy had no statistically significant impact on depression among New Yorkers. Females are associated with a higher likelihood of having depression. Meanwhile blacks are less likely to be depressed. Respondents within the 45-64 age group have an increased risk of depression. Additionally, higher educational attainment is associated with a decreased risk of depression.

The results in regression (5) reveal that Hurricane Sandy had no statistically significant effect on anxiety based on a sample of New York City residents. Females are associated with an increased likelihood of anxiety. The coefficient for black is statistically significant and negative. Meanwhile, the coefficient for Hispanic is significant and positive. Individuals under the age of 65 are associated with a greater chance of depression while the relationship is negative for people over 65. Moreover, higher levels of education are correlated with a decreased likelihood

of anxiety.

The results in regression (6) show that Sandy had no statistically significant impact on the presence of non-specific psychological disorders among the population of New York City. Women are correlated with an increased likelihood of having a non-specific psychological disorder. Meanwhile, blacks are associated with a decreased risk of nspd while Hispanics are associated with an increased risk. Younger individuals are correlated with a lower likelihood of nspd. Higher levels of education result in an increased risk of nspd.

Discussion

The results of this study largely contradict the findings of other similar studies. While the research conducted by Kessler and Sastry found associations between natural disaster exposure and mental health decline, the results of this study imply that there is no causal link between the hurricane and long-term psychological health deterioration among the general population of New York.

Hurricane Sandy may have had no effect on mental health outcomes for various reasons. The damage caused by the storm may have simply been too negligible to impact the long-term health of New Yorkers. Comparatively to other major natural disasters in the United States, Hurricane Sandy was not as devastating. Hurricane Maria resulted in 20 times the fatalities as Hurricane Sandy. Additionally, Sandy caused only about half the financial damage that Hurricane Katrina did.

It is also possible that mental health deterioration did occur as a result of Sandy, but the effect did not persist for longer than a few months. By the time the Community Health Survey began surveying, respondents may have recovered from any trauma caused by the hurricane. This explanation is supported by the research conducted by Schwartz who found that individuals

exposed to Sandy experienced worse mental health outcomes shortly after the hurricane, but that these effects did not persist after a one-year follow-up (Schwartz, 2017).

Government assistance post-Sandy may have played a key role in mitigating the economic hardship caused by the storm. New York City used $14 billion in federal aid for various disaster relief projects. The city's housing programs assisted 32,000 households in obtaining reimbursements, repairs or upgrades to their homes. Furthermore, 1,282 businesses received grants or loans for the purpose of making working capital available to businesses impacted by Sandy (NYC Recovery, 2018). Those who were most vulnerable to Hurricane Sandy were targeted for government aid, which likely alleviated some of the economic burden.

This study does not account for the fact that individuals who lived in a severely flooded neighborhood were plausibly more likely to change residence. Many individuals who might have moved as a result of the hurricane may have moved to neighborhoods that were not severely affected by Sandy. This implies that a portion of the sample of respondents from the Community Health Survey could have experienced severe flooding but indicated they currently live in a dry neighborhood. This would bias the results of this study towards a result of no statistically significant effect. It is also feasible that individuals living in flooded neighborhoods who were least mentally affected by Sandy moved to dry neighborhoods, resulting in a positive bias. Since the CHS interviews a new set of respondents each year, it is impossible to ascertain whether they changed residence.

This study adds a variety of contributions to the field of disaster related research. As of writing, this paper is the first to utilize both ex-ante and ex-post data to analyze the long-term effect of Hurricane Sandy on the mental health of New York residents. Furthermore, the difference-in-differences approach is not used in any previous research. This method is appropriate because

Hurricane Sandy separated New York City neighborhoods into natural treatment (flooded) and control (dry) groups. The existence of pre- and post-Sandy survey data of mental health outcomes grants researchers the ability to examine long-term effects using a DiD model. Additionally, while other research (notably Schwartz) describes associations between Sandy and mental health, the DiD approach enables this study to be the first to attempt to identify a plausibly causal effect.

Conclusion

Knowledge of the causal impact of natural disasters on mental health can assist policy makers in designing high quality, evidence-based programs with the intent of long-term disaster relief. The results of this study may provide evidence in support of the relief efforts undertaken by the local, state, and federal governments during the hurricane. It is unclear whether the public would react in the same way to other natural disasters such as earthquakes or volcanic eruptions. Additionally, the population of New York City does not necessarily reflect the population of the United States or the rest of the world. People living in other areas may be impacted in differing ways. The method used in this paper can be adapted for use in other regions of the world in combination with other kinds of natural disasters. More research needs to be conducted to further understand the relationship between natural disaster exposure and psychological health.

Table 1 – Flood Severity by Neighborhood

Neighborhood	Frequency	(%)	Flood Severity
Kingsbridge-Riverdale	652	1.62	0
Northeast Bronx	826	2.05	0
Fordham-Bronx Park	968	2.40	0
Pelham-Throgs Neck	1,095	2.71	0
South Bronx	2,964	7.35	.20
Greenpoint	676	1.68	1.0
Downtown-Heights-Slope	1,124	2.79	1.0
Bedford Stuyvesant-Crown Heights	1,263	3.13	0
East New York	998	2.47	.25
Sunset Park	626	1.55	.17
Borough Park	888	2.20	0
East Flatbush-Flatbush	1,039	2.58	0
Canarsie-Flatlands	792	1.96	.67
Bensonhurst-Bay Ridge	745	1.85	.33
Coney Island-Sheepshead Bay	1,082	2.68	1.0
Williamsburg-Bushwick	1,023	2.54	0
Washington Heights-Inwood	1,468	3.64	0
Central Harlem-Morningside Heights	1,180	2.93	0
East Harlem	770	1.91	1.0
Upper West Side	1,423	3.53	0
Upper East Side-Gramercy	2,384	5.91	.14
Chelsea-Village	2,007	4.98	.78
Union Square-Lower Manhattan	1,840	4.56	.82
Long Island City - Astoria	883	2.19	0
West Queens	1,358	3.37	0
Flushing-Clearview	1,218	3.02	0
Bayside - Meadows	1,061	2.63	0
Ridgewood-Forest Hills	968	2.40	0
Southwest Queens	943	2.34	.25
Jamaica	1,237	3.07	0
Southeast Queens	964	2.39	0
Rockaway	605	1.50	1.0
Northern Staten Island	1,416	3.51	.33
Southern Staten Island	1,853	4.59	.33

Table 2 – Summary Statistics

Variable	Observations	Mean	SD
Drinker	40361	.54	.50
Heavy drinker (drinkers)	21763	.09	.28
Smoker	40498	.14	.34
Depression	24467	.06	.23
Anxiety	24468	.06	.23
Nspd	24430	.05	.22
Age: 25-44	40720	.32	.47
Age: 45-64	40720	.41	.49
Age: 64+	40720	.27	.44
Female	40720	.59	.49
Black	40720	.22	.42
Hispanic	40720	.26	.44
Less than HS	40720	.16	.37
HS or GED	40720	.21	.41
Some College	40720	.20	.40
College Grad	40720	.42	.49

Table 3 – Logistic Regressions

VARIABLES	(1) Drinker	(2) Heavy drinker	(3) Smoker	(4) Depression	(5) Anxiety	(6) Nspd
Severe Flooding	0.091	0.091	0.024	-0.167	0.074	-0.115
	(1.318)	(0.767)	(0.288)	(-0.934)	(0.372)	(-0.762)
Female	-0.641***	0.417***	-0.417***	0.201***	0.407***	0.245***
	(-14.121)	(4.492)	(-8.971)	(2.859)	(7.247)	(4.810)
Black	-0.303***	-0.307***	-0.001	0.004	-0.491***	-0.260**
	(-4.071)	(-3.321)	(-0.007)	(0.042)	(-4.188)	(-2.280)
Hispanic	-0.257***	-0.341***	-0.359***	0.440***	0.254**	0.424***
	(-3.526)	(-3.566)	(-3.978)	(4.067)	(2.533)	(4.039)
Age: 45-64	-0.444***	-0.219***	-0.032	0.399***	0.280***	0.497***
	(-9.263)	(-3.831)	(-0.780)	(4.847)	(4.216)	(7.958)
Age: 65+	-0.903***	-0.303***	-0.888***	0.078	-0.169**	-0.038
	(-15.402)	(-4.539)	(-16.130)	(0.793)	(-2.511)	(-0.414)
HS or GED	0.447***	-0.168*	-0.124**	-0.449***	-0.524***	-0.489***
	(9.405)	(-1.710)	(-2.297)	(-5.525)	(-5.839)	(-5.194)
Some College	0.780***	-0.190**	-0.121*	-0.667***	-0.621***	-0.639***
	(12.164)	(-2.267)	(-1.898)	(-7.726)	(-5.391)	(-5.698)
College Graduate	1.158***	-0.292***	-0.834***	-1.118***	-0.869***	-1.053***
	(12.353)	(-2.962)	(-11.760)	(-8.710)	(-10.420)	(-8.251)
Observations	39,713	21,500	39,835	24,017	24,019	23,982

Test-statistics in parentheses

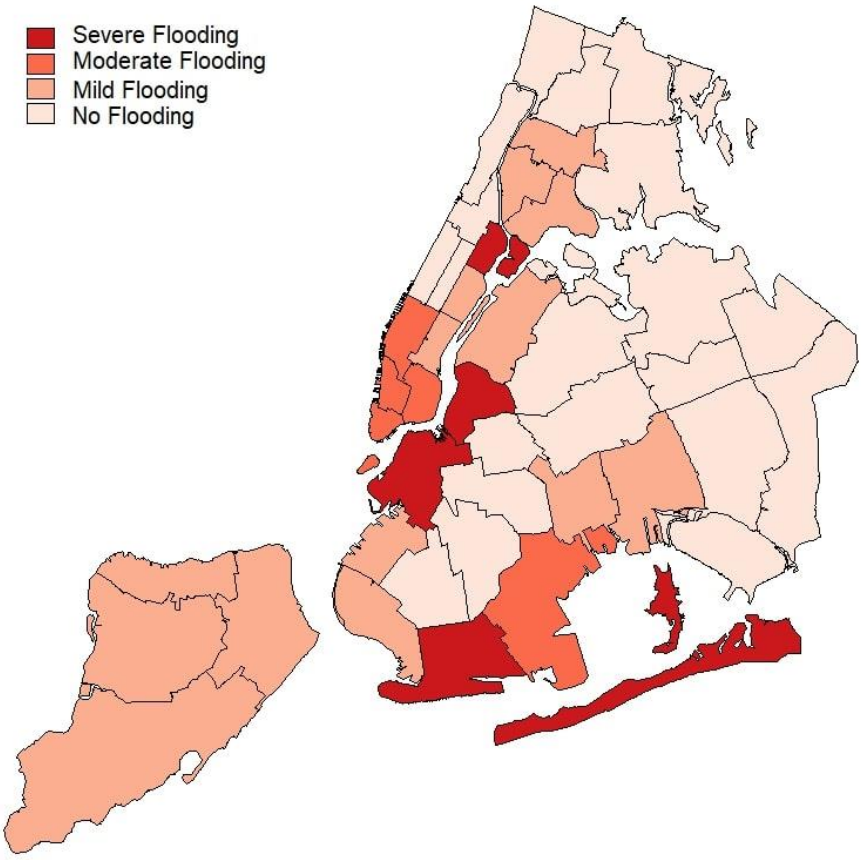
**p< 0.1, **p<0.05, ***p<.01*

Dummies for individual years and UHF zones not shown

Table 4 – Marginal Effects of Severe Flooding

Regression	Outcome	Flooding	P-Value
(1)	drinker	0.0195	0.188
(2)	heavy drink	0.0072	0.443
(3)	smoker	0.0027	0.774
(4)	depressed	-0.0088	0.350
(5)	anxiety	0.0039	0.710
(6)	nspd	-0.0054	0.446

Figure 1 - Post-Sandy NYC Flood Severity Map



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