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Mental Health Impact of Disasters

By
Saman Faisal

A Thesis Submitted to the Graduate Faculty of Georgia State University in Partial Fulfillment of the Requirements for the Degree

MASTER OF PUBLIC HEALTH

ATLANTA, GA 30303

Approval Page

Mental Health Impact of Disasters

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Important Definitions

Disaster:

"A disaster is a situation or event which overwhelms local capacity, necessitating a request to a national or international level for external assistance."

Depression:

"Depression is a mental disorder that presents with depressed mood, loss of interest or pleasure, feelings of guilt or low self-worth, disturbed sleep or appetite, low energy, and poor concentration."

Post Traumatic Stress Disorder (PTSD):

"Post-traumatic stress disorder is a type of anxiety disorder. It can occur after you've seen or experienced a traumatic event that involved the threat of injury or death."

Frequent Mental Distress:

"Experiencing 14 or more mentally unhealthy days during the previous 30 days."

Terrorism:

Terrorism is the use of force or violence against persons or property in violation of the criminal laws of the country for purposes of intimidation, coercion, or ransom.

Mental Health:

"A level of cognitive or emotional wellbeing or an absence of a mental disorder."

Saman Faisal
Mental Health Impact of Disasters
(Under the direction of Dr. Michael Eriksen, Faculty Member)

It is very important to study the mental health impact of disasters to provide adequate mental health services when there is an increased demand of mental health services and a concurrent deterioration of mental healthcare capacity after disasters. This study examined the mental health impact of 9/11 attacks among the individuals living close to the disaster area and compared them to the individuals living farther from the disaster area. New York (NY) state and Washington DC were selected as the disaster areas and Illinois (IL) was selected to study individuals living farther from the disaster area. The study also assessed the effects of mental health on risky behaviors such as cigarette smoking and alcohol consumption and how they vary based on age, gender and proximity to the disaster. Ten year Behavior Risk Factor Surveillance System (BRFSS) data from 1996-2005 was obtained for NY, DC and IL. Significant increase in mental distress was observed in NY and DC but not in IL. Increased use of alcohol was found among DC and NY residents but the increase in IL was not significant. Logistic regression showed that increase in alcohol consumption was not associated with mental health. An overall decrease in cigarette smoking was observed and there was no impact of disaster on smoking rates. Mental distress was much higher among the female

respondents as compared to the male respondents. Mental distress was highest among 35-49 year old respondents as compared to other age groups. In future longitudinal studies should be conducted in order to establish the causal relationship of mental health and risk behaviors such as smoking and alcohol consumption after disasters. Most of the interventions regarding post-disaster mental health focus on PTSD but other mental disorders should also be addressed.

CHAPTER 1

INTRODUCTION

The lack of adequate mental healthcare is a pattern that exists throughout the world; not even one single country meets its mental health needs [1]. This is especially true during disasters, when there is an increased demand for mental health services and a concurrent deterioration of mental healthcare capacity. Mental healthcare is particularly important during disasters because such events can cause fear in addition to the physical injuries among affected people. Disasters also result in long lasting psychological consequences due to the disruption of social networks and loss of property [2].

For a mental health intervention to be effective, it is important to take into consideration the local socio-cultural setting, requirements, problems, and the perception within the community of those requirements and problems. A balance should be maintained between individual mental health services and community focused interventions. The psychological impact of large scale disasters, particularly in urban areas, affects not only the victims but the general population as well [3]. September 11, 2001 terrorist attacks on the World Trade Center and the Pentagon were unprecedented. Thousands of people in New York watched the actual event unfold, and millions around the world watched it on televisions. This single event impacted people throughout the world [4].

Reactions of survivors after any disaster are usually associated with a loss that they suffered, such as the loss of property, the loss of loved ones, or a physical disability resulting from the disaster [5]. Stressful physical and mental conditions and the loss of social support resulting from disasters can increase the incidence of mental health problems among survivors [6].

Individuals—depending on their age, gender, race, knowledge, culture, and prior experience of disasters—react differently under stressful conditions. They present with varying combinations of emotional, behavioral, and mental manifestations. Studies show that people's reactions under stressful conditions are adaptive. They usually try to cope with disasters by applying their best knowledge and capabilities rather than reacting in a chaotic way [7]. Reaction to terrorist attacks varies even within homogeneous groups of people who have been exposed to the same event with the same magnitude. People tend to feel insecure and vulnerable after terrorist acts more than after natural disasters [8].

Response to trauma is different in adults and children. Adults usually present with PTSD (Post Traumatic Stress Disorder) and depression whereas children present with varying symptoms such as depression, anxiety, school problems, and sleep problems. Young adults show higher rates of cigarette smoking, alcohol use, and drug use [9]. Reactions to traumatic situations also vary between different gender groups and between different racial groups [10].

The focus of this study is on the mental health impact of a disaster in relation to the proximity of the disaster area. Research shows that people living geographically close to a disaster site have greater mental health impact than those living far from the area [11]. But people living in the areas far from the disaster site are also affected

psychologically. Most of the studies focus on populations living in the disaster zone. This study is comparing the residents of the New York (NY) state and Washington DC with residents of Illinois (IL). NY and DC are the target locations in the 9/11 attacks; whereas, IL is used as a reference state. The study will also assess the effects of mental health on risky behaviors such as cigarette smoking and alcohol consumption.

It is extremely important to understand post disaster mental health indicators in order to identify vulnerable populations and develop mental health interventions specific to that culture and situation. Existing mental health services should be assessed during disasters and efforts should be focused on filling in the gaps in the delivery of services (12). Most of the studies in the past have focused on survivors rather than the general population.

The hypothesis is "the mental health impact is greater in populations living closer to the disaster area". The null hypothesis is that "the mental health impact is the same in the population living close to the disaster as it is in the population living far from the disaster." The study will answer the following questions:

1. Is the mental health impact greater in the population living closer to the disaster area as compared to the population living far from the disaster area?
2. What is the association between mental health impact and age?
3. What is the association between mental health impact and gender?
4. What are the trends of rates of cigarette smoking and alcohol consumption in New York State, Washington DC and Illinois from 1996 to 2005?

CHAPTER 2

LITERATURE REVIEW

It has been recognized that people often experience psychological problems when they are exposed to traumatic situations [13]. One week after 9/11 attacks, 44% of US adults had at least one significant symptom of stress, and 90% had low levels of stress symptoms [10]. PTSD is the most researched mental health issue among survivors [2]. Research indicates that most of the survivors of any traumatic event show remission of PTSD within the first three to six months of the disaster [14]. But some studies have shown that even after three years of a disaster, half of the survivors still suffered from PTSD [15].

Most of the research in the past has focused on survivors of disasters rather than the general population. One study done on New York City residents after 9/11 attacks shows that symptoms of PTSD were more persistent among individuals directly affected by the attacks compared to people that were not directly affected by the attacks Two thirds of the cases of PTSD were resolved within the first six months, but 5.3% of the population living in New York City still showed symptoms of PTSD (see Fig. 1) [3].

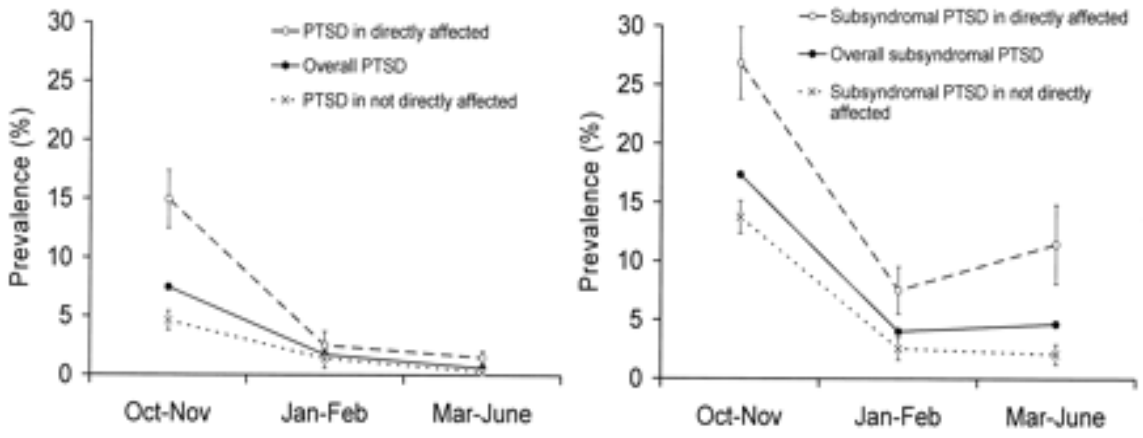

Fig. 1: Prevalence of probable post-traumatic stress disorder (PTSD) and subsyndromal PTSD in Manhattan south of 110th Street during the first 6 months after the September 11, 2001, terrorist attacks [3].

Another study done after 9/11 attacks concluded that there was significant burden of PTSD and depression among the Manhattan residents five to eight weeks after the attacks [16]. Prevalence of PTSD was associated with the exposure to the event (i.e. the more exposed they were, the higher the degree of PTSD). Depression, on the other hand, was usually associated with losses that people suffered because of the attacks [16]. It has been observed that people who have pre-disaster psychological problems had more physical symptoms after the disaster. Yet individuals who did not have pre-disaster psychological issues utilized mental health services after disasters more. Increased utilization of mental health services was found to be associated with being a victim rather than having pre-disaster psychological problems [17].

Mental health problems are significantly higher among displaced population. Large-scale disasters cause displacement in populations and cause other disruptions in lives of the residents of the disaster area. Displacement causes disruption of social

networks, economic burden, and health care accessibility problem. All of these factors put additional burden on deteriorating health care infrastructure [18]. Some natural disasters affect huge populations, and due to their magnitude, it becomes almost impossible to deliver individual services to the affected population. In such circumstances, non-specific, generic type of counseling is provided to the victims [19]. Research shows that these generic types of counseling fail to decrease the rates of PTSD among the victims [20]. In large scale disasters, instead of providing generic counseling to the victims, quick recovery and return to normal routine has shown to be the most effective in reducing stress in the community [21].

Occasionally, in large scale disasters, health services are provided by international agencies that are not familiar with local culture and customs. For example, Sri Lanka has a history of internal conflict which has affected their health services, particularly their mental health services. When Sri Lanka was affected by the 2004 tsunami, a number of international agencies offered mental health services for the tsunami victims, but the interventions were relatively unsuccessful because they were short term, untested, and non-specific to that population. The impact of those interventions has not been measured [22].

One study on the mental health utilization in the New York City one year after the 9/11 attacks revealed that there was no significant increase in the mental health services utilized among the New York residents. But there was a significant increase in the mental health services utilization among the individuals who were already receiving some therapy. The number of counseling sessions were directly associated to the level of exposure to the terrorist attacks. The use of medications after the attacks was positively

associated with younger age, females, level of exposure to the event, anxiety, and negative life events, while it was negatively associated with being African American [24].

Another study showed that utilization of mental health services after disasters has been associated with younger age, unemployment, being an immigrant, exposure to the disaster, self-reported psychological issues, and other physician diagnosed health problems [25]. But the strongest association exists with having negative thinking, avoidance behavior, resentment, and pre-disaster health problems [25]. There was a 10.1% increase in Emergency Department visits for mental and behavioral issues among the adult Medicaid recipients living within a three miles radius of the World Trade Center (WTC). An increase was seen even in populations living outside of the 3 mile radius of World Trade Center; however, it was a relatively small increase (see Table 1).

Table 1: Rate per 100 person-years of eligibility for Emergency Department visits for behavioral and mental health diagnoses, New York State Medicaid recipients aged 21 to 64 years, by geographic zone in relation to World Trade Center site and period [26].

Period	**Residence in Relation to World Trade Center Site**			
	<3 miles	**3–10 miles**	**New York City >10 miles**	**Non–New York City**
Sept. 2001–Dec. 2001	97.4	46.2	55.1	82.5
Jan. 2001–Aug. 2001	88.5	52.3	58.5	85.6
Sept. 2000–Dec. 2000	79.8	45.0	47.2	83.5
Jan. 2000–Aug. 2000	80.5	51.1	53.7	88.3

Many researchers believe that instead of providing psychotherapy to the victims, helping them get back to their normal lives is a better way to improve their mental health [27, 28]. The use of mental health services such as psychotherapy to treat victims of disasters has been criticized, particularly when it is used in different cultures. Diagnostic criterion for PTSD that is used in one culture might not be applicable for another culture [19, 29].

2.1 Natural Disasters vs Man made Disasters

Disasters, whether natural or man-made, can cause an increase in mortality, morbidity, and occasionally displacement among the affected population. But there are some differences in the victim's responses and the responder's responses. The world response to the 2004 tsunami was immense. Approximately 220,000 people died in eleven countries [30]. Within twelve days of the tsunami, governments of nineteen countries attended a conference and $14 billion was pledged [31]. Whereas, in the Democratic Republic of Congo (DRC), approximately 3.8 million people were killed, and millions were displaced over the period of six years [32]. The response to conflict in DRC has been very slow and insufficient [32].

Sexual violence against women and children is seen after some disasters, but the rates are very high in the areas of conflict. Rape is often used as a war tool. Some places this has occurred are Darfur and DRC, but an unknown number of women have been raped [33, 34]. Killings and rapes further deteriorate the mental health of the people living in the conflict zone. Mental health impact of conflict differs from that of natural disasters in many ways. Torture and ethnic cleansing seen in conflicts result in feeling of

hatred and revenge among the survivors, and these feelings of hatred may be passed on to the next generation. The feelings of hatred do not exist in natural disasters [35]. There is a sense of insecurity and vulnerability among the survivors after any terrorist act. It is easier for the responders to act during natural disasters as compared to the complex emergencies because such emergencies are very complicated and involve many political issues.

2.2 Gender

Studies suggest that men and women tend to react differently to traumatic events. Many factors influence their reactions including the frequency of exposure to the trauma victims and the degree to which they identify themselves with the victims. According to some studies, women are exposed to fewer traumatic events than men; on an average, men experience 5.3 traumatic events while females experience 4.3 traumatic events [36]. Some studies suggest that women are exposed to trauma more frequently than men, while other studies indicate that there is no difference between men and women [40]. One study reports that women are five times more likely to have PTSD as compared to men and another study suggests the ratio to be 2.1 times [10, 36,42]. Women are also seven times more likely to report increased alcohol use. Women are also 2.6 times more likely to experience depression than men [37].

Other studies show that men are approximately five to seven times more likely to be diagnosed of alcohol abuse than women [38]. Women with PTSD are twice as likely to develop depression and anxiety problems as men with PTSD [36]. There are also gender differences in types of trauma exposure. Men are more likely to be exposed to

combat, mugging, and physical violence than women. On the other hand, women are more likely to be exposed to rape and other sexual assault [41].

2.3 Short and Long-Term Effect

Short term mental health effects of disasters have been studied extensively, but there are very few long-term studies. Short-term effects of disasters include PTSD, depression, anxiety, somatic complaints (gastrointestinal, constipation, heartburn, nausea, vomiting, colitis, headaches, migraines, back/neck aches, skin disorders) and nightmares [43-44]. The limited studies regarding long-term effects of repeated exposures show that the individuals who have already experienced a certain disaster in the past experience a higher degree of psychological distress when exposed for a second time, as compared with the people who are experiencing a disaster event for the first time. This is true, even if the second disaster event is seven years later than the first [45]. On the contrary, first time flood victims showed higher rates of distress than those who had previous exposure to floods [47].

Usually a decline in symptoms is seen with time after any disaster. Research has revealed that up to one year psychological impact is directly related to dose exposure, but after three and a half years that relation does not exist [46]. The initial impact of a disaster is directly related to the exposure of the survivors to the event (i.e. the greater the exposure, the stronger the impact), but after some time, that affect is reduced. This pattern is demonstrated in the response to the 9/11 attacks. One to two months after 9/11 attacks 57.8 % of Manhattan residents showed at least one symptom of PTSD, and they

were more likely to report an increased use of substance abuse [16, 48]. Six months after the attacks the prevalence rate of PTSD among Manhattan residents declined to 1.5% [3]. The rates for use of cigarettes, alcohol, and marijuana declined from 30.8% to 27.3%. This is still very high considering the decline in PTSD from 57.8% to 1.5% as shown in Fig. 2 [49].

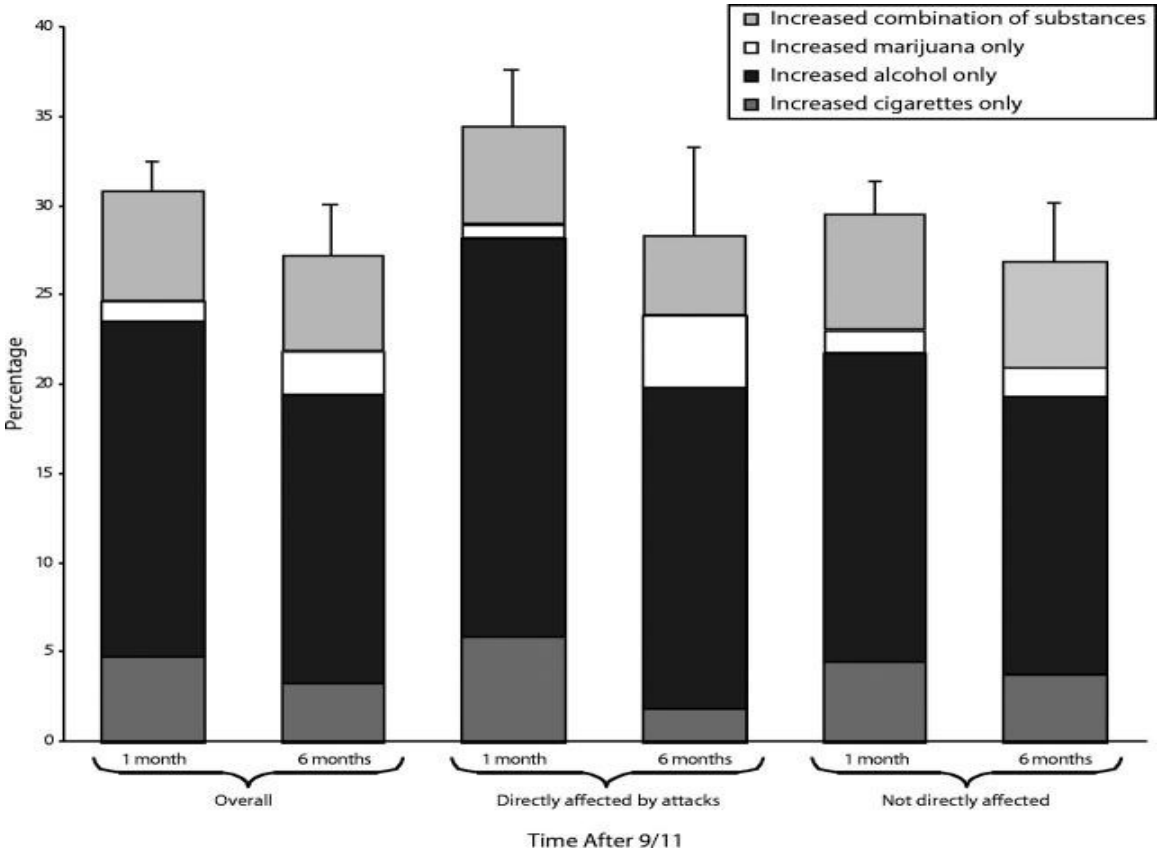

Fig. 2: Percentages and confidence intervals for increased consumption of cigarettes, alcohol, and marijuana among Manhattan residents after September 11, 2001, grouped by whether or not they were directly affected by the terrorist attacks [49].

Another study conducted once three weeks after a disaster and once eighteen months after a disaster concluded that there was a decline in the prevalence rates of mental health problems among the victims. However, they were still higher than the rates

in the control group [50]. The prevalence of PTSD was reported to be 17% two months after the attacks, nationwide. Six months after the 9/11 attacks, the prevalence of PTSD nationwide declined to 5.8%. High prevalence rates were associated with female gender, severity of exposure, pre-attacks physician diagnosed mental or physical health problem, marital separation, and early disengagement from coping strategies [51].

2.4 Proximity

Research has shown that the individuals living closer to the site of a disaster suffer greater mental distress than those living far from the area [52]. Nationwide study after 9/11 attacks showed that the prevalence of probable PTSD was significantly higher in New York city metropolitan area residents as compared to the rest of the country (see Fig. 3).

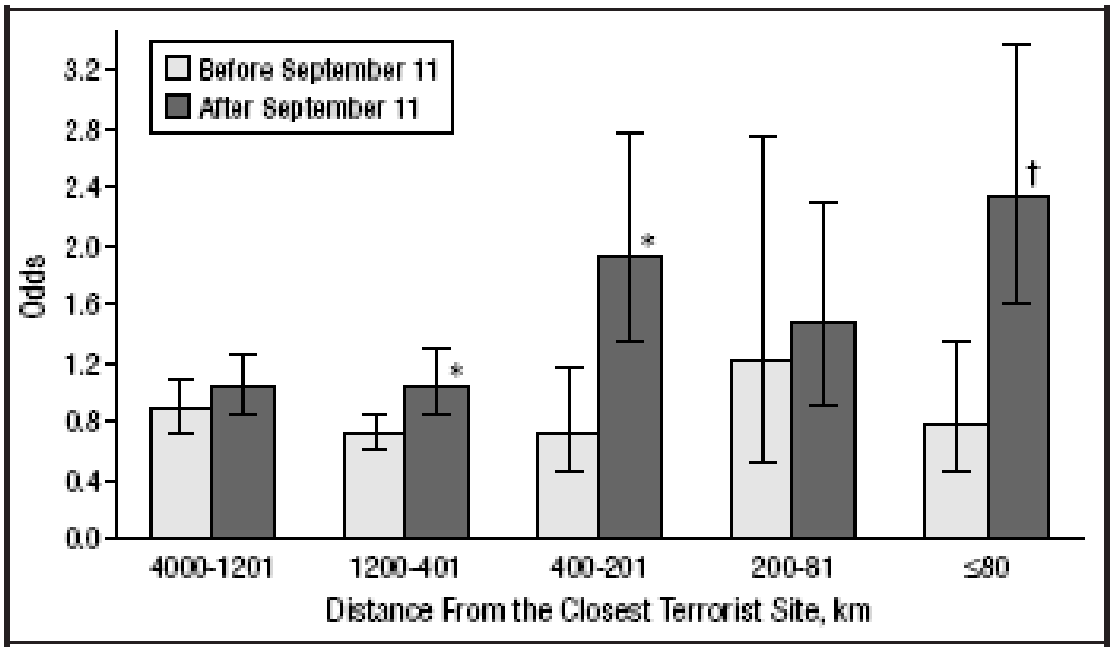

Fig. 3: Sadness among female young adults (aged 18-26 years) before and after September 11, 2001, by distance from the World Trade Center or the Pentagon [52].

But researchers found that some of the differences can be attributed to the differences in socio-demographic characteristics of that area. After adjusting for those differences, New York City residents were 2.9 times more likely to have PTSD than the rest of the country [53]. Although Washington DC was also a target, prevalence of PTSD was found to be greater in New York City than Washington DC.

Another study done on Manhattan residents five to eight weeks after 9/11 attacks showed that 7.5% of the respondents had PTSD and 9.7% had depression. The baseline prevalence for PTSD and depression were 3.6% and 4.9% respectively. Prevalence of PTSD was highest among people who were directly exposed to the event or were geographically very close to the site. Rate of depression was higher among individuals who suffered loss [16].

A study was conducted after the Oklahoma City bombing that compared residents of Oklahoma City and Indianapolis 3-4 months after the event. Fourty-three percent of the respondents living in Oklahoma City reported symptoms of stress as compared to 11% in Indianapolis [54].

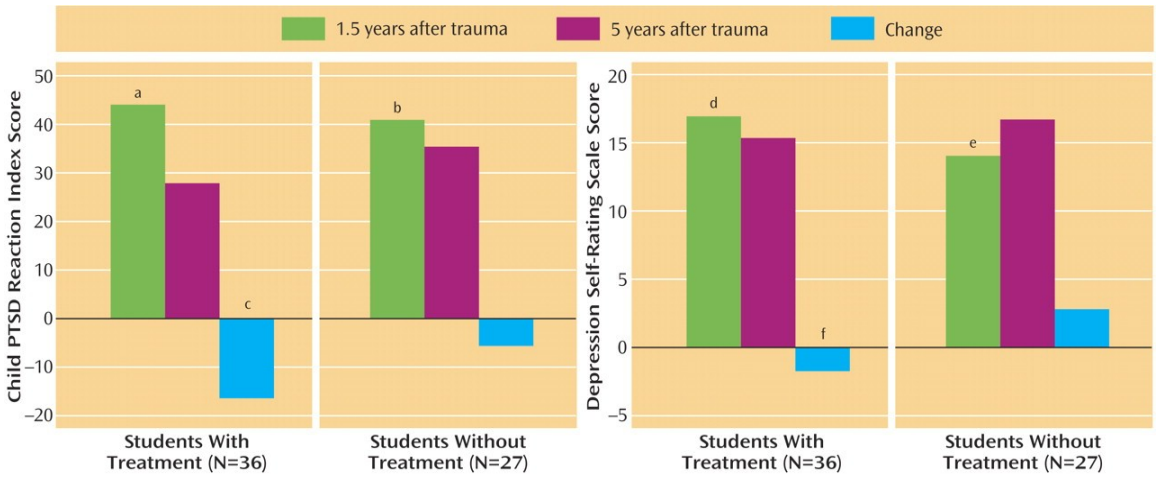

Fig. 4: Child PTSD Reaction Index (CPTSD-RI) Scores, Depression Self-Rating Scale (DSRS) Scores, and Changes in Scores between 1.5 and 5 Years After a disaster [55].

Another study compared adolescent victims of an earthquake who received treatment to those adolescent victims who did not receive treatment. The study was done 1.5 years and five years after the earthquake (see Fig. 4). At both 1.5 years and 5 years after the earthquake, the highest rates of PTSD were seen among the victims, who lived closest to the epicenter. Researchers call this "dose of exposure pattern." Among the victims who received treatment, there was three times greater decrease of PTSD symptoms than untreated victims. Regarding change in depression rates among treated victims, there was a decrease in the depression rates in the initial period, but then this progress in decrease stopped and an increase in rates was seen among the untreated [55].

Research has shown that there is an association between exposure to trauma and suicide ideation [56]. Study shows that suicide ideation among police officers who worked in the proximity of World Trade Center increased significantly from pre 9/11 assessment to the three-year post 9/11 assessment, as shown in Fig. 5 [57].

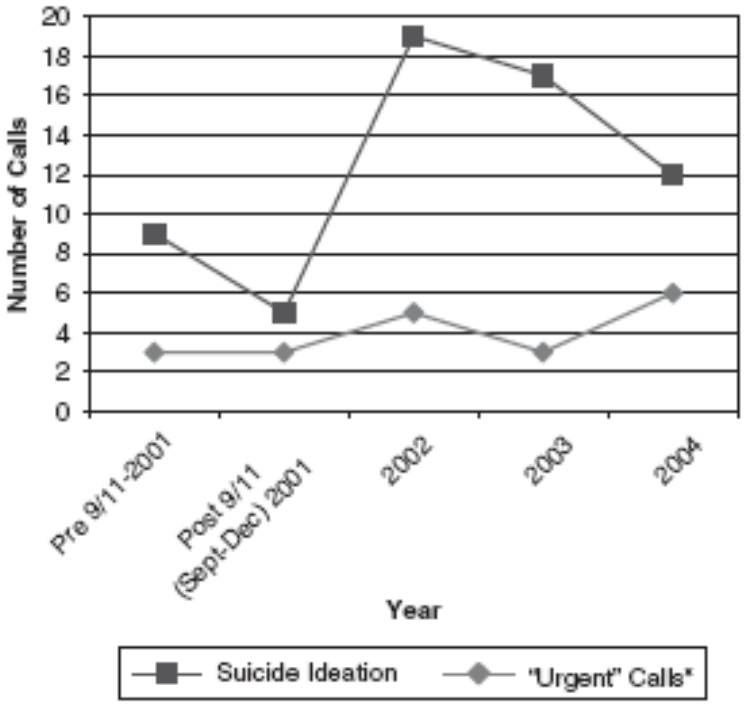

Fig. 5: Cop number of suicide ideation and urgent calls before and after 9/11.Urgent calls were those whose complaints and symptoms warranted immediate contact with a mental health practitioner.

A study done on adolescents (grades 7-12) shows those individuals who did not directly witness the attacks had feelings of sadness and psychological distress after the attacks. But this feeling was transient and returned to baseline within 4-6 weeks of the attacks. Participants closer to the site of the attacks were affected more than those living farther from the site [52]. Stress reactions were also associated to television viewing. Television provided information regarding what to do, and for some people, it helped them. For others, particularly children, watching the event repeatedly worsened the stress [58].

2.5 Substance Abuse

Studies show that there is an increase in the rates of psychiatric problems among the survivors of a disaster, and because of these psychiatric problems, substance abuse becomes a major issue after disasters [59]. There was a significant increase in the prevalence rates of cigarette smoking, alcohol use, and marijuana use among Manhattan residents after 9/11 attacks [49]. Among the individuals studied, 28.8% reported an increase in either one of these substances. There was a higher prevalence of depression among the people who increased the use of any of these substances than those who did not increase the use. Among the people who did increase the use of marijuana and cigarettes, symptoms of PTSD were higher than those who did not increase the use of these substances [49]. There have been several studies to determine the relationship between trauma exposure and alcohol abuse. A study revealed that there was 30% increase in alcohol consumption among the population exposed to disaster [60]. Another study revealed that there is a strong association between stressful conditions after an emergency and alcoholism. The more involved survivors are with the rescue efforts; more vulnerable they are for alcohol abuse [61]. Studies done on psychiatric patients reveal those women who self reported their history of physical or sexual abuse either in their childhood or in their adult life showed significantly high rates of alcoholism [62]. Very high rate of self reported physical abuse, sexual abuse, or both was seen in women who were trying to get treatment or are being treated for alcoholism [63].

Some researchers believe the more violent and more frequent the abuse is, the greater the chances are of alcoholism among the victims. Studies done on veterans suggest that the rate of alcohol abuse is greater among individuals exposed to war.

Duration and level of violence exposed are closely related to alcohol abuse. Greater levels and durations of violence, resulted in higher rates of alcohol abuse [64].

2.6 Race

Research shows that there are significant racial differences in rates of PTSD across survivors of the same traumatic event. Studies done on Vietnam war veterans showed that the rate of PTSD was highest in Hispanic veterans and it was lowest in Caucasian veterans. Although there might be other factors associated with this difference, these were not included in the study [65]. Other studies done on Vietnam War veterans also show that Hispanics have the highest prevalence rates of PTSD than individuals from other racial and ethnic groups. Researchers believe that socio-cultural influences are responsible for the differences [16].

Many researchers believe that racial and ethnic minorities would experience a greater mental health impact from a disaster as compared to Whites because the minorities usually experience more frequent and chronic stressful conditions such as living in poverty [66].

A study on hurricane Katrina victims revealed that there were very strong racial and class differences in victim's reactions. African Americans were more affected by the event than any other racial or ethnic group, but socioeconomic class and job security were also very important factors in the reactions [67]. Research done after 9/11 attacks showed no significant racial differences in mental health impact to the attacks [68].

2.7 Age

Adults usually present with PTSD or depression under stressful conditions, whereas, children's reactions vary among PTSD, depression, anxiety, behavioral problems, or dissociative identity disorder (multiple personality disorder) [69]. Children and adolescents suffer more significant mental health impacts as a result of disasters when compared to adults [70]. They show different symptoms such as depression, anxiety, concentration problems, school problems and sleep problems. Studies suggest that in the time immediately after the disaster, that is, up to six months, there is an increase in the rate of depression, anxiety, aggression and an increase in substance abuse. Then these symptoms decrease with in one year, but an increase in alcohol use after the disaster persisted. Even after one year of the event there was an increased use of hypnotic drugs and sedatives [71].

Teenage survivors of a disaster showed some mental health problems within six months of the disaster [72]. The survivors were more likely to experience anxiety and affective disorders 5-8 years after the event [73]. Immediately after 9/11, 11% of New York City public high school students reported increased use of alcohol as shown in Fig. 6. Direct exposure to the event was significantly associated with increased alcohol consumption. Family exposure and media exposure caused some increase in alcohol intake but not statistically significant increase [74].

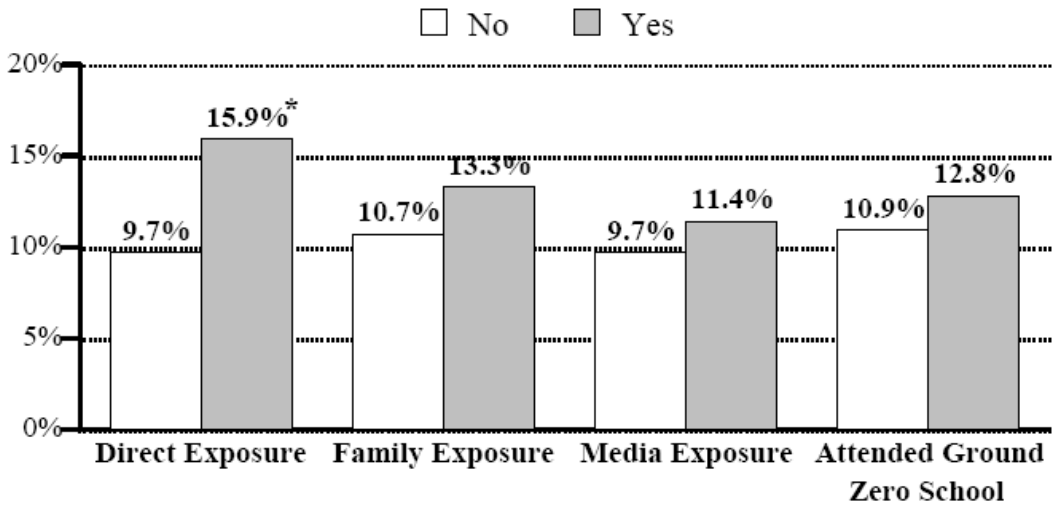

Fig 6: Percentage of New York City public high school students reporting increased alcohol consumption in the 6 months after 9/11 by exposure level [74].

Post-traumatic response varies among children depending upon the severity, duration, and frequency of the traumatic events. Children who are exposed to repeated trauma such as sexual abuse are more likely to develop alcoholism in their adult life as compared to children who are exposed to a single traumatic event such as kidnapping [69]. Research shows that older individuals, that is, 65 and above, bear less emotional burden than younger individuals [75]. Middle age group is the one that is most affected by the disasters. It has been observed that anxiety, depression, and long-term psychological effects are greater among middle aged people as compared to young ones or people older than 55 years of age [60]. Another study shows that people between the ages of 36-50 years show greatest risk for developing new psychological problem [76].

Comparing different age groups shows that among the victims exposed to a disaster, middle age group were the most affected. But the individuals who were not exposed to the disaster directly showed a linear trend as shown in Fig. 7. Younger adults

showed the highest psychological impact, and then middle age and elderly population had the least impact [77].

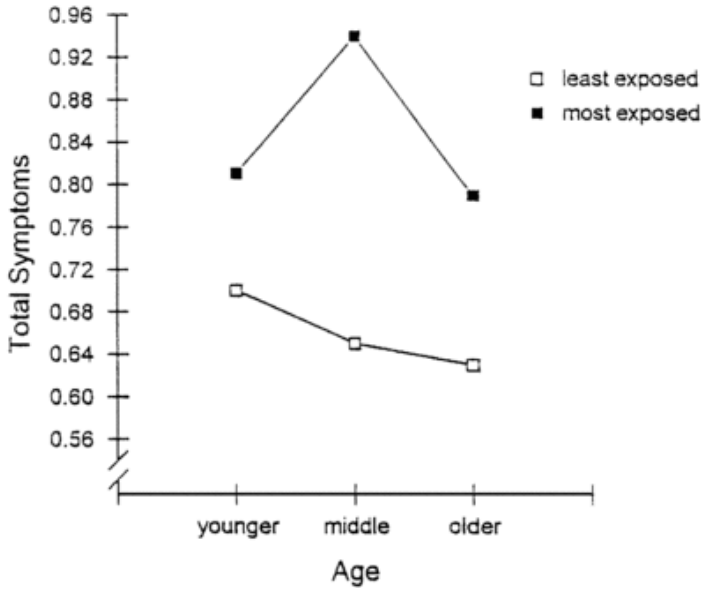

Fig. 7: Different levels of stress among different age groups depending on their level of exposure. Young adults (18–34 years), early middle-aged adults (35–49 years), late middle-aged adults (50–64 years), and older adults (65 and older) [77].

The psychological impact of disaster was studied in children between the ages of 2-9 years. The rate of aggressive behavior among the children rose from 0% to 10%, and a significant number of children who had bladder control before the disaster developed "enuresis" (involuntary urination) [77]. Another study done on the children between the ages of 9-19 years three months after a disaster showed high rates of anxiety and PTSD. Girls had higher rates of both anxiety and PTSD than boys. Black children were more likely to report PTSD than White children [78].

CHAPTER 3

METHODS

3.1 Data

Ten year (1996-2005) BRFSS (Behavioral Risk Factor Surveillance System) data of NY, DC, and IL were used in this study.

3.1.1 BRFSS

BRFSS is an ongoing state based telephone survey. It was established by the Centers for Disease Control and Prevention (CDC) to collect the data on health risk behaviors, preventive health practices, and health care access in relation to injuries and chronic diseases. Telephone numbers are randomly selected by region in each state. Data is collected monthly in all fifty states, Washington DC, Puerto Rico, the Virgin Islands, and Guam. Trained interviewers administer identical questionnaires by random-digit dialing of non-institutionalized US adults.

Each year a standardized questionnaire is designed. It consists of three sections: a core component, a optional component, and state added questions. Core questions are asked by all states, while the optional section includes questions on specific topics and is included if the state desires. State specific questions are included in section three [80].

Data for NY and DC were used to represent the population living close to the disaster area. IL represented population living farther from the disaster area. IL was included in the study because it is demographically similar in size and population to NY. Because it is the federal capital, DC is unique.

Table 2: Demographics of DC, IL and NY.[81]

	DC		IL		NY	
Subject	**Number**	**Percent (%)**	**Number**	**Percent (%)**	**Number**	**Percent (%)**
Total population	572,059	100	12,419,293	100	18,976,457	100
Male	269,366	47.1	6,080,336	49	9,146,748	48.2
Female	302,693	52.9	6,338,957	51	9,829,709	51.8
Median age (yrs)	34.6	(X)	34.7	(X)	35.9	(X)
18 years and over	457,067	79.9	9,173,842	73.9	14,286,350	75.3
65 years and over	69,898	12.2	1,500,025	12.1	2,448,352	12.9
White	184,309	32.2	9,322,831	75.1	13,275,834	70
Black or African American	350,455	61.3	1,937,671	15.6	3,234,165	17
American Indian and Alaska Native	4,775	0.8	73,161	0.6	171,581	0.9
Asian	17,956	3.1	473,649	3.8	1,169,200	6.2
Native Hawaiian and Other Pacific Islander	785	0.1	11,848	0.1	28,612	0.2
Some other race	28,627	5	847,369	6.8	1,721,699	9.1
Hispanic or Latino (of any race)	44,953	7.9	1,530,262	12.3	2,867,583	15.1

Data were checked for matching variables and then merged. Most of the questions that were asked in all ten years were included in the study. Variables for the year 2001

were recoded to divide it into pre-disaster and post-disaster. The following questions from BRFSS were included in the study:

1. Now thinking about your mental health, which includes stress, depression and problems with emotions, for how many days during the past 30 days was your mental health not good?
2. Do you now smoke cigarettes everyday, some days or not at all?
3. During the past month, have you had at least one drink of any alcoholic beverage such as beer, wine, wine coolers or liquor?
4. What is your age?
5. What is your sex?

The age variable was recoded into four groups: 18-34 years, 35-49 years, 50-64 years, and above 65 years. The question regarding mental health ("Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?") was recoded into FMD (Frequent Mental Distress) and non-FMD. The FMD was defined as poor mental health for ≥ 14 days in the past 30 days. A minimum period of 14 days has been chosen because this number is used by clinicians as a marker for depression and it is widely used by researchers to study depression and anxiety [82, 83].

The variable for smoking was recoded into two groups; smokers and non-smokers. The variable regarding alcohol consumption was recoded as "at least one drink in the past 30 days". The question was not asked in 1996 and 2000 in DC and in 1998 and 2000 and 2005 in NY.

3.2 Research Design

This study is conducted to assess the mental health impact of 9/11 attacks. The purpose of this study is to:

- Determine if the mental health impact of disasters is greater among populations living closer to the disaster area as compared to the people living farther from the disaster area.
- Assess the trends of cigarette smoking and alcohol consumption in NY, DC and IL from 1996 to 2005 in adults and determine if they increased after the disaster.
- Determine the association between the mental health impact of the disaster and the age.
- Determine the association between the mental health impact of the disaster and the gender.

3.3 Statistical Analysis

SPSS version 16.0 was used for the statistical analysis. Initially, prevalence rates of all the variables were calculated for the states and years separately. Subsequently statistical significance was established by using "chi square tests" and "P value". The chi square test examined the relationship between the dependent variable (FMD) and the independent variables (age, sex, smoking, and alcohol). The larger value of the chi square shows that it is less likely that the difference is due to chance. A P value of less than 0.05 means that the difference between the populations is significant and not likely to be due

to chance. Differences between the rates of FMD, smoking, and alcohol across different states were determined using a 95% confidence interval (CI). Differences between the prevalence rates of FMD, smoking, and drinking before and after the disaster were determined by computing 95% confidence limits. Lack of overlap in confidence limits was used to determine statistical significance in rates between compared states. Logistic regression was conducted, and the odds ratio with a 95% confidence interval was calculated to compare different variables in the two categories, that is, FMD (Yes) and FMD (No). The data was compared for different states by logistic regression analysis. The univariate analysis was conducted with FMD as dependent variable.

CHAPTER 4

RESULTS

This study was conducted to find out the difference in the mental health impact of disasters among the individuals living close to the disaster area and the individuals living farther from the disaster area. Figure 8 shows the percentage of males and females who participated in the survey. The percentage of female respondents is greater than male respondents and this difference is seen in three states in all ten years. Fig 9 describes the prevalence of FMD throughout the years in DC, NY and IL. The graph shows that there is an increase in the prevalence of FMD after the 9/11 attacks in NY, DC and IL.

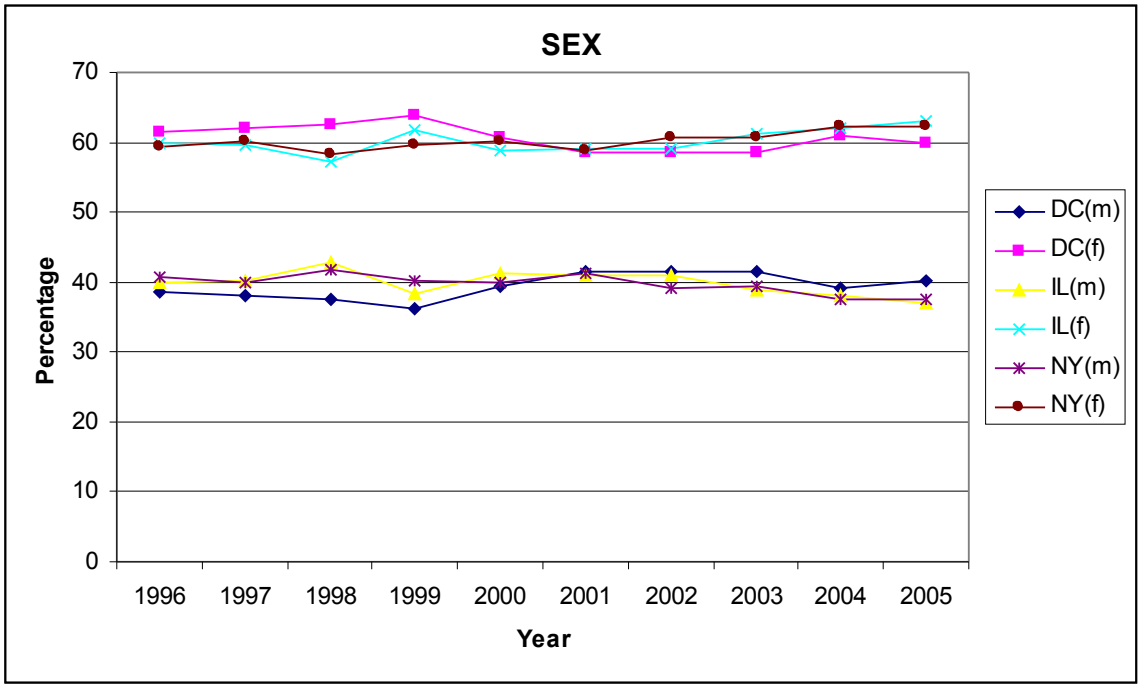

Fig. 8: Percentage of male and female respondents in the BRFSS data for three state (DC, IL and NY) over 10 years.

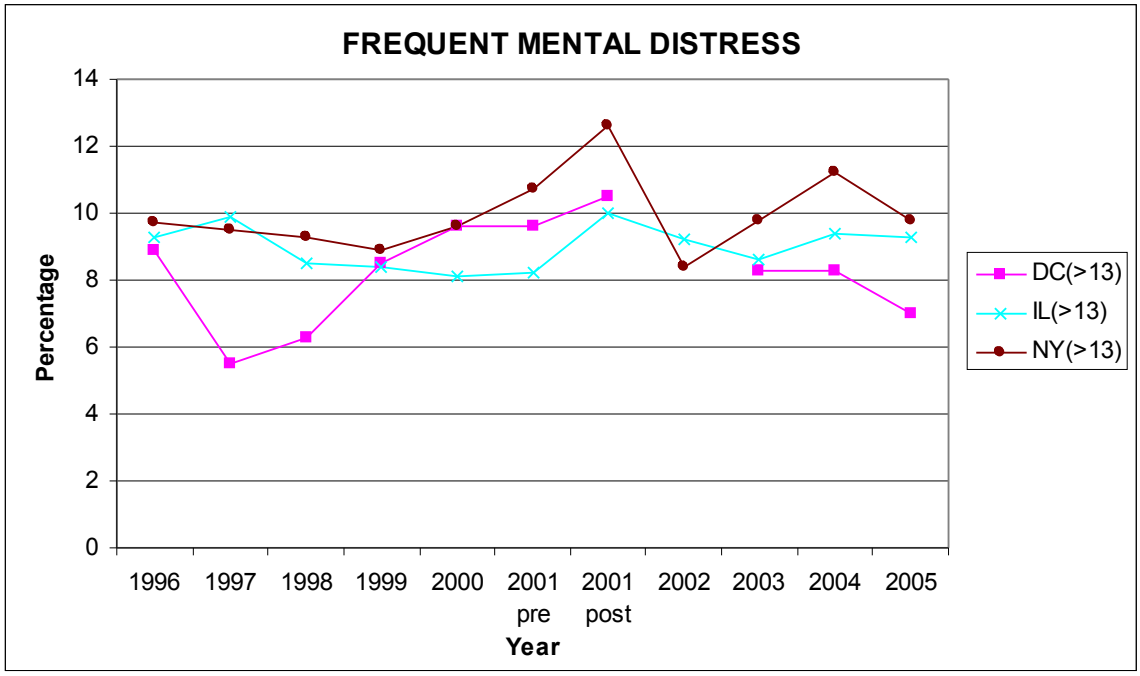

Fig. 9: Percentage of FMD among respondents in DC, IL and NY over 10 years.

Table 3: Chi square analysis and 95% Confidence Interval of FMD before9/11 and after 9/11.

	Before 9/11		P-value	After 9/11	
State	Frequent Mental Distress	95% CI		Frequent Mental Distress	95% CI
DC	7.1	6.99-7.2	0.002	8.1	7.99-8.2
IL	9.1	9.02-9.2	0.76	9.2	9.1-9.25
NY	9.6	9.5-9.67	0.001	10.4	10.35-10.45

Table 3 shows that there is an increase in the prevalence of FMD after the attacks in DC and NY. This increase is significant in DC and NY but for IL, the P-value is 0.76

which shows that the difference in the rate of FMD before and after the attacks is not statistically significant in IL.

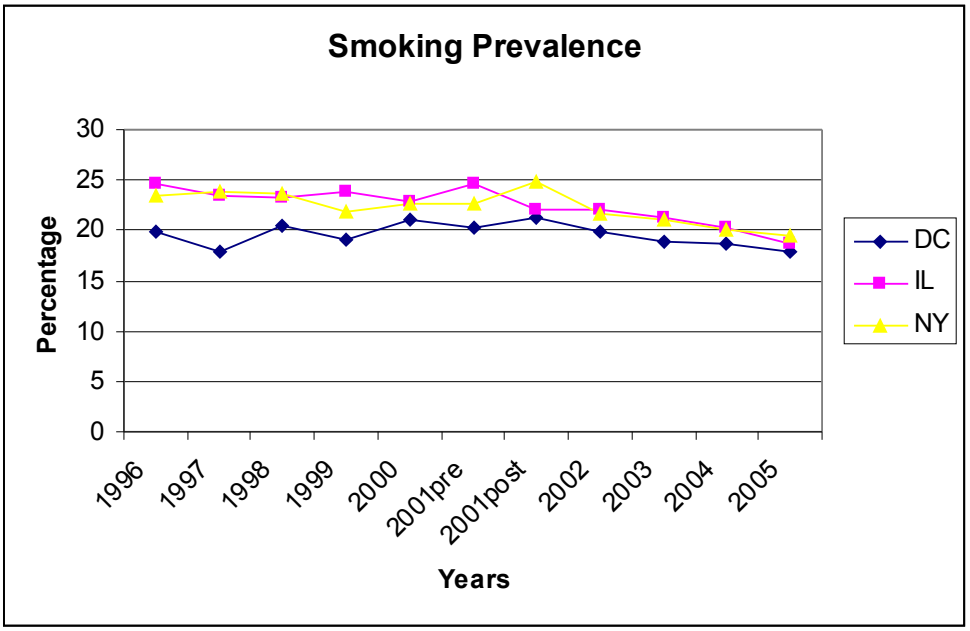

Fig. 10: The percentage of the current smokers for the three states (NY, DC and IL) over ten years.

Table 4 shows the chi square analysis of smoking before and after the 9/11 terrorist attacks. There is a significant decrease in the prevalence rate of smoking in NY and IL. The P-value is <0.001 for NY and IL which shows statistical significance in the smoking rate but in DC, since the P-value is greater than 0.05, the decrease in smoking rate is not statistically significant. The values of the 95% CI show that the difference in smoking rates before and after 9/11 is statistically significant in NY and DC since the CIs before and after 9/11 do not overlap; whereas, it is not statistically significant in IL because the CI before and after 9/11 are overlapping. Figure 10 shows that the prevalence

rate of smoking is decreasing and the change is seen in NY, DC, and IL. Over the period of ten years a gradual decline in the smoking rates in all jurisdictions is seen.

Table 4: Chi square analysis and 95% Confidence Interval of smoking before 9/11 and after 9/11.

	Before 9/11		P-value	After 9/11	
State	**Current Smoker**	**95% CI**		**Current Smoker**	**95% CI**
DC	19.5	19.39-19.6	0.1	18.7	18.59-18.8
IL	23.6	23.5-23.67	<0.001	20.7	20.6-20.7
NY	23.7	23.6-23.8	<0.001	20.3	20.2-20.4

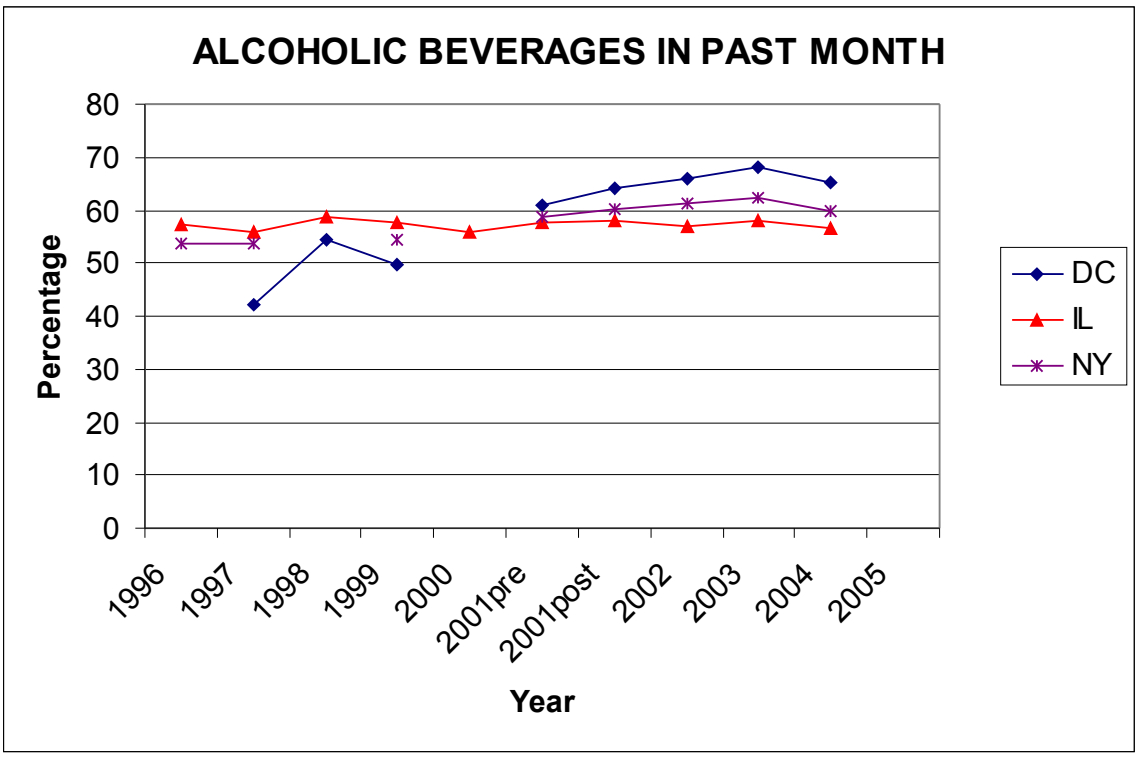

Fig. 11: The percentage of the respondents who had at least one drink in the past month over three states (DC, IL and NY) over ten years.

Fig 11 is the graphic representation of the prevalence rates of alcohol consumption, that is, at least one drink in the last 30 days. An increase is seen in the prevalence rates of alcohol consumption in DC and NY after the disaster, and the rates in IL remain almost the same. Table 5 shows the chi square analysis of drinking before the attacks and after the attacks. A significant increase is seen in alcohol consumption after the attacks. The increase in rate is greater in DC and NY compared to IL. The CIs of alcohol consumption before and after 9/11 do not overlap in NY and DC; therefore the increase in drinking rates is statistically significant. In IL, the confidence intervals of drinking rate before and after 9/11 are overlapping; hence the difference is not statistically significant. Chi square analysis does not show any difference in alcohol consumption between the individuals with FMD and the individuals who do not have FMD.

Table 5: Chi square analysis and 95% Confidence Interval of alcohol consumption in a month before 9/11 and after 9/11

	Before 9/11		**P-value**	**After 9/11**	
State	**At least One Drink in 30 days**	**95% CI**		**At least One Drink in 30 days**	**95% CI**
DC	48.2	48.1-48.3	<0.001	66.2	66-66.4
IL	57.2	57.1-57.3	0.9	57.2	57.07-57.3
NY	53.8	53.7-53.9	<0.001	61.1	60.9-60.2

Tables 6 and 7 show the association of smoking and alcohol respectively with mental health in DC, IL and NY. Table 6 shows the odds of being a smoker in relation to FMD and the results indicate that the odds of being a smoker are twice in individuals with FMD as compared to individuals who do not have FMD. The P-value and odds ratio with the 95% confidence interval for both the variables are shown in the table. The percentage of each variable is shown in two groups (FMD - yes and FMD - no). The mental health question was not asked in DC during year 2002; therefore 2002 was excluded from the analysis for DC. Questions regarding alcohol were not asked in DC in 1996 and 2000 and in NY in 1998 and 2000. Table 7 explains the odds of drinking in relation to FMD, and the odds ratios show no significant impact of FMD on drinking behavior between the individuals with FMD and the individuals with no FMD.

Table 6: Chi square and logistic regression analyses of association of smoking with FMD before 9/11 and after 9/11.

State	Prevalence of smoking in relation to FMD (%)		P-Value	OR	95% CI
	FMD(No)	FMD(Yes)			
Pre					
DC	18.3	36.5	<.001	2.56	2.3-2.8
IL	22	39.4	<.001	2.3	2.2-2.5
NY	22.3	36.1	<.001	1.9	1.8-2.1
Post					
DC	17.6	32	<.001	2.2	1.8-2.6
IL	19.2	35.2	<.001	2.3	2.03-2.6
NY	18.7	33.8	<.001	2.2	2.01-2.4

Reference is non-smokers

There is an overall decrease in prevalence of smoking, but the comparison of the smoking rates between the individuals with FMD and individuals who do not have FMD

shows that the prevalence of smoking is much higher among the individuals with FMD as compared to individuals who do not have FMD. The mean P-value of <0.001 shows that this difference is statistically significant. The odds ratio also suggests that the odds of smoking are much higher among respondents with FMD.

Table 7: Chi square and logistic regression analyses of association of drinking with FMD before 9/11 and after 9/11.

State	Prevalence of drinking in relation to FMD (%)		P-Value	OR	95% CI
	FMD(Yes)	FMD(No)			
Pre					
DC	48.5	56.4	<.001	0.73	0.64-0.83
IL	57.7	55.5	0.04	1.09	1.01-1.2
NY	54.8	53.2	0.05	1.06	0.99-1.14
Post					
DC	76	66.9	<.001	1.57	1.3-1.86
IL	66.5	64.5	0.16	1.09	0.96-1.24
NY	71.5	65	<.001	1.35	1.22-1.5

Reference is non-drinkers

Figures 12, 13, and 14 show the prevalence of mental distress by gender in NY, DC, and IL respectively. The rate of mental distress is higher among the female respondents in both states as compared to male respondents. This difference exists before and after the disaster. The increase in mental distress is also much higher among females than male respondents.

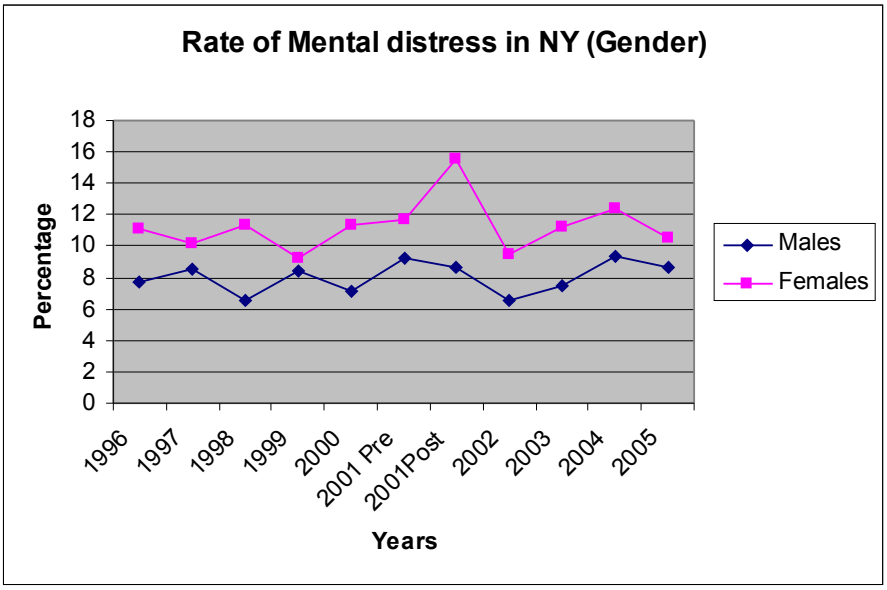

Fig. 12: Prevalence rate of Mental Distress in DC among male and female respondents.

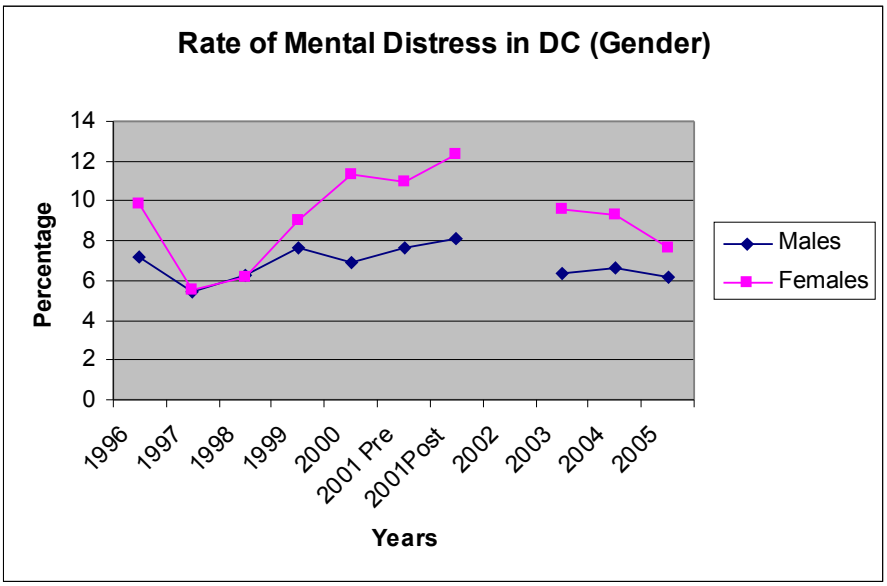

Fig. 13: Prevalence rate of Mental Distress in DC among male and female respondents.

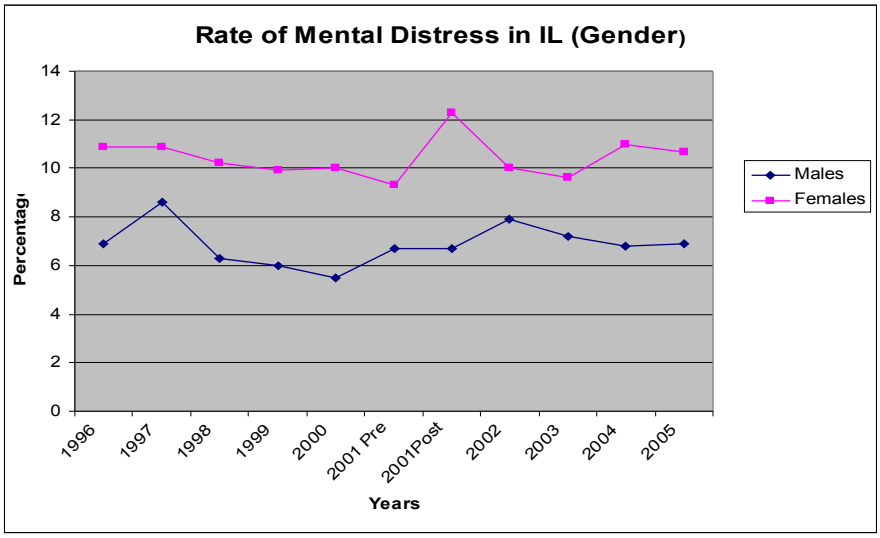

Fig. 14: Prevalence rate of Mental Distress in DC among male and female respondents.

Figure 15 shows the prevalence of distressed mental health among different age groups in NY. Prevalence rates were highest among the individuals with the age in range of 35-49 years, then 18-34 years, and then the older individuals. The rate of mental distress was least in individuals of age 65 years and more.

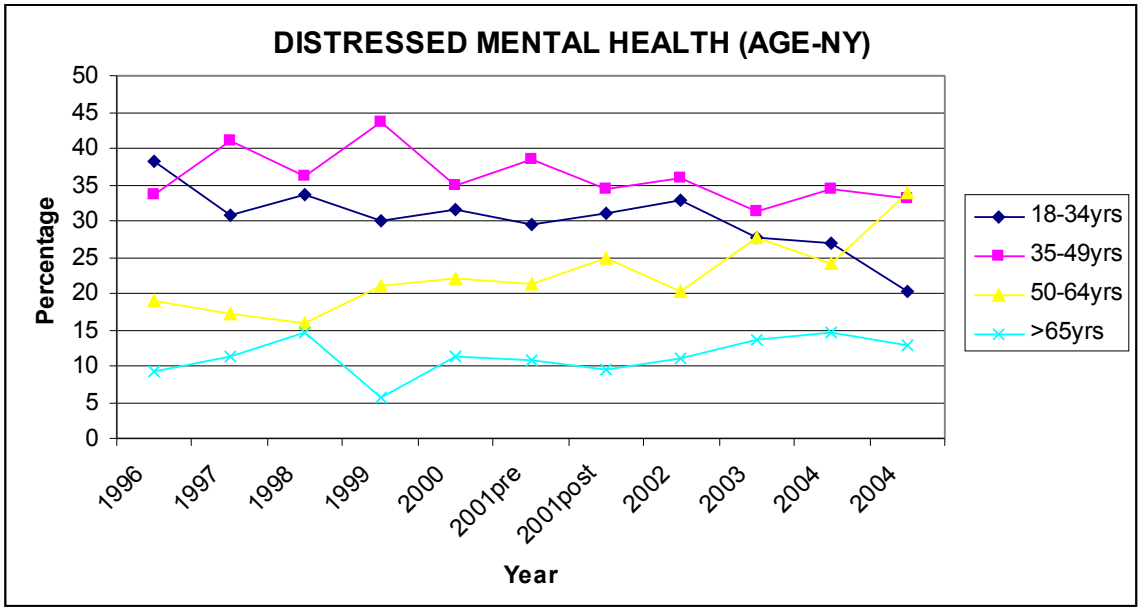

Fig. 15: Proportion of different age groups (18-34, 35-49, 50-64 and >65 years) among individuals with FMD.

CHAPTER 5

DISCUSSION

The mental health impact of disasters among survivors has been well documented, but the impact on individuals who are not directly affected by the disaster has not been thoroughly studied, particularly those living far from the disaster area. This study examines the prevalence rate of distressed mental health before and after the 9/11 terrorist attacks in populations close to the disaster area in comparison to the population far from the disaster area. Table 3 shows the chi square analysis of FMD before and after the attacks. In NY and DC, there was a significant increase in mental distress with a P-value of 0.001 and 0.002 for NY and DC respectively but there was no significant increase in the rate of FMD in IL.

5.1.1 Smoking and Mental Health

The study presented overall prevalence rates for smoking in the three states over the period of ten years. Smoking rates are seen to be decreasing over the years in the three states (NY, DC and IL). But the rate of smoking is much higher among FMD as compared to the individuals without FMD. The odds ratio for the smokers was 2.56 before the attacks and 2.2 after the attacks in DC, 1.9 before the attacks and 2.2 after the attacks in NY, and 2.3 before and 2.3 after the attacks for IL. Table 4 shows that the

prevalence rate of smoking from 1996 to 2001 before 9/11 was higher than the prevalence rate of smoking from 2001 after 9/11 to 2005. The decrease in NY and IL was statistically significant because the P-value is <0.001; whereas the decrease in DC was not statistically significant (P-value = 0.053). Although the overall rate of smoking did not increase after the disaster but the odds of smoking were higher among the individuals with FMD.

Prevalence rate of smoking over the period of ten years has been decreasing. This study did not find any effect of the attacks on smoking rates which is consistent with the findings of other studies [88]. Studies conducted on a national representative sample also suggest that there was no change in the prevalence rates of smoking after the disaster [88]. Some studies done after 9/11 showed that there was an increase in smoking after the attacks and an increase in smoking and alcohol consumption was associated with depression [49]. Most of the studies conducted after 9/11 regarding smoking and alcohol consumption included only New York City residents or Manhattan residents. Whereas, this study included residents of two disaster states and one control state. The results suggest that the rate of smoking is decreasing but it is higher among people with FMD.

5.1.2 Alcohol and Mental Health

Table 5 shows the results of chi square test of alcohol before and after the 9/11 attacks. There was an increase in prevalence rate of drinking in NY and DC, but the drinking rate did not change in IL. The increase in rate is highest in DC, then NY, and no change in rate was observed in IL. The P-value of drinking for NY and DC was <0.001 and 0.9 for IL; therefore the increase in DC and NY is significant. But the P value is not

significant in IL. Because the confidence intervals for DC and NY do not overlap, the difference in the increased rate is significant, but the confidence intervals for IL before and after 9/11 overlap indicating the difference is not statistically significant.

Increase in alcohol consumption in DC and NY is consistent with the findings of other studies which suggest that individuals living close to the disaster site tend to increase alcohol intake after the disasters as compared to the individuals living farther from the disaster site [49]. Logistic regression did not show any significant association of alcohol with mental health. Therefore the increase in the prevalence rate of drinking was not associated with mental health. Studies have shown that exposure to traumatic conditions is associated with an increase in alcohol consumption [60], but this study did not find any association between FMD and drinking.

5.1.3 Gender and Mental Health

The percentage of female respondents is higher in the three states in all the years as compared to the men in the BFRSS data. Chi square analysis shows no significant gender difference in the prevalence rate of FMD in reaction to the 9/11 attacks in the three states. Figure 8 also shows no change in FMD after the attacks, but FMD is much more prevalent among female respondents as compared to male respondents. The percentage of females in the individuals with FMD is 63.4% in DC, 69.7% in IL, and 59.1% in NY. The mean odds ratio of FMD among male respondents as compared to female respondents is 0.68 ± 0.12 in NY, 0.75 ± 0.15 in DC and 0.66 ± 0.06 in IL. This means that females have 32% greater odds in NY, 25% greater odds in DC, and 34% greater odds in IL of having FMD as compared to males. These finding are consistent

with the other studies which show that females are more likely to have depression than men [37].

5.1.4 Age and Mental Health

Results do not show any difference in FMD across different age groups before and after the 9/11 attacks, but the rate of FMD is different among different age groups. The mean odds ratio of FMD is 0.99 ±0.2, 0.9 ± 1.3 and 0.52± 0.12 in NY; 1.1 ± 0.24, 0.87 ± 0.2 and 0.8 ± 0.25 in DC; and 1.001 ± 0.12, 0.84 ± 0.08 and 0.5 ± 0.05 in IL for the age groups 35-49 years, 50-64 years and >65 years respectively. This shows that the overall rate of FMD is highest in the age group of 35-49 years, then 18-34 years, then 50-64 years, and the lowest rates are seen in >65 years. No difference in the reaction was found in the population living in the disaster area and the population far from the disaster area, but the differences in the prevalence rate of depression among different age groups were consistent in the three states. These results are very close to other studies which show that middle age men have greater prevalence of FMD than older individuals [77].

5.3 Limitations

The study found an increase in FMD in NY and DC after the 9/11 attacks, but this increase may be attributed to other events happening at that time. Many letters containing anthrax spores were sent to the offices of several news media organizations and two senators a few days after the 9/11 attacks. Five people were killed and 17 became infected that caused lot of panic, fear, and anxiety among the people nationwide [86]. This study did not focus on other reasons such as anthrax attacks, war, or economic

problems because of the lack of availability of data that comprehensively covers all the issues and aspects during the 9/11 attacks.

Another important aspect to be considered in massive scale disasters such as the 9/11 terrorist attacks is the impact of media exposure. There was immense media coverage of the event which exposed people all around the world to the catastrophe. Studies suggest that the degree of television watched after the event is positively associated with PTSD and depression [87].

The NY and DC were used to study the population close to the disaster and IL was included to study the population living farther from the disaster area. The Pentagon is located in Arlington, VA instead of DC. DC data was used because the Pentagon is very close to DC and had a great impact on the federal capital.

This study used the data of the New York state to proxy for the New York City, which was the main 9/11 terrorist site, since the data of the New York City was not explicitly available. The proxy approach introduces artificial bias in the study since a state can not summarize the response and behavior of one of its major city. Furthermore, lot of people working in the New York City commute from different parts of the New Jersey and Connecticut states, which are not surveyed as part of the New York City or state data.

Some other limitations of this study mainly related to the missing data or different variables/questions being asked over 10 years are:

1. Cross-sectional data design does not allow establishing causal relationship between mental health and the behaviors.

2. Mental health question was not asked in 2002 in BRFSS survey in DC, therefore analysis was not done for DC in 2002.
3. Random selection of respondents is done in BRFSS every year. So each year the respondents are different from the previous years. Ideally when studying a change, the questions should be asked from the same respondents every year.
4. BRFSS is a telephone survey so people who do not have telephone are not included in the study.

CHAPTER 6

CONCLUSIONS

This study found increased mental distress in NY and DC but no significant increase in mental distress was found in IL. Stress and depression after disasters are normal reactions of individuals to abnormal situations. Rates of smoking have been decreasing over the period of ten years. However, smoking was associated with distressed mental health. Consumption of alcohol in the disaster areas increased compared to the area farther from the disaster site. Gender differences were also found; females showed a much higher rate of frequent mental distress as compared to men. Smoking was not found to be associated with the disaster. Public health efforts should continue to further reduce the smoking rates. Steps should be taken to reduce the rate of alcohol and marijuana use.

In the future, more longitudinal studies should be conducted to examine the mental health impact of disasters. It is important to do longitudinal study in order to establish the causal relationship of mental health and risk behaviors such as smoking and alcohol consumption. People may use substance to cope with stressful situation after disaster. Once psychological problem has developed, substance use can aggravate the problem and can interfere with the resolution of the situation.

It is essential to assess the mental health needs after disasters to analyze which type of services should be delivered to the affectees. Most of the interventions regarding post-disaster mental health focus on PTSD, but other mental disorders should also be

addressed. Policy makers should focus not only on providing health care services but also on resolving the problems and getting people back to their normal routine. Physicians treating patients after a disaster must focus on their pre-disaster health history.

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APPENDICES

Chi square test and logistic regression of smoking, alcohol consumption, sex and age of DC respondents over ten years.

Year	Variable		Current smoker		At least one drink in past 30 days		Sex		Age			
			everyday	some day	yes	no	Male	Female	18-34	35-49	50-64	65>
1996	FMD%	Yes	18.6	81.4			39.3	60.7	37.2	27.7	17.6	17.5
		No	32.4	67.6			31.4	68.6	30.8	35.6	13.5	20.2
	P-Value		<0.001				<.001		<.001			
	OR		2.09	1			0.7	1	1	1.5	0.9	1.4
	95% CI		1.7-2.5				0.6-0.86			1.2-1.9	0.7-1.2	1.07-1.8
1997	FMD%	Yes	17	83	41.4	58.6	38.2	61.8	36	29.7	17.9	16.5
		No	34.1	65.9	56.1	43.9	37.8	62.2	46.9	32.1	11.1	9.9
	P-Value		<0.001		0.001		0.868		<.001			
	OR		2.5	1	1.8	1	0.98	1	1	0.8	0.5	0.5
	95% CI		2.04-3.1		1.48-2.2		0.8-1.2			0.65-1.04	0.34-0.66	0.32-0.65
1998	FMD%	Yes	19	81	54.3	45.7	37.4	62.6	35.1	25.8	19.9	19.1
		No	44.4	55.6	58.4	41.6	37.8	62.2	37.8	37.8	12.2	12.2
	P-Value		<0.001		0.089		0.887		<.001			
	OR		3.4	1	1.2	1	1.04	1	1	1.35	0.6	0.6
	95% CI		2.7-4.1		0.97-1.4		0.83-1.2			1.09-1.7	0.4-0.7	0.43-0.8
1999	FMD%	Yes	17.7	82.3	49.9	50.1	36.9	63.1	33.5	25.8	21.1	19.6
		No	35.8	64.2	47.7	52.3	32.7	67.3	31.1	31.1	20.8	17
	P-Value		<.001		0.663		0.393		0.669			
	OR		2.6	1	0.915	1	0.8	1	1	1.3	1.05	0.9
	95% CI		1.7-3.9		0.62-1.4		0.5-1.3			0.8-2.15	0.6-1.8	0.5-1.7
2000	FMD%	Yes	19.4	80.6			40.3	59.7	36.2	29	19.7	15
		No	34.4	65.6			28.4	71.6	36.4	31.5	18.5	13.6

	P-Value		<.001				0.003		0.894			
	OR		2.17	1			0.6	1	1	1.08	0.9	0.9
	95% CI		1.5-3.08				0.4-0.84			0.7-1.6	0.6-1.5	0.5-1.5
2001 (pre)	FMD%	Yes	19	81	62.2	37.8	42.7	57.3	30.3	30.6	21.1	18
		No	34.8	65.2	58	42	66.7	33.3	28.4	37.3	19.4	14.9
	P-Value		0.004		0.493		0.133		0.714			
	OR		2.3	1	0.84	1	0.67	1	1	1.3	0.98	0.8
	95% CI		1.3-3.8		0.5-1.4		0.4-1.1			0.7-2.4	0.5-2.05	0.4-1.9
2001 (post)	FMD%	Yes	19.3	80.7	64.7	35.3	42.6	57.4	34.3	28.4	24.2	13.1
		No	36.4	63.6	64.1	35.9	31.9	68.1	39.7	28.4	23.3	8.6
	P-Value		<.001		0.899		0.025		0.47			
	OR		2.39	1	0.97	1	0.63	1	1	0.87	0.83	0.57
	95% CI		1.6-3.6		0.65-1.45		0.42-0.9			0.54-1.4	0.5-1.4	0.3-1.2
2003	FMD%	Yes			69.3	30.7	42.5	57.5	30.2	29	24.1	16.7
		No			57.2	42.8	32.3	67.7	29.5	28.3	29.5	12.7
	P-Value				0.001		0.011		0.333			
	OR				0.59	1	0.65	1	1	1.01	1.2	0.7
	95% CI				0.43-0.82		0.46-0.9			0.6-1.5	0.8-1.9	0.45-1.3
2004	FMD%	Yes	17.8	82.2	66.1	33.9	39.7	60.3	28.9	27.9	26.1	17.1
		No	33.5	66.5	58.5	41.5	31.4	68.6	29.4	30.6	25.1	14.9
	P-Value		<.001		0.017		0.011		0.72			
	OR		2.3	1	0.72	1	0.7	1	1	1.08	0.9	0.85
	95% CI		1.65-3.3		0.55-0.945		0.5-0.9			0.76-1.5	0.6-1.36	0.5-1.3
2005	FMD%	Yes	17.4	82.6			40.6	59.4	25.2	28.8	27	19
		No	32.8	67.2			35.8	64.2	28	27.6	27.2	17.1
	P-Value		<.001				0.125		0.722			
	OR		2.3	1			0.8	1	1	0.86	0.9	0.8
	95% CI		1.7-3.08				0.6-1.06			0.6-1.2	0.64-1.3	0.5-1.2

Chi square test and logistic regression of smoking, alcohol consumption, sex and age of Illinois respondents over ten years.

Year	Variable		Current smoker		At least one drink in past 30 days		Sex		Age			
			everyday	some day	yes	no	Male	Female	18-34	35-49	50-64	65>
1996	FMD%	Yes	23.3	76.7	58	42	41.1	58.9	32.4	31.1	19.5	17
		No	36.6	63.4	53.8	46.2	29.7	70.3	28.2	38.3	20.3	13.2
	P-Value		<.001		0.035		<.001		<.001			
	OR		1.9	1	0.9	1	0.6	1	1	1.02	0.9	0.6
	95% CI		1.7-2.14		0.86-0.9		0.6-0.7			0.9-1.1	0.8-0.97	0.5-0.6
1997	FMD%	Yes	21	79	55.8	44.2	41	59	32.1	31.5	18.4	18
		No	44.4	55.6	58.1	41.9	34.9	65.1	32.7	39.1	19.4	8.8
	P-Value		<.001		0.248		<.001		<.001			
	OR		3.01	1	1.01	1	0.7	1	1	1.1	0.9	0.5
	95% CI		2.7-3.4		0.95-1.07		0.7-0.7			1.05-1.2	0.8-1.004	0.5-0.6
1998	FMD%	Yes	21.8	78.2	58.9	41.1	44	56	29.1	34.2	20	16.7
		No	37.7	62.3	57	43	31.6	68.4	31.1	36.1	22.5	10.2
	P-Value		<.001		0.354		<.001		<.001			
	OR		2.17	1	1.04	1	0.7	1	1	1.1	0.8	0.6
	95% CI		1.9-2.45		0.9-1.2		0.6-0.75			0.9-1.1	0.77-0.9	0.5-0.6
1999	FMD%	Yes	22.3	77.7	57.8	42.2	39.2	60.8	30.9	33.3	18.6	17.3
		No	39.8	60.2	55.8	44.2	27.2	72.8	32.3	40.9	17.2	9.5
	P-Value		<.001		0.672		<.001		0.008			
	OR		2.3	1	0.935	1	0.7	1	1	1.2	0.9	0.5
	95% CI		1.7-3.04		0.8-1.1		0.6-0.8			0.9-1.3	0.8-1.2	0.4-0.67

2000	FMD%	Yes	21.8	78.2	56.5	43.5	42.6	57.4	28.4	33.9	21.6	16.1
		No	34.2	65.8	51.8	48.2	28	72	30.9	34.2	21.5	13.4
	P-Value		<.001		0.244		<.001		0.566			
	OR		1.8	1	0.83	1	0.55	1	1	0.9	0.9	0.6
	95% CI		1.4-2.4		0.6-1.1		0.5-0.6			0.8-1.1	0.8-1.1	0.5-0.7
2001 (pre)	FMD%	Yes	21.1	78.9	58.5	41.5	41.7	58.3	27.8	30	23.4	18.8
		No	41.1	58.9	50.7	49.3	33.3	66.7	32	32	22.8	13.2
	P-Value		<.001		0.025		0.016		0.179			
	OR		2.6	1	0.8	1	0.7	1	1	1.1	0.9	0.6
	95% CI		1.9-3.5		0.7-0.9		0.6-0.8			0.8-1.3	0.7-1.2	0.5-0.7
2001 (post)	FMD%	Yes	23.1	76.9	57.9	42.1	42.5	57.5	28.3	30.5	22.7	18.5
		No	40.5	59.5	58.5	41.5	27.5	72.5	36.2	28.5	20.8	14.6
	P-Value		<.001		0.91		0.001		0.286			
	OR		2.3	1	0.75	1	0.56	1	1	0.87	0.87	0.5
	95% CI		1.56-3.3		0.6-0.9		0.5-0.7			0.7-1.08	0.7-1.09	0.4-0.7
2002	FMD%	Yes	21	79	57.7	42.3	40.1	59.9	26.5	33.2	22.4	17.9
		No	37.4	62.6	53.6	46.4	34	66	27.7	42.6	18.3	11.5
	P-Value		<.001		0.239		0.07		0.007			
	OR		2.2	1	0.8	1	0.7	1	1	1.02	0.7	0.5
	95% CI		1.7-2.9		0.6-0.9		0.6-0.8			0.8-1.2	0.5-0.9	0.4-0.7
2003	FMD%	Yes	20.7	79.3	58.5	41.5	39.6	60.4	24.4	32	24.1	19.5
		No	34.7	65.3	55	45	32.4	67.6	30	32.9	25.8	11.3
	P-Value		<.001		0.147		0.003		<.001			
	OR		2.03	1	0.8	1	0.7	1	1	0.8	0.8	0.5
	95% CI		1.6-2.5		0.7-0.9		0.6-0.77			0.75-0.98	0.7-0.98	0.4-0.6
2004	FMD%	Yes	18.7	81.3	56.6	43.4	39.4	60.6	22	30.7	24.9	22.3
		No	34.1	65.9	57	43	27.9	72.1	27.2	34.9	24.5	13.3
	P-Value		<.001		0.899		<.001		<.001			
	OR		2.2	1	0.8	1	0.67	1	1	0.9	0.7	0.5

	95% CI		1.8-2.8		0.7-0.9	0.6-0.75			0.8-1.04	0.7-0.88	0.4-0.55
	FMD%	Yes	17.1	82.9		37.9	62.1	19	30.2	26.2	24.5
		No	35.1	64.9		27.2	72.8	21.6	36.8	29.1	12.4
	P-Value		<.001			<.001		<.001			
	OR		2.6	1		0.7	1	1	1.01	0.9	0.5
2005	95% CI		2.1-3.2			0.6-0.75			0.9-1.1	0.8-1.1	0.4-0.5

Chi square test and logistic regression of smoking, alcohol consumption, sex and age of NY respondents over ten years.

			Current smoker		At least one drink in past 30 days		Sex		Age			
Year	Variable		everyday	some day	yes	no	Male	Female	18-34	35-49	50-64	65>
	FMD%	Yes	22.6	77.4	54.2	45.8	41.5	58.5	31.7	33.1	18	17.2
		No	32.8	67.2	53.2	46.8	32.3	67.7	38.1	33.7	18.9	9.3
	P-Value		<.001		0.389		<.001		<.001			
	OR		1.6	1	0.9	1	0.67	1	1	0.8	0.87	0.45
1996	95% CI		1.5-1.8		0.87-1.05		0.6-0.7			0.76-0.9	0.77-0.9	0.4-0.5
	FMD%	Yes	22.4	77.6	55	45	40.6	59.4	30.7	33.6	18	17.6
		No	39.2	60.8	45	47.5	36	64	30.7	40.9	17.3	11.2
	P-Value		<.001		0.068		<.001		<.001			
	OR		2.3	1	0.9	1	0.8	1	1	1.2	0.9	0.6
1997	95% CI		2-2.5		0.8-1.007		0.7-0.9			1.07-1.3	0.8-1.1	0.5-0.76
	FMD%	Yes	22.4	77.6			43.1	56.9	31	32	18.5	18.6
		No	36.2	63.8			29.6	70.4	33.5	36.1	15.9	14.5
	P-Value		<.001				<.001		<.001			
	OR		1.9	1			0.55	1	1	1.04	0.8	0.7
1998	95% CI		1.7-2.2				0.5-0.6			0.9-1.2	0.65-0.9	0.6-0.8

1999	FMD%	Yes	20.4	79.6	54.4	45.6	40.3	59.7	30.6	30.8	20.8	17.7
		No	40.3	59.7	55.8	44.2	38.1	61.9	30	43.5	20.9	5.7
	P-Value		<.001		0.682		0.518		<.001			
	OR		2.6	1	1.1	1	0.9	1	1	1.4	1.02	0.3
	95% CI		1.9-3.5		0.8-1.4		0.7-1.2			1.04-1.9	0.7-1.5	0.2-0.6
2000	FMD%	Yes	20.9	79.1			41.1	58.9	29.5	33.8	20.2	16.5
		No	38.2	61.8			29.6	70.4	31.5	35	22.1	11.4
	P-Value		<.001				<.001		0.126			
	OR		2.3	1			0.6	1	1	0.97	1.02	0.64
	95% CI		1.8-2.9				0.5-0.7			0.7-1.3	0.7-1.4	0.4-0.96
2001 (pre)	FMD%	Yes	23.5	76.5	59.6	40.4	41.4	58.6	30.3	31.8	21.1	16.9
		No	36	64	55.3	44.7	34.9	65.1	29.4	38.5	21.4	10.7
	P-Value		<.001		0.19		0.047		0.037			
	OR		1.8	1	0.8	1	0.7	1	1	1.25	1.05	0.65
	95% CI		1.4-2.4		0.64-1.09		0.6-0.9			0.9-1.7	0.7-1.5	0.41-1.04
2001 (post)	FMD%	Yes	20.7	79.3	62.5	37.5	44.7	55.3	27.2	34.4	22.9	15.5
		No	32.2	67.8	46.7	53.3	29.5	70.5	31.1	34.4	25	9.4
	P-Value		<.001		<.001		<.001		0.169			
	OR		1.8	1	0.5	1	0.5	1	1	0.87	0.95	0.5
	95% CI		1.3-2.5		0.4-0.7		0.4-0.7			0.6-1.3	0.63-1.5	0.3-0.95
2002	FMD%	Yes	20.3	79.7	62.4	37.6	39.9	60.1	26	31.4	23.3	19.3
		No	35.4	64.6	55.3	44.7	30.7	69.3	32.9	36	20.2	11
	P-Value		<.001		0.009		0.001		<.001			
	OR		2.2	1	0.75	1	0.67	1	1	0.9	0.7	0.45
	95% CI		1.7-2.7		0.6-0.9		0.5-0.8			0.7-1.2	0.5-0.9	0.3-0.65
2003	FMD%	Yes	19.9	80.1	63.1	36.9	40.2	59.8	23.2	30.5	25.7	20.6
		No	33.7	66.3	60.7	39.3	30	70	27.6	31.2	27.6	13.6
	P-Value		<.001		0.261		<.001		0.001			
	OR		2.05	1	0.9	1	0.6	1	1	0.85	0.9	0.55
	95% CI		1.7-2.5		0.75-1.08		0.5-0.7			0.7-1.1	0.7-1.1	0.4-0.74

	FMD%	Yes	18.2	81.8	60.9	39.1	38.6	61.4	20.1	30.9	26.4	22.7
		No	35	65	53.3	46.7	31.1	68.9	27	34.3	24	14.7
	P-Value		<.001		<.001		<.001		<.001			
	OR		2.4	1	0.7	1	0.7	1	1	0.8	0.67	0.5
2004	95% CI		2.03-2.8		0.6-0.86		0.6-0.8			0.66-1.02	0.5-0.85	0.4-0.63
	FMD%	Yes	18	82			38.2	61.8	17.2	30.5	27.4	24.9
		No	33.1	66.9			33.3	66.7	20.3	33.1	33.9	12.7
	P-Value		<.001				0.009		<.001			
	OR		2.25	1			0.8	1	1	0.9	1.04	0.4
2005	95% CI		1.9-2.6				0.7-0.9			0.74-1.1	0.84-1.3	0.33-0.56