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The Mental Health Impacts of Disasters

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The Mental Health Impacts of Disasters

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Section I. Introduction

Disasters are events which produce such material and human losses that the resources of the community are overwhelmed and consequently the usual social mechanisms to cope with emergencies are insufficient, local resources are overwhelmed, and national or even international assistance is required.

Disasters can be dichotomised into natural disasters and man-made disasters. The research literature on the mental health consequences of natural disasters covers earthquakes and tsunamis, hurricanes, cyclones and floods. Man-made disasters of a similar scale to natural disasters include oil spills, nuclear accidents and factory explosions.

This brief review examines the mental health consequences of disasters, in terms of epidemiology and use of mental health services, identifies methodological problems arising in the existing studies and suggests key priorities for further research.

Five specific disasters have been selected to provide an illustrative context for this review on the basis of:

- **Availability of published research** focusing on the psychiatric morbidity of those in the disaster area;
- **Type of disaster:** tsunami, hurricane, oil spill, nuclear accident, factory explosion;
- **Size of affected area:** the affected population must be large enough for epidemiological research to have been carried out;
- **When it took place:** the ability to look at short term and long term consequences of the disaster via cross-sectional and longitudinal studies;
- **Degree of displacement:** whether those affected stayed, were relocated to another area, region or country.

The five selected disasters are:

1. The Gulf of Mexico oil spill: 20 April 2010
2. Hurricane Katrina: 29 August 2005
3. The Indian Ocean tsunami: 26 December 2004
4. Enschede fireworks disaster 13 May 2000
5. Chernobyl disaster: 26 April 1986

This review will start with a brief description of the five selected disasters (Section 2) followed by a section focusing on the psychiatric morbidity of the populations affected by them (Section 3). The post-disaster studies encompass adults and children, locals and tourists, displaced persons and those who stayed in the disaster zone. The environmental, ecological, economic and socially disruptive effects of disasters will only be described to contextualise the disaster-mental health relationship or as potential mediators or moderators in the causal pathway.

Results from all studies have to be treated with caution owing to the numerous methodological difficulties in: creating sample frames, applying a robust sampling method, and achieving a suitable sample size as well as the choice of measurement instruments and the practicalities of data collection (Section 4). Our discussion raises generic methodological and research issues highlighted by these case studies, but of course further problems may be raised when other studies are included in such a review. In addition, it is important to recognise that the 5 disasters selected as case examples represent different magnitudes of societal impact and, as yet, there are no standardised criteria for exposure to such hazards for individual victims.

In Section 5, we briefly look at the evidence of how health services have coped with the mental health consequences of disasters as well as the willingness of those affected by the disaster to seek assistance for mental health problems.

In Section 6, we make recommendations for future research.

Section 2. The five selected disasters

Indian Ocean tsunami: 26 December 2004

The 2004 Indian Ocean earthquake and tsunami occurred on Sunday, 26 December 2004, with its epicentre off the west coast of Sumatra, Indonesia. Although the earthquake is known as the Sumatra–Andaman earthquake, the resulting tsunami is referred to as the 2004 Indian Ocean tsunami, the South Asian tsunami, Indonesian tsunami, and the Boxing Day tsunami.

The earthquake triggered a series of devastating tsunamis along the coasts of most landmasses bordering the Indian Ocean, killing approximately 280,000 people in fourteen countries, and inundating coastal communities with waves up to 30 meters high (BBC News, 25 January 2005) Indonesia was the hardest-hit country, followed by Sri Lanka, India, and Thailand.

The tsunami caused serious damage and deaths as far as the east coast of Africa. Relief agencies reported that one-third of the dead appear to be children. This is a result of the high proportion of children in the populations of many of the affected regions and because children were the least able to resist being overcome by the surging waters. Oxfam went on to report that as many as four times more women than men were killed in some regions, and suggested this was because the women were waiting on the beach for the fishermen to return and looking after their children in the houses (BBC News 26 March 2005).

In an addition to the large number of local residents, up to 9,000 foreign tourists (mostly Europeans) enjoying the peak holiday travel season were among the dead or missing, mostly residents of Sweden and Norway.

The Gulf of Mexico oil spill: 20 April 2010

The oil spill in the Gulf of Mexico which started on 20 April 2010 continued unabated for 3 months. It is also known as the Deepwater Horizon oil spill, the BP oil disaster, or the Macondo blowout. It is regarded as the largest accidental marine oil spill in the history of the petroleum industry, 20 times greater than the Exxon Valdez oil spill (New York Times, 15 August 2010)

On July 15, 2010, the leak was stopped by capping the gushing wellhead after it had released about 4.9 million barrels of crude oil. An estimated 53,000 barrels per day escaped from the

well before it was capped. (New York Times, 12 August 2010) The explosion killed 11 men working on the platform and injured 17 others (USA Today, 26 May 2010)

Hurricane Katrina: 29 August 2005

Hurricane Katrina was the deadliest and most destructive Atlantic hurricane of the 2005 Atlantic hurricane season. At least 1,836 people died in the actual hurricane and in the subsequent floods. Hurricane Katrina formed over the Bahamas on 23 August, 2005 and crossed southern Florida as a moderate Category 1 hurricane, causing some deaths and flooding there before strengthening rapidly in the Gulf of Mexico. The storm weakened before making its second landfall as a Category 3 storm on the morning of Monday, 29 August in southeast Louisiana.

Hurricane Katrina caused severe destruction along the Gulf coast from central Florida to Texas, much of it due to the storm surge. The most significant number of deaths occurred in New Orleans, Louisiana, which flooded as the levee system failed, in many cases hours after the storm had moved inland. Eventually 80% of the city and large tracts of neighboring parishes became flooded.

Katrina caused over one million people from the central Gulf coast to be displaced elsewhere across the United States. The term “diaspora” has been used to describe this displaced population from Hurricane Katrina in the United States. Houston, Texas, had an increase of 35,000 people; Mobile, Alabama, gained over 24,000; Baton Rouge, Louisiana, over 15,000; and Hammond, Louisiana received over 10,000, nearly doubling its size. Chicago received over 6,000 people, the most of any non-southern city. By late January 2006, about 200,000 people were once again living in New Orleans, less than half of the pre-storm population.

Chernobyl disaster: 26 April 1986

The Chernobyl disaster was a catastrophic nuclear accident that occurred on 26 April 1986 at the Chernobyl Nuclear Power Plant in Ukraine. An explosion and fire released large quantities of radioactive contamination into the atmosphere, which spread over much of Western USSR and Europe. It is widely considered to have been the worst nuclear power plant accident in history, and is one of only two classified as a level 7 event on the International Nuclear Event Scale (the other being the Fukushima Daiichi nuclear disaster).

The radioactive fire burned for 10 days releasing 190 tons of toxic materials into the atmosphere. The wind blew 70% of the radioactive material into Belarus. The explosion caused the displacement of over 200 000 people, and instantly killing a further 54 residents and emergency workers.

Enschede fireworks disaster 13 May 2000

The Enschede fireworks disaster was a catastrophic fireworks explosion occurring at the SE Fireworks depot on 13 May 2000, in the eastern Dutch city of Enschede. The fire led to an enormous explosion which killed 23 and injured 947 people. The first explosion had a strength in the order of 800 kg TNT equivalence, while the strength of the final explosion was within the range of 4000-5000 kg TNT. The biggest blast was felt up to 30 kilometres from the scene.

A 40 hectare area around the warehouse was destroyed by the blast. Around 400 houses were destroyed, 15 streets incinerated and a total of 1,500 homes were damaged, leaving 1,250 people homeless – essentially obliterating the neighborhood of Roombeek. Ten thousand residents were evacuated.

Section 3. Psychiatric morbidity arising from disasters

Overview

*Mental health problems are prevalent in all countries and so are a major public health issue before any disaster arises. On average, in the absence of any major disasters, adult populations have around 10-15% with common mental disorders (largely depression and anxiety), 0.5-1% psychosis and a variable prevalence of alcohol and substance abuse depending on local availability and culture, while child and adolescent populations have around 10% of mental disorders at any one time. (Jenkins *et al* 2009).*

*The most common mental health consequences of disasters are increased rates of depression, anxiety, post-traumatic stress disorder, and medically unexplained somatic symptoms. The excess morbidity rate of psychiatric disorders in the first year after a disaster is in the order of 20% (Bromet *et al.*, 2012). Increases in suicidal behaviour are also associated with disasters. The risk of a suicide attempt is higher among those with current psychiatric morbidity, a past history of psychiatric illness, suicidal ideation and plans, and living with inadequate support (Kar, 2010). There is also evidence of increased domestic violence and substance abuse after disasters. (Goldstein, Osofsky & Lichtveld, 2011)*

*Morbidity is also influenced by pre-existing contextual issues, for example, the pre-existing conflict and ethnic tension, poverty, rigorous way of life, scarce health care and previous high rates of illness influenced the psychiatric morbidity in the Kashmir region of Pakistan before the 2005 earthquake, and so the earthquake generated a rate of illness over and above the already high baseline rate (eg Mumford *et al* 1996). Negative changes in a person's life circumstances following a disaster appear to have as important an effect on psychopathology as much as the direct experience of the disaster (Irmansyah *et al*, 2010).*

*Geographic displacement caused by the disaster can aggravate the psychological responses to the disaster, especially in women. Thus, in displaced populations, studies have found higher levels of panic disorder, unspecified anxiety disorder and somatic complaints in displaced women compared to the non-displaced population, and significant gender differences.(Viswanath *et al*, 2011). The three psychological processes of attachment, familiarity, and place identity are threatened by post disaster displacement, and problems of*

disorientation and alienation may ensue (Fullilove, 1996). This may help to explain some ethnic differences where religious or culturally held values are of importance (Laditka, Murray & Laditka, 2010).

Losses of personal, social, and material resources resulting from traumatic events significantly contribute to psychopathology. The loss of social support, physical health, and personal property significantly affect psychological distress over and above the effect of pre-disaster psychological functioning and disaster exposure. (Zweibach, Rhodes & Roemar, 2010) Negative changes in a person's life circumstances following a disaster appear to have as important an effect on psychopathology as the direct experience of the disaster (Irmansyah *et al*, 2010). Nevertheless, gains of such resources have been shown to have protective effects on post-trauma mental health. (Zweibach, Rhodes & Roemar, 2010). Disasters in developing countries and those associated with substantial community destruction are associated with worse outcomes. (Davidson & McFarlane, 2006). The level of exposure to a disaster has a direct impact on survivors' mental well-being (Milligan & McGuinness, 2009, Davidson & McFarlane, 2006)

Indian Ocean tsunami, 2004

Many of the epidemiological surveys which have been conducted on survivors of the Indian Ocean tsunami of 2004 have focussed on the tourists who were affected by the tsunami. European countries and most notably the Nordic countries have an established infrastructure to carry out a programme of ad hoc surveys, the results of which are published in academic journals. Nevertheless, a few surveys on survivors who were living in the affected area have been conducted.

A study of the indigenous population

In Thailand, the Ministry of Health in collaboration with the US Center for Disease Control and Prevention conducted a mental health survey utilising a multistage, clustered sample design in February 2005 on random samples of 371 displaced and 322 non-displaced persons in Phang Nga province and 368 non-displaced persons in the provinces of Krabi and Phuket.

Anxiety symptoms were reported by 37% of the displaced and 30% of the nondisplaced population in Phang Nga and 22% of non-displaced persons in Krabi and Phuket. Symptoms of depression were reported by 30% of displaced and 21% of non-displaced persons in Phang Nga and 10% of non-displaced persons in Krabi and Phuket. PTSD symptoms were less

prevalent than anxiety or depression; reported by 12% of displaced and 7% of non-displaced persons in Phang Nga and 3% of nondisplaced persons in Krabi and Phuket.

The loss of livelihood of the tsunami survivors was independently and significantly associated with all three mental health outcomes (symptoms of anxiety, depression and PTSD). In a 9-month follow-up survey prevalence rates of symptoms of anxiety, depression and PTSD among displaced persons decreased to 25%, 17%, and 7% respectively, and among non-displaced persons, prevalence rates fell to 26%, 14% and 2% (van Griensven *et al*, 2006).

Survivors of the tsunami from the Nordic countries

In a cross-sectional study, 1505 Swedish tourists who survived the tsunami were interviewed 14 months later. Different types of exposure during the disaster were associated with a higher risk for reporting of physical symptoms. Physical symptoms showed significant correlations with psychological symptoms (Keskinen-Rosenqvist *et al*, 2011).

Mental health problems have also been reported in a sample of Swedes who lost a relative in the 2004 tsunami. The psychiatric morbidity of 345 adults who lost a close relative in the tsunami, but who were themselves not present, were compared with 141 people who not only lost a relative, but also were themselves exposed to the tsunami two years later. Exposure to the tsunami was associated with prolonged grief, posttraumatic stress reactions and doubled the risk for impaired mental health. Loss of children increased the risk for prolonged grief for both women and men. (Johannesson *et al.*, 2011)

The mental health of 63 Norwegian tourists who survived the 2004 tsunami in Thailand was assessed two and a half years later. The most prevalent disorders were specific phobia (30%), agoraphobia (18%), social anxiety disorder (11%), PTSD (11%), major depressive disorder (11%), and dysthymic disorder (11%). In 24 of the 40 respondents with a current psychiatric disorder, symptoms had originated after the tsunami. This small study supports the findings from larger studies that psychiatric disorders such as anxiety and depressive disorders are the most common consequence of disasters, and that PTSD only forms a relatively small proportion of the total, when considering long-term mental health effect of disasters. (Hussain *et al*, 2011).

Children

Earthquakes may increase the risk for psychopathology in children because the disaster may disrupt family functioning through causing psychopathology in the parents or disrupting social network through migration, school changes, or socioeconomic status changes caused by the job losses of the parents (Kiliç *et al*, 2011).

Regretfully, some studies use instruments which focus purely on PTSD rather than conducting a comprehensive assessment of all psychopathology. Such studies supply high prevalence figures for PTSD, but we do not know what proportion of these would have been reclassified as depression and anxiety had a more comprehensive assessment been used (see next chapter for a fuller discussion of this problem).

The mental health problems in 133 Norwegian children and adolescents (ages 6-17) exposed to the tsunami were assessed 10 months after the tsunami using the UCLA PTSD Reaction Index, and 104 were interviewed again 2.5 years after the tsunami. Confirmatory factor analyses supported the theory of a four-factor model of intrusion, active avoidance, numbing, and arousal. The factors of intrusion and active avoidance were highly correlated 2.5 years after the tsunami. General mental health problems were highly related to arousal at both assessments, supporting the theory that some symptoms of posttraumatic stress reactions overlap with other, concurrent mental problems. (Nygaard, *et al.*, 2012).

Elderly

How do the elderly cope with a disaster compared with other groups of the population? One study reported that the geriatric sample had greater levels of adjustment disorder than the non-geriatric group. The two groups also differed in terms of displacement as the elderly preferred to stay in their own locality. A comparison between displaced geriatric and non-geriatric groups showed that major depression was less common in the geriatric sample. However, in the non-displaced group, geriatric subgroup showed a higher incidence of posttraumatic stress disorder. Within the geriatric sample, there were higher levels of adjustment disorder in the non-displaced group whereas the displaced group suffered more depressive episodes and unspecified anxiety disorders (Viswanath *et al.*, 2012).

Hurricane Katrina

A representative sample of 1077 displaced or greatly affected households was drawn in 2006 using a stratified cluster sampling of federally subsidized emergency housing settings in Louisiana and Mississippi, and of Mississippi census tracts designated as having experienced major damage from Hurricane Katrina. Two rounds of data collection were conducted: a baseline face-to-face interview at 6 to 12 months post-Katrina, and a telephone follow-up at 20 to 23 months after the disaster. More than half of the cohort at both baseline and follow-up reported significant mental health distress, measured using the Medical Outcome Study Short Form 12, version 2 mental component summary score. Self-reported poor health and safety concerns were persistently associated with poorer mental health. Nearly 2 years after the

disaster, the greatest predictors of poor mental health included situational characteristics such as greater numbers of children in the household and attitudinal characteristics such as fatalistic sentiments and poor self-efficacy. Informal social support networks were associated significantly with better mental health status (Abramson *et al*, 2008).

Socio-economic factors

However, housing and economic factors have been reported as key factors in post Katrina psychological distress among low income families. A longitudinal survey of 532 low-income mothers from New Orleans was conducted approximately one year before, 7-19 months after, and 43-54 months after Hurricane Katrina. Although post-traumatic stress symptoms did decline over time after the hurricane, it was nonetheless still relatively high 43-54 months later. Psychological distress overall also declined, but did not return to pre-hurricane levels. At both time periods, psychological distress before the hurricane, hurricane-related home damage, and exposure to traumatic events were associated with post-traumatic stress symptoms. Hurricane-related home damage and traumatic events were associated with post-traumatic stress symptoms without psychological distress. Home damage was an especially important predictor (Paxson, Fussell, Rhodes & Waters; 2012).

In a study of 113 adult Vietnamese Katrina survivors from New Orleans, financial strain was the strongest risk factor for post-traumatic stress symptoms, and physical and mental health post-disaster, while social support was a strong protective factor for health. Less-acculturated individuals also reported higher levels of PTSD symptoms and poorer physical health. (Chen *et al*, 2007).

However not all longitudinal studies show decline in post traumatic stress symptoms several years after the Hurricane Katrina. Kessler *et al* (2008) reported increases in the prevalence of PTSD, serious mental illness (SMI), suicidal ideation and suicide plans in certain groups. The increases in PTSD-SMI were confined to respondents not from the New Orleans Metropolitan Area, while the increases in suicidal ideation-plans occurred both in the New Orleans sub-sample and in the remainder of the sample. Unresolved hurricane-related stresses accounted for large proportions of the increases (Kessler *et al*, 2008).

A survey of displaced New Orleans, LA, residents in the fall of 2006, 1 year after Hurricane Katrina found high rates of mental illness and major disparities in mental illness by race, education, and income. Severe damage to or destruction of an individual's home was a major covariate of mental illness. The prevalence of mental illness remained high in the year following Hurricane Katrina, in contrast to the pattern found after other disasters. Economic losses and

displacement may account for this finding as well as the disparity in mental illness between Blacks and Whites. (Sastry & VanLandingham, 2009)

Ethnicity

African American women were more likely than others to report that the hurricane experience produced mental health disorders and stress, disrupted social relationships, and strengthened faith and appreciation of families. African American women emphasized the need to preserve cultural memories (Laditka, 2010)

Children and young people

The prevalence of serious emotional disturbance among youths exposed to Hurricane Katrina remained significantly elevated several years after the storm. Youths with high stress exposure had the highest risk of long-term hurricane-related social and emotional disturbances (McLaughlin *et al*, 2010)

Resilience

Post Katrina, resilience was most likely among White women, older women, and women who had a partner. A greater experience of the storm, particularly injury/illness or danger, was associated with lower resilience (Harville *et al.*, 2010). PTSD was measured using the PTSD checklist, a commonly used, 17-item inventory of PTSD-like symptoms, with response alternatives ranging from 1 (not at all) to 5 (extremely) ;Weathers, Ruscio, & Keane, 1999; Weathers, Litz, Herman, Huska, & Keane, 1993). Using a 5-point scale, respondents indicate how much they are bothered by each PTSD symptom in the past month. PTSD resilience was operationalized as not more than one symptom of PTSD, with a symptom defined as reporting “moderately” to one of the symptoms.

Oil spill in Gulf of Mexico

Many communities affected by the Gulf oil spill were still recovering from Hurricane Katrina at the time of the spill. Potential health consequences of oil spills fall into four categories: those related to worker safety; toxicologic effects in workers, visitors, and ecosystem effects that have consequences for human health and community members, and mental health effects from social and economic disruption, which are of particular concern in the Gulf. (Goldstein, Osofsky & Lichtveld, 2011).

The results from the Gulf oil spill studies can be compared with the post Exxon Valdez oil spill, The 12 month prevalence of generalized anxiety disorder and PTSD for communities with all degrees of exposure was 20.2% and 9.4%, respectively. The prevalence of respondents with

depression (with CES-D Scale scores above 16 and 18) was 16.6% and 14.2%, respectively. When compared with the unexposed group, members of the high-exposure group were 3.6 times as likely to have generalized anxiety disorder, 2.9 times as likely to have PTSD, 1.8 times as likely to have a CES-D Scale score of 16 and above, and 2.1 times as likely to have a CES-D Scale score of 18 and above. Women exposed to this event were particularly vulnerable to these conditions, and Alaska Natives were particularly vulnerable to depressive symptoms after the oil spill (Palikas *et al*, 1993).

Resilience

A survey of 452 residents of areas of south-eastern Louisiana affected by the Deepwater Horizon oil spill in the Gulf of Mexico was designed to assess their mental health post disaster. The greatest effect on mental health related to the extent of disruption to participants' lives, work, family, and social engagement, with increased symptoms of anxiety, depression, and posttraumatic stress. Conversely, the ability to rebound after adversity and place satisfaction were highly associated with better mental health outcomes (Osofsky, Osofsky & Hansel, 2011).

Grattan *et al* (2011) sought to determine the acute level of distress (depression, anxiety), mechanisms of adjustment (coping and resilience, unfortunately undefined in the paper), and perceived risk in a community indirectly impacted by the oil spill and to identify the extent to which economic loss may explain these factors in 47 participants who reported income stability compared with 47 individuals with spill-related income loss. Although residents of both communities displayed clinically significant depression and anxiety, relative to those with stable incomes, participants with spill-related income loss had significantly worse scores on tension/anxiety, depression, fatigue, confusion, and total mood disturbance scales; had higher rates of depression; were less resilient; and were more likely to use behavioural disengagement as a coping strategy.

Chernobyl nuclear disaster

In a review of the health effects of the Chernobyl disaster, Sumner (2007) reports that the clearest effect to be seen to date is the dramatic increase in thyroid cancer in children with the possibility of increased leukaemia, but there are indications of increased leukaemia incidence in Russian clean-up workers. There is also evidence of increases in breast cancer, cataract and cardiovascular disease. However, Sumner (2007) states that to date the largest public health problem caused by the accident is the mental health impact.

After the Chernobyl disaster, studies of clean-up workers and adults from contaminated areas found a two-fold increase in post-traumatic stress and other mood and anxiety disorders and significantly poorer subjective ratings of health. In general population samples, the major risk factor was perceived exposure to harmful levels of radiation. These findings are consistent with results from A-bomb survivors and populations studied after the Three Mile Island nuclear power plant accident (Bromet, 2012)

A review of research on the psychological impact of the accident during the 25 year period since the catastrophe began indicate that first responders and clean-up workers had the greatest exposure to radiation. Recent studies show that their rates of depression and post-traumatic stress disorder remain elevated two decades later. Very young children and those in utero who lived near the plant when it exploded or in severely contaminated areas have been the subject of considerable research, but the findings are inconsistent. Recent studies of prenatally exposed children conducted in Kiev, Norway and Finland point to specific neuropsychological and psychological impairments associated with radiation exposure, whereas other studies found no significant cognitive or mental health effects in exposed children grown up. General population studies report increased rates of poor self-rated health as well as clinical and subclinical depression, anxiety, and post-traumatic stress disorder. Mothers of young children exposed to the disaster remain a high-risk group for these conditions, primarily due to lingering worries about the adverse health effects on their families. Thus, long-term mental health consequences continue to be a concern. The unmet need for mental health care in affected regions remains an important public health challenge 25 years later (Bromet 2011).

In an interview with mothers 20 years after disaster, evacuees reported poorer well-being and more negative risk perceptions than controls. Group differences in psychological well-being remained after adjustment for epidemiologic risk factors but became non-significant when Chernobyl risk perceptions were added to the models. The relatively poorer psychological well-being among evacuees is largely explained by their continued concerns about the physical health risks stemming from the accident (Adams *et al*, 2011)

Multilevel modelling indicates that long-term psychological distress among Belarusians affected by the Chernobyl disaster is better predicted by stress-moderating psychosocial factors present in one's daily life than by level of residential radiation contamination (Beehler *et al.*, 2008).

Emigrés from the disaster area

Foster and Goldstein (2007) report on Chernobyl disaster sequelae in 321 émigrés to the United States. Both geographical proximity to the 1986 disaster, and perception of radiation risk stood as long-term indicators of current psychological distress. Proximity was related to poor self-perceived physical health, as well as current symptoms of depression, anxiety, and Chernobyl-related trauma distress.

Among immigrants to Israel, the somatic and mental health of Chernobyl survivors were significantly worse than in other immigrants of the same gender and age; a significant share of reported health problems were probably psychosomatic. Depression, sense of stigma and cancer-related anxiety were more prevalent in the study group. Immigrants from contaminated areas tended to use more health services (both conventional and alternative), but were less satisfied with their quality and providers' attitude. The link between perceived health impairment and poorer social accommodation in the host country has been confirmed: Chernobyl-area immigrants experienced more severe occupational downgrading and were more disappointed with the results of their resettlement than other immigrants. (Remennick, 2002)

Enschede firework explosion

A survey was conducted among 3792 residents, passers-by, and rescue workers after the Enschede firework explosion. At least 30% of those affected by the disaster reported serious physical and mental health problems 2-3 weeks after the explosion. Compared with the general Dutch population, survey respondents had high scores for somatic symptoms, sleeping problems, and restrictions in daily functioning due to physical and mental problems, such as anxiety, depression, and feelings of insufficiency (van Kamp *et al.* 2006).

A community sample of 516 evacuated adults and a control group of 119 residents situated near the disaster area, but not affected by the explosion were assessed 3 months after the disaster by standardized instruments. Of the evacuated sample, 13% met DSM-IV criteria for PTSD in contrast to 1% in the control group; 35% of the exposed sample and 7% of the control group were identified as 'probable cases' by the GHQ-30 (Elklit, 2007)

Section 4. Methodological challenges of post disaster mental health surveys

There are numerous methodological challenges in this field which are discussed in turn below.

The first issue is about attributable risk.

Following any disaster there will be the normal range of psychological responses in the general population to the disaster. However, a sample of this general population will have pre-existing mental disorders. Some may be in contact with primary care and hospital services in the area and some may not. The disaster is likely to produce additional mental disorders (new cases, relapses of old cases and aggravated pre-existing cases) with attendant physical and social effects. There will also be a loss of pre-existing health, social and educational infrastructure and human resource, and interruptions of medical supplies, which may cause relapses of illnesses previously on maintenance medication, e.g., people with chronic depression, bipolar disorder, schizophrenia or epilepsy. Exhaustion, burn out and illness will emerge in relief workers and remaining local infrastructure staff

The second issue is about the design of the survey.

Most surveys conducted after disasters have generally focussed on cross sectional surveys of the affected population at a single time point after the disaster or with a longitudinal element, but rarely with pre-disaster data on psychiatric morbidity. Therefore the prevalence estimates of mental disorders reported after disasters inevitably include contributions from all the above factors, but generally do not disentangle the relative proportions of each contribution, although in principle it would be possible to do. Therefore in order to estimate the mental health consequences of disasters per se, we need to be able to measure the post disaster prevalence and subtract the pre-disaster prevalence in the affected population. This rarely has been done owing to the lack of pre-disaster data.

Although mental health surveys are carried out after many large natural and man-made disasters, synthesis of findings about patterns and correlates of post-disaster psychopathology is hampered by inconsistencies in sample design, the use of different assessment instruments, variations in survey implementation and lack of pre-disaster baseline data (Kessler 2008, Galea 2008). All too often, numbers of participants in studies are too small, and there is no proper random sample, and so samples are heavily biased, and there is no proper

denominator, so rates of illness cannot be properly estimated. Study designs have generally been cross-sectional only rather than also having a longitudinal component, and delays in study initiation have resulted in inadequate data on early post disaster aftermath and on those variables occurring during or immediately after the disaster which may have contributed to mental health status (Kessler *et al.*, 2008, Savitz *et al*, 2008). The time frame after the disaster is a crucial variable as we generally expect rates of illness to gradually fall over time, but how quickly recovery occurs, if at all, is not known. These issues can only be assessed by longitudinal studies, which are rarely funded, and at present, studies following disasters occur at differing time periods after the disaster.

These differences may limit the synthesis of data (Raphael, 2008) but they do not preclude the building up of a body of evidence that can influence mental health policy.

It is usually necessary to create an appropriate sampling frame very quickly so that survey results can be used to make timely planning decisions (Kessler *et al* 2008) While probability random sampling is the best approach for precise prevalence estimates, an argument could be made that even non-probability sampling would be useful in situations where probability sampling is prohibitively expensive so long as the sampling was based on characteristics identified as reflecting high exposure to disaster-related stressors (e.g., areas that were directly hit by a tornado or areas that were not reconnected to services after a natural disaster), as such an approach could provide useful information about the range of exposures and psychological reactions to the disaster (Kessler *et al* 2008).

The third issue is about selection of assessment instruments

In all the studies reviewed to investigate post disaster psychiatric morbidity the same assessment instruments were very rarely used, making comparisons across surveys difficult. The instruments used to measure emotional functioning, anxiety and depression have ranged from the SF36 (van Griensven *et al*, 2006) to the General Health Questionnaire-12 (Keskinen-Rosenqvist *et al*, 2011; [Johannesson *et al* 2011](#)), the Medical Outcome Study Short Form 12, version 2 (Abramson *et al*, 2008), the the Hospital Anxiety and Depression Scale (Kraemer *et al*, 2009), the Suicidality Screening Questionnaire (Kar, 2010) and the Self-Reporting Questionnaire (SRQ) (Irmansyah *et al* 2010). These are generally pencil and paper questionnaires, while more detailed information would be obtained from the use of comprehensive epidemiological assessment of the kind that is used in the best of epidemiological studies in non-disaster populations, generally those using either the CIDI

(http://www.hcp.med.harvard.edu/wmhcdi/instruments_papi.php) or the CIS-R (Lewis *et al*, 1992)

As there has been a keen interest in PTSD, numerous instruments focussing purely on PTSD symptoms and disorder have been used: Impact of Event Scale-Revised (Keskinen-Rosenqvist *et al*, 2011), UCLA PTSD Reaction Index (Nygaard, Jensen, & Dyb, 2012), PTSD module of the Structured Clinical Interview for DSM-IV Axis I disorders (Hussain *et al*, 2011), the Post-traumatic Diagnostic Scale and the Post-traumatic Growth Inventory (Kraemer *et al*, 2009). Indeed, many studies have used PTSD instruments on their own, without the context of a comprehensive assessment of all mental health symptoms, and such surveys have led to major over-estimates of the prevalence of PTSD, and a lack of attention to the wider range of morbidity, especially depression and anxiety.

In a few studies, psychiatrists conducted clinical assessments without the use of structured standardised instruments, making diagnoses using the International Classification of Diseases, Tenth Revision (Viswanath, 2012).

Depending on the focus of the study, other instruments used include the Work and Social Adjustment Scale (WSAS), the Global Assessment of Functioning function score (GAF-F) (Kraemer *et al*, 2009), the Connor-Davidson Resilience Scale and the Sheehan Stress Vulnerability scale (Connor, 2006)

Similarly there has been a range of instruments used in surveys of children and adolescents: the Strengths and Difficulties Questionnaire (SDQ) (Mclaughlin *et al*, 2010), Depression Self - Rating Scale (DSRS) (Goenjian *et al.*, 2009), Pediatric Symptom Checklists part II (PSC-II), Childhood Depressive Intervention (CDI) (Piyasil, 2011)

For the effect of trauma the Revised Child Impact of Events Scales (CRIES 8) have been administered (Piyasil, 2011) as well as the Traumatic Stress Symptom Checklist for Children and Adolescents (Kiliç *et al*, 2011) and the Child Posttraumatic Stress Disorder Reaction Index (CPTSD-RI) (Goenjian *et al.*, 2009)

Masten and Osofsky (2008) question the reliability of assessments of mental health consequences in children and adolescents based on surrogate data from parents.

The fourth issue is that of classification of the disorders

There are two main diagnostic systems, ICD and DSM, and each has somewhat variable criteria for disorders. There are also differing approaches by researchers about the approach to

a diagnostic hierarchy, and to comorbidity. The impact of these issues has been aggravated by researchers sometimes using instruments which focussed on one disorder only, frequently PTSD, and therefore not being able to assess how much depression and anxiety are present, and running the likely risk that actual depression and anxiety are misclassified as PTSD.

Where researchers have used comprehensive instruments, they have found that posttraumatic stress disorder (PTSD) commonly co-occurs with other psychiatric disorders. Data from epidemiological surveys indicate that the vast majority of individuals with PTSD meet criteria for at least one other psychiatric disorder, and a substantial percentage have 3 or more other psychiatric diagnoses. There is a substantial amount of symptom overlap between PTSD and a number of other psychiatric diagnoses, particularly major depressive disorder, anxiety and substance abuse. It has been suggested that high rates of comorbidity may be simply an epiphenomenon of the diagnostic criteria used. In any case, this high degree of symptom overlap can contribute to diagnostic confusion (Brady *et al*, 2000).

It has been argued that PTSD may be underdiagnosed when trauma histories are not specifically obtained, but this is not a logical argument, as firstly most psychiatric disorders follow stresses of various kinds, secondly depression and anxiety are in any case more common than PTSD following disasters, and thirdly, diagnoses should generally be made on the basis of symptom constellation, not on the type of preceding stress.

Mental health professionals in different regions of the world may also take a different approach to classification, which can hinder comparison of studies. Mental health professionals in Western countries and the former Soviet Union) have been examining the social and psychological consequences of the 1986 Chernobyl nuclear accident on the people who lived or are living in the exposed areas. Based on reviews of the literature, papers from international conferences, and communication between researchers in various countries, different perspectives have emerged on classifying distress and disorders and designing treatment programs. The origins of these differences lie in philosophical, historical, and political developments in the West and the CIS. These different approaches often have made it difficult for mental health professionals from the CIS and the West to work together. For example, in the CIS edition of the ICD-9, there is no mention of post traumatic stress disorder as a distinct disorder. (Yevelson *et al*, 1997)

The final crucial issue is about the difficulties of survey implementation in the midst of infrastructure damage.

Kessler *et al* (2008) has argued that this is the biggest difficulty. A complicating factor in many disaster situations even in developed countries is that infrastructure damage creates logistical problems that hamper implementation of conventional telephone surveys and that impedes the travel of field interviewers to carry out face-to-face surveys. In the case of Hurricane Katrina, there was the additional complication that a massive flood led to the evacuation and wide geographic dispersion of the population of New Orleans. There is also the need to gain ethical approval and funding before the start of the study, which are time-consuming processes which add to the inevitable delays before the survey can begin .

Section 5. Impact on mental health service needs and use by whole affected population

There is wide variation in health service structure and availability across the world, and so post disaster health system response and use of services will depend on regional and local system factors. In rich countries there will generally be ready availability of primary health care (eg 1 doctor per 2000 population), specialist mental health care (eg 1 psychiatrist per 10,000 population) and social services, while in poorer countries, specialist services will be very scarce (e.g 1 psychiatrist per million), primary care much more thinly spread (eg 1 health worker per 10,000 population) and social services other than those provided by the extended family will be non-existent.

Most of the available data on mental health aspects of service delivery post disaster come from three sources, all in rich countries: the fireworks disaster in The Netherlands, the September 11, 2001, attack on New York City, and hurricane Katrina. Most survivors of disasters are reluctant to utilize specialist mental health services and face barriers to accessing care. Among those who do receive assistance, more than half drop out shortly thereafter (Rodriguez & Kohn, 2008).

Minimal research exists regarding the magnitude of the effects of disasters on those with pre-existing mental illness. Even among disaster victims who are severely mentally ill, only a minority receive treatment (Rodriguez & Kohn, 2008). For those with a pre-existing mental health problem, the basic requirements are as far as possible a lack of disruption to their daily routine which includes taking their prescribed medication and access to a health care provider. The shortage of human resources in psychiatry, particularly in developing countries, places a considerable burden on psychiatric services even without the additional constraints imposed by disaster (Davidson & McFarlane, 2006).

Mental health professionals must include crisis management, planning, and communication in pre- and post-disaster interventions with people who have mental illness (Milligan & McGuinness, 2009).

In patients with posttraumatic stress disorder, resilience can be used as a measure of treatment outcome, with improved resilience increasing the likelihood of a favourable outcome (Connor, 2006)

Hurricane Katrina

Springate *et al.*, 2011 describe a disaster recovery model focused on developing **mental health services** and capacity-building via community-based participatory, partnered training and **services** delivery intervention in a post-disaster setting in the Post-Katrina Greater New Orleans community. More than 400 community providers from more than 70 **health** and social **services** agencies participated in the trainings. Clinical **services** in the form of outreach, education, screening, referral and treatment were provided in excess of 110,000 service units. More than 400 trainees participated in training, and provided feedback that led to evolution of training curricula and training products, to meet evolving community needs over time.

Children

Mental health and case management needs persisted four years after Hurricane Katrina and showed no signs of abating. Many children who received mental health services had shown signs of psychological distress prior to the hurricane, and no causal inferences are drawn between disaster experience and psychiatric disorders. Post-disaster mental health and case management services should remain available for years post-event. To ensure timely identification and intervention of child mental health needs, paediatricians and school officials may need additional training. (Olteanu *et al*, 2011)

Firework factory accident

A longitudinal comparative health study was instituted directly after the fireworks disaster. 1116 directly affected inhabitants completed a questionnaire 2 to 3 weeks and/or 18 months after the disaster and a comparative group of 609 inhabitants not directly affected. Directly affected inhabitants had more psychological problems 18 months after the disaster and made more use of the Mental Health Service (31%) than did the comparative group (9%) 6 to 18 months after the disaster. Affected inhabitants with psychological problems according to the Symptom Checklist-90, Impact of Event scale, and the Self-Rating Scale for Post-traumatic Stress Disorder on the occasion of the first and/or second measurement made more frequent use of the Mental Health Service, more often considered seeking help, and still had more frequent contact with the MHS than did affected inhabitants without psychological problems. Of the affected inhabitants who, according to the Self-Rating Scale, satisfied the criteria for PTSD (19.6%) 18 months after the disaster, 45.8% were still in contact with the Mental Health Service. In the 6 to 18 month period after the disaster those affected by the disaster used the

MHS 3 times more often. The Mental Health Service succeeded in making contact with many affected inhabitants who had psychological problems (van der Velden *et al*, 2005).

Using a different methodology electronic records of 339 survivors aged 18 years and older registered in a mental health service (MHS) were linked with general practice based electronic medical records (EMRs) of survivors and data obtained in surveys. EMR data were available from 16 months pre-disaster until 3 years post-disaster. Symptoms and diagnoses in the EMRs were coded according to the International Classification of Primary Care (ICPC). Surveys were carried out 23 weeks and 18 months post-disaster, and included validated questionnaires on psychological distress, post-traumatic stress reactions and social functioning. Demographic and disaster-related variables were available. In multiple logistic models, adjusting for demographic and disaster related variables, MHS utilization was predicted by demographic variables (young age, immigrant, public health insurance, unemployment), disaster-related exposure (relocation and injuries), self-reported psychological problems and pre- and post-disaster physician diagnosed health problems (chronic diseases, musculoskeletal problems). After controlling for all health variables, disaster intrusions and avoidance reactions, hostility, pre-disaster chronic diseases, injuries as a result of the disaster, social functioning problems and younger age predicted MHS utilization within 18 months post-disaster. The most important factors to predict post-disaster MHS utilization were disaster intrusions and avoidance reactions and symptoms of hostility (which can be identified as symptoms of PTSD) and pre-disaster chronic diseases (den Ouden, 2007).

Disasters in low income countries

Studies of mental health service response in low income countries have been patchy, and donors have focused much more on service response than on evaluation of its outcomes. There has been considerable controversy about the effectiveness of post disaster response in low income countries (Von Ormeron *et al* 2005), with programmes generally being separate, vertical programmes to address PTSD, or psychosocial programmes outside the health care system, or else complete neglect of mental health issues. Separate vertical programmes to address PTSD alone run the risk of over-diagnosing PTSD and neglecting all the other disorders. Psychosocial programmes outside the health care system ignore the health care needs of people with moderate and severe illness. Although opinion varies widely on the public health value of focussing on PTSD, there is agreement on basic issues, namely that exposure

to extreme stressors is a risk factor for mental health problems, especially common mental disorders, and that emergencies can severely disrupt social structures and pre-existing formal and informal care and support for people with pre-existing disorders. WHO has proposed 8 principles for populations exposed to extreme stressors. There are contingency planning before the disaster, assessment of sociocultural context, available services, resources and needs, a focus on the medium and long term development of services rather than just on the acute phase, strong collaboration between agencies, especially with the government to achieve sustainability, integration of mental health into primary care to ensure access to services for the largest number of people, outreach and awareness programmes for vulnerable groups, training and supervision by specialists to primary care, monitoring and evaluation (WHO 2001) .

When considering these principles, it is clear that the actions that need to be taken after a disaster are in fact the same as those that need to be taken by countries wishing to meet population needs for mental health whether or not there is a disaster, and whether or not a disaster is likely.(Jenkins *et al* 2002). Thus all countries need to establish a solid understanding of their geographic, historical , social and cultural contexts ; population epidemiology of mental disorders, risk and protective factors; a detailed appraisal of current primary care and specialist services, human resources and their level of training, availability of interventions including medicines, and the degree of routine intersectoral collaboration(Jenkins *et al* 2004). All countries should have an active plan to integrate mental health into primary care,(eg Jenkins *et al* 2009, Jenkins *et al* 2010a,Jenkins *et al* 2010b, Jenkins *et al* 2011a), which they are continuously implementing. This would entail adequate mental health content in basic, postbasic training and continuous professional development programmes for health workers so that front line staff are competent to undertake mental health promotion, prevention and assess, diagnose and manage mental disorders and refer if necessary to specialist services. The training should also include a module on disaster management so that all health staff are aware of their potential roles. Support and supervision from district levels to primary care levels are crucial to establish and sustain whether or not there is a disaster. (eg Kiima and Jenkins 2010, Mbatia and Jenkins 2010) Intersectoral collaboration (between health, education, criminal justice and NGO sectors etc) for mental health is crucial whether or not there is a disaster, and needs to be at national, regional and local levels as part of a national integrated mental health policy(eg Jenkins 2003, Jenkins *et al* 2010 c, Jenkins *et al* 2011). If this capacity for primary care of mental disorders and for intersectoral collaboration is well embedded across the country before any subsequent disaster, then the country will be well prepared.

Conclusion on research recommendations

- A. enhance capacity for rapid research response , to obtain speedy funding, ethical approval, deployment of trained researchers to field, supervision in field
- B. Improve options for sample design, sample frames, denominators
- C. Use comprehensive assessment instruments
- D. Agree diagnostic algorithms and hierarchies
- E. quantify the physical, social and economic consequences of the disaster as well as the psychological impact by adding the questions into the survey on activities of daily living, social support, primary support group, employment, housing, income, debt
- F. develop standardised criteria for relative degree of hazard exposure for each of the study subjects.

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